



**RECOMMENDED BEST
MANAGEMENT
PRACTICES
for Pagosa Bladderpod
(*Physaria pruinosa*)**

**Practices Developed to
Reduce the Impact of
Road Maintenance Activities
to Plants of Concern**

CNHP's mission: We advance conservation of Colorado's native species and ecosystems through science, planning, and education for the benefit of current and future generations.

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Report Prepared for:
the Colorado Natural Areas Program

Recommended Citation:

Panjabi, S.S. and G. Smith, 2017. Recommended best management practices for Pagosa bladderpod (*Physaria pruinosa*): practices developed to reduce the impacts of road maintenance activities to plants of concern. Colorado Natural Heritage Program, Colorado State University, Fort Collins, Colorado.

Front Cover: *Physaria pruinosa* plants and habitat, from top to bottom,
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June 2017

ACKNOWLEDGEMENTS

Funding for this important project was provided by the Colorado Natural Areas Program (CNAP).

We appreciate the input of numerous individuals during the preparation of this document, especially Raquel Wertsbaugh, Jessica Smith, Sara Brinton, Peggy Lyon, Janis Huggins, Brian Elliott, Jill Handwerk, Bernadette Kuhn, and Ann M. Grant. Special thanks to Cora Marrama for making the Special Management Area maps.

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INTRODUCTION

Pagosa bladderpod (*Physaria pruinosa*=*Lesquerella pruinosa*) is a small, rosette-forming, yellow-flowered plant in the Brassicaceae (Mustard Family) that is known only from two counties in southern Colorado and one county in northern New Mexico. This species is considered to be imperiled at a global and state level (G2/S2; Colorado Natural Heritage Program 2017). One of the biggest conservation issues for this imperiled plant species is the lack of awareness of its existence and status. Avoiding or minimizing impacts to this species during road maintenance activities will effectively help to conserve its habitat and is unlikely to confer substantial impacts on road maintenance goals and projects. The Best Management Practices (BMPs) included in this document are intended to help increase the awareness of this species for anyone involved in road maintenance activities.

The desired outcome of these recommended BMPs is to reduce significantly the impacts of road maintenance activities to the Pagosa bladderpod on federal, state, and/or private land. The BMPs listed here are intended to be iterative, and to evolve over time as additional information about the Pagosa bladderpod becomes available, or as road maintenance technologies develop.

The intent of these BMPs is to inform people working along roadside areas regarding the importance of Pagosa bladderpod, one of Colorado's botanical treasures, and to outline some of the ways in which this species can coexist with road maintenance activities. The implementation of these recommendations will help to assure that maintenance activities proceed without unintended harm to these globally imperiled plants. A summary checklist of BMPs is presented in **Appendix One**.

BEST MANAGEMENT PRACTICES FOR PAGOSA BLADDERPOD (*PHYSARIA PRUINOSA*)

1. Gather mapped location information for Pagosa bladderpod along roadsides (within 20 meters/22 yards of all roads: CDOT, County, USFS, BLM, and municipalities) consulting with the Colorado Natural Heritage Program (CNHP) at Colorado State University, local herbaria, and other known sources of rare plant location data. In 2014 and 2016 this step was conducted by the Colorado Natural Heritage Program as part of a pilot project to conserve roadside populations of globally imperiled plants (Panjabi and Smith 2014).
2. Work with the Colorado Natural Heritage Program to create **Special Management Areas** based on the distribution of Pagosa bladderpod within 20 meters/22 yards of roads. **Special Management Areas** (maps and data tables) are presented in **Appendix Two** if a data sharing agreement has been signed with the Colorado Natural Heritage Program.

3. Prior to road maintenance work, the field supervisor (CDOT) or land manager (County, BLM, etc.) should provide maps to road crews showing all known Special Management Areas for the plants (as hard-copy and GIS files, and including the UTM coordinates indicating the extent of the Special Management Areas along roads). The maps and other data should be “species blind”; they should *not* indicate what species are found within the Special Management Areas (Pagosa bladderpod as well as other rare taxa). The maps should be updated as new plant locations are found.
4. Within the Special Management Areas the roadsides should not be seeded, sprayed or mowed to avoid disturbance to soils, plants, and habitat. This includes all brush control, fire control, and weed control. (For appropriate management of noxious weeds, please refer to the Noxious Weed Management section below.) Dust abatement applications, if necessary, should be comprised of water only, with use of magnesium chloride limited to the minimum extent necessary.
5. If mowing is necessary, for example for safety reasons, avoid mowing from May 1-August 31. If mowing is necessary during May 1-August 31, mow with a 6 in/15 cm or higher cut, and do not drive over/park on top of the plants.
6. Discourage use of vehicle pull-off and turn-around areas where the plants are present. Signage, fencing, obstacles (boulders) are possible solutions.
7. If grading is necessary, following rain or other events that wash out roads, avoid burying the rare plants.
8. Snow and ice control measures present some concerns for the Special Management Areas, though public safety is a priority. When possible, plowing, deicer and sand applications, rock slide removal, snow fence maintenance and construction activities should consider the locations of the Special Management Areas. For example, sand applications could cover plants when the snow melts and should be avoided if possible.
9. Locating signs away from Special Management Areas would benefit the Pagosa bladderpod. If guardrails need to be installed/repaired, minimize impacts to the bladderpod to the greatest extent possible.
10. Transplanting is not recommended under any circumstances.
11. Develop monitoring plans for the roadside locations of Pagosa bladderpod, with the goals of detecting any decrease in the population size or condition, and/or needs for restoration efforts and/or noxious weed management.

12. Minimize impacts to Pagosa bladderpod habitat through appropriate and creative project planning. Some examples of appropriate and creative project planning include:
 - Wash vehicles and other equipment to reduce the spread of noxious weeds from other areas.
 - Assure that straw and hay bales used for erosion control are certified free of noxious weeds.
 - Contact the Colorado Natural Heritage Program at Colorado State University when planning ground breaking activities at or near (within 200 meters/218 yards of) Pagosa bladderpod sites.

NOXIOUS WEED MANAGEMENT IN HABITAT FOR PAGOSA BLADDERPOD (*PHYSARIA PRUINOSA*)

1. Document, map, monitor and control all infestations of noxious weeds (Colorado Noxious Weed Act 2003) and other non-native invasive plant species in and adjacent to occupied habitat for Pagosa bladderpod. The Colorado Noxious Weed List can be found online at: <https://www.colorado.gov/pacific/agconservation/noxious-weed-species>
2. Monitor Special Management Areas for new weed infestations. Noxious weeds in close proximity (within 400–800 meters/437-875 yards) to the plants of concern should be the highest priority for control. Ensure that the rare plants are protected from any damage resulting from weed control efforts.
3. Control noxious weeds using integrated techniques. Limit chemical control in areas within 200 meters/218 yards of rare plant species to avoid damage to non-target species. Mechanical or chemical control in and near rare plant habitat should only be implemented by personnel familiar with the rare plants.
4. Herbicide application should be kept at least 200 meters/218 yards from known plant populations, except in instances where weed populations threaten habitat integrity or plant populations. Great care should be used to avoid pesticide drift in those cases.
5. For further information on managing weeds in the vicinity of rare plant populations please see the Recommended Best Management Practices for Managing Noxious Weeds on Sites with Rare Plants (Mui and Panjabi 2016). Link provided here: [http://www.cnhp.colostate.edu/download/documents/2016/BMP Noxious Weeds on Sites with Rare Plants CMui SPanjabi May 2016.pdf](http://www.cnhp.colostate.edu/download/documents/2016/BMP%20Noxious%20Weeds%20on%20Sites%20with%20Rare%20Plants%20CMui%20SPanjabi%20May%202016.pdf).

OTHER NEEDS AND RECOMMENDED GUIDELINES

Further inventory, monitoring, research, and conservation planning is recommended for the Pagosa bladderpod to assist with future development and implementation of these Best Management Practices (BMPs), as well as our basic understanding of this rare species. As we work to manage for the long-term viability of the Pagosa bladderpod it will be important to conduct botanical surveys (inventories) and map new locations to improve our understanding about how roadside locations contribute to full species distribution. Inventory work may also help to identify sites that could be suitable for conservation efforts. Monitoring roadside locations is important to determine if the BMPs are effective, and clarify the conservation status of the species. Research into pollination ecology, recommended setbacks, and phenology is also suggested. As these research efforts are undertaken, the following recommendations can help assure high quality results that will be most useful in conservation planning activities.

1. Botanical field surveys should be conducted by qualified individual(s) with botanical expertise, according to commonly accepted survey protocols, and using suitable GPS equipment. The Colorado Natural Heritage Program (CNHP) at Colorado State University can provide references, field forms, etc. Surveys should be repeated at least once every 10 years. Prioritize surveys on preferred geologic substrates within species range.
2. Botanical field surveys should be conducted from mid-May to late August when the Pagosa bladderpod can be detected and accurately identified. In some cases multi-year surveys may be necessary, e.g., if drought conditions occur during the survey window.
3. If Pagosa bladderpod (or other species of concern) are found within the survey area, the botanist should endeavor to determine the complete extent of the occurrence and the approximate number of individuals within the occurrence. Ideally, occurrences should be delineated by GPS and the results imported to GIS for inclusion on updated project maps.
4. Field survey results should be reported to CNHP, and to appropriate land managers. A photograph or voucher specimen (if sufficient individuals are present) should be taken. Vouchers should be deposited in one of Colorado's major herbaria (e.g., University of Colorado, Colorado State University, Denver Botanic Gardens). Negative results of surveys should also be reported to CNHP.
5. Perform frequent and timely inspections of development sites and plants of concern occurrences to ensure that BMPs are being followed, and to identify areas of potential conflict. Inspections of plant occurrences should be performed by a botanist or other qualified personnel.

6. Monitoring is more likely to succeed if properly planned. Collection of baseline data, prior to any impact, is vital. Although land management agencies may have specific monitoring guidelines, an excellent reference for developing and implementing a monitoring plan is Elzinga et al. (1997).
7. Monitor impacts on plants of concern from road maintenance or other activities in the area. If impacts are noted, change management to address the cause of impacts.
8. Develop and implement monitoring plans for noxious weeds. Plans should be designed to detect new infestations and document the extent and spread of existing weeds.

SPECIES PROFILE

Physaria pruinosa (Pagosa Bladderpod)

Brassicaceae (Mustard Family)



Close up Pagosa bladderpod (*Physaria pruinosa*) flowering rosette by Janis Huggins.



Close up of Pagosa bladderpod (*Physaria pruinosa*) in flower by Sara Brinton.



Close up of Pagosa bladderpod (*Physaria pruinosa*) seed pods by Peggy Lyon.

Ranks and Status

Global rank: G2

State rank: S2

Federal protection status: USFS Sensitive, BLM Sensitive

State protection status: None

Description and Phenology



Pagosa bladderpod (*Physaria pruinosa*) by Mary Clark.

General description: Pagosa bladderpod (*Physaria pruinosa*) stems are 10 to 20 cm long, can be decumbent or erect and arise out of a simple or woody caudex. The basal leaves are 4-8 cm long with suborbicular or obovate blades which can be entire to sinuate or shallowly toothed. The cauline leaves, 0.8-2.3 cm long, are obovate to rhombic and can be entire or shallowly toothed. The flowers are small and yellow with petals spatulate and expanded at the base. The fruiting inflorescence (infructescences) are dense and elongated. The pedicels are 8-11 mm long and sigmoid. The siliques, 6-9 mm long, are sessile or substipitate and globose to ellipsoid. The seeds are not winged or margined. Rosettes formed from the abundant basal leaves help to characterize the plants.

Look Alikes: None in this part of Colorado.

Phenology: *Physaria pruinosa* begins to flower by mid-May with fruiting time depending on elevation. Plants at lower elevations are in late stages of fruiting by the beginning of June, whereas plants at higher elevations are only in early stages of fruiting at that time (Rouse 1981). Plants have been observed with a few flowers as late as the last week of August (Anderson 1988).

Habitat



Habitat of Pagosa bladderpod (*Physaria pruinosa*) by Peggy Lyon.

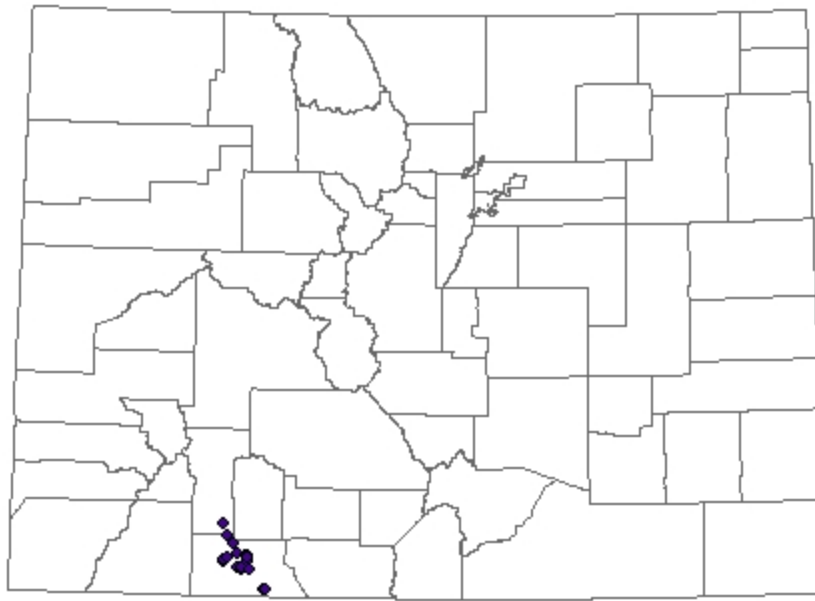
Habitat description: Pagosa bladderpod (*Physaria pruinosa*) occurs on Mancos Shale, open clay barrens surrounded by montane grasslands. This species is also found in small/micro openings within mountain grasslands and in open *Pinus ponderosa* stands with *Quercus gambelii*. It can also be associated with Douglas fir and Englemann spruce communities at the upper limits of its range (Rouse 1981), but still on Mancos Shale substrates. Commonly associated species include: *Pinus ponderosa*, *Quercus gambelii*, *Mahonia repens*, *Commandra umbellatum*, *Townsendia glabella*, *Astragalus lonchocarpus*, and *Penstemon linarioides* (Anderson 1988).

Elevation Range: 6,827 - 8,507 feet (2,081 - 2,593 meters).

Distribution

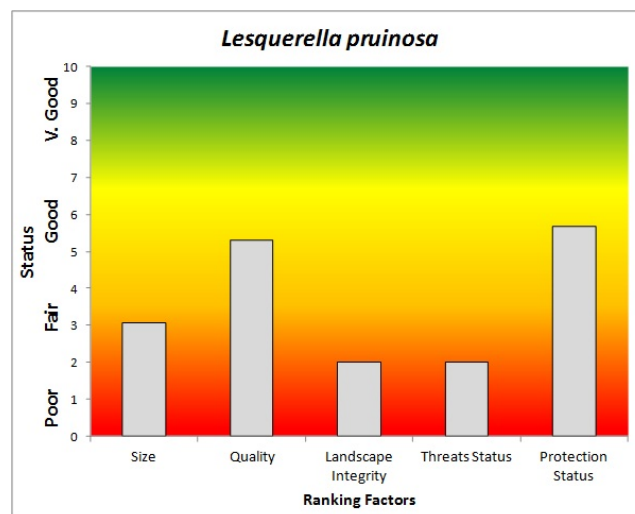
Colorado endemic: No

Global range: Known from southern Colorado (Archuleta County, and the extreme southern portion of Hinsdale County) and northern New Mexico (Rio Arriba County). Estimated range is at least 588 square kilometers (227 square miles), calculated in 2008 by the Colorado Natural Heritage Program in GIS by drawing a minimum convex polygon around the Colorado occurrences. The New Mexico location needs to be added to this range calculation.



Distribution of Pagosa bladderpod (*Physaria pruinosa*) in Colorado.

Threats and Management Issues



Summary results of an analysis of the status of Pagosa bladderpod (*Physaria pruinosa*=*Lesquerella pruinosa*) based on several ranking factors. This species was concluded to be “moderately conserved”.
From Rondeau et al. 2011.

Residential and commercial developments are considered to be the primary threats to the species at this time (Rondeau et al. 2011). The city of Pagosa Springs lies within the plant's range. Residential growth, development of resort homes, and increased tourism due to the development of a proposed ski resort 20 miles east of Pagosa Springs threaten occurrences. Archuleta County is growing rapidly, and future land use plans that have been drafted by Archuleta County do not include adequate provisions for the protection of Pagosa bladderpod (Anderson 2006).

Populations in the Piedra Valley may be vulnerable to the effects of livestock grazing. Though cattle pose a minimum threat of grazing the plants (they contain chemicals which render the plants unpalatable), cattle grazing tends to promote erosion and up-rooting where plants occur on slopes by severely disturbing the soil (Anderson 1988). These populations are at risk mainly where cattle trails traverse the shale barrens (Neely 1990).

Pagosa bladderpod is also threatened by off-road vehicle recreation, other recreational activities, energy resource development, exotic species invasions, use of herbicides and pesticides for weed management and range improvement, effects of small population size, prairie dog herbivory, fire, global climate change, and pollution (Anderson 2006).

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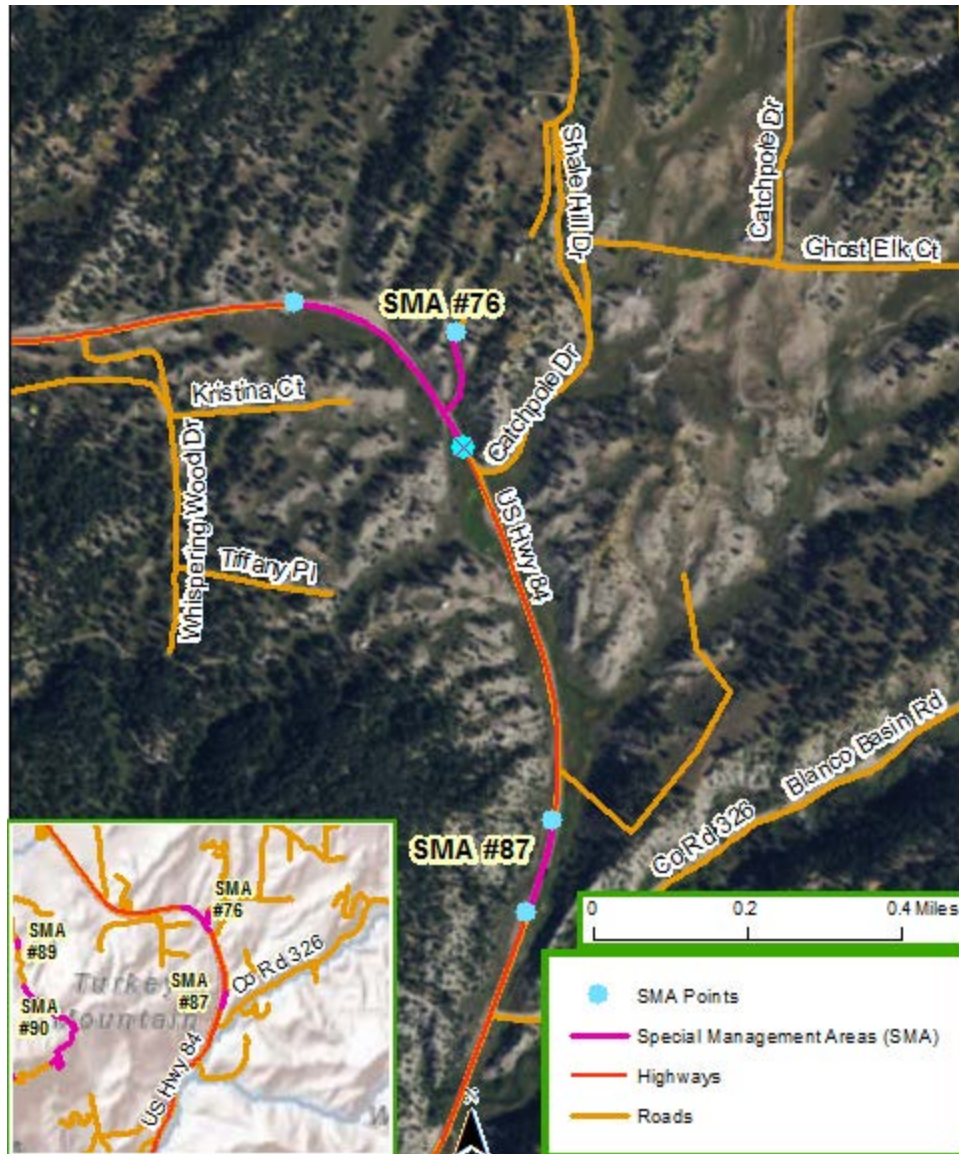
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APPENDIX ONE-SMA BMP CHECKLIST

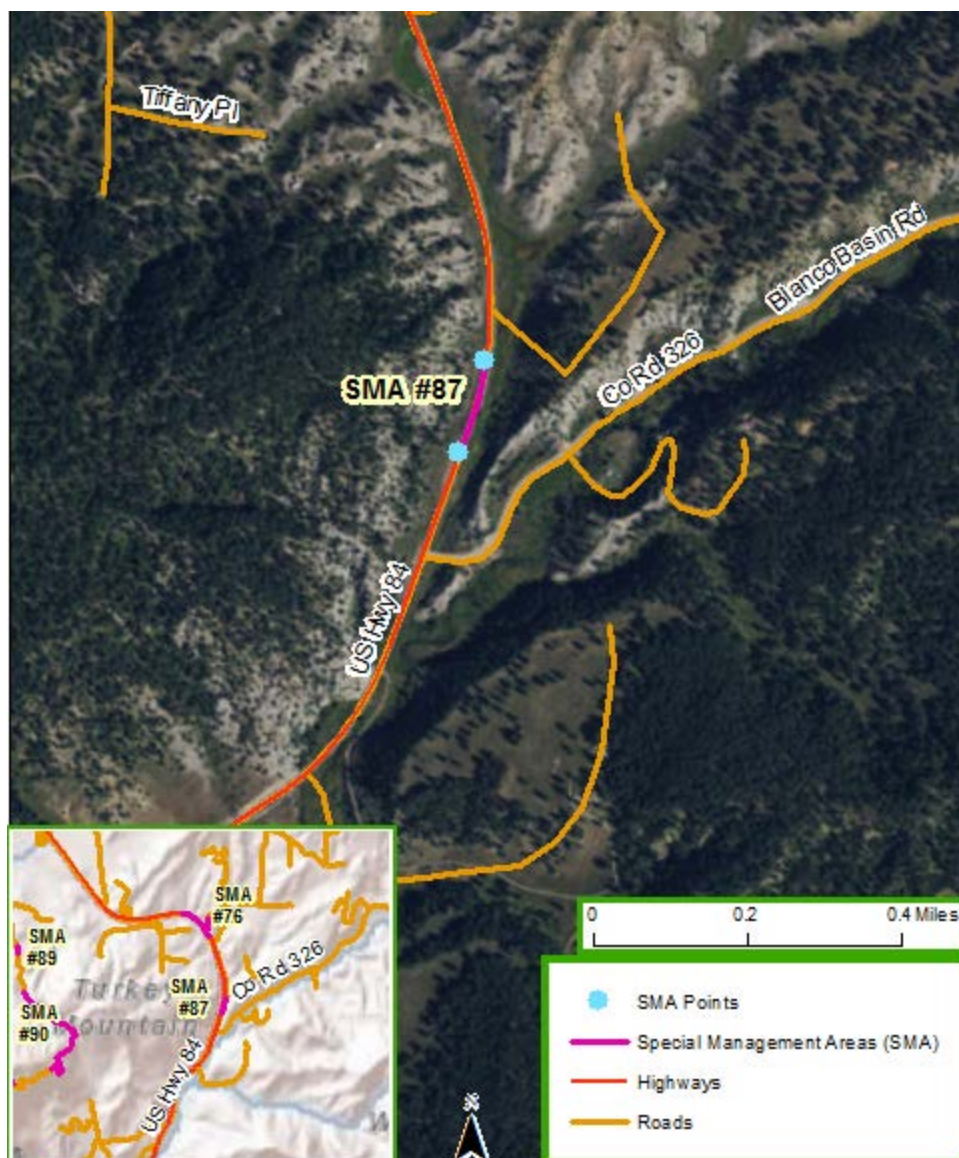
This checklist is intended as a reminder for the Best Management Practices (BMPs) presented in the full report above that are recommended for the Special Management Areas (SMAs) presented in Appendix Two. Please see the full report for further details about the recommended BMPs listed here.

1. Avoid seeding, spraying, and mowing.
2. If mowing is necessary, avoid mowing during the “No Mowing Dates”. If mowing is necessary during this timeframe, avoid mowing below the specified recommended blade heights.
3. If weed control is necessary, use integrated techniques that are implemented by personnel familiar with the rare plants.
4. Avoid burying plants.
5. Plowing, deicer and sand applications, rock slide removal, snow fence maintenance and construction activities should consider the locations of the SMAs.
6. Locate signs and guardrails away from SMAs to the greatest extent possible.
7. Minimize the use of vehicle pull-off and turn-around areas in SMAs.
8. Do not transplant rare plants.
9. Monitor rare plant occurrences within SMAs.
10. Monitor SMAs for new weed infestations.
11. Wash vehicles and other equipment to reduce the spread of noxious weeds from other areas.
12. Assure that straw and hay bales used for erosion control are certified free of noxious weeds.
13. Contact the Colorado Natural Heritage Program at Colorado State University when planning ground breaking activities in SMAs.

APPENDIX TWO-SPECIAL MANAGEMENT AREAS



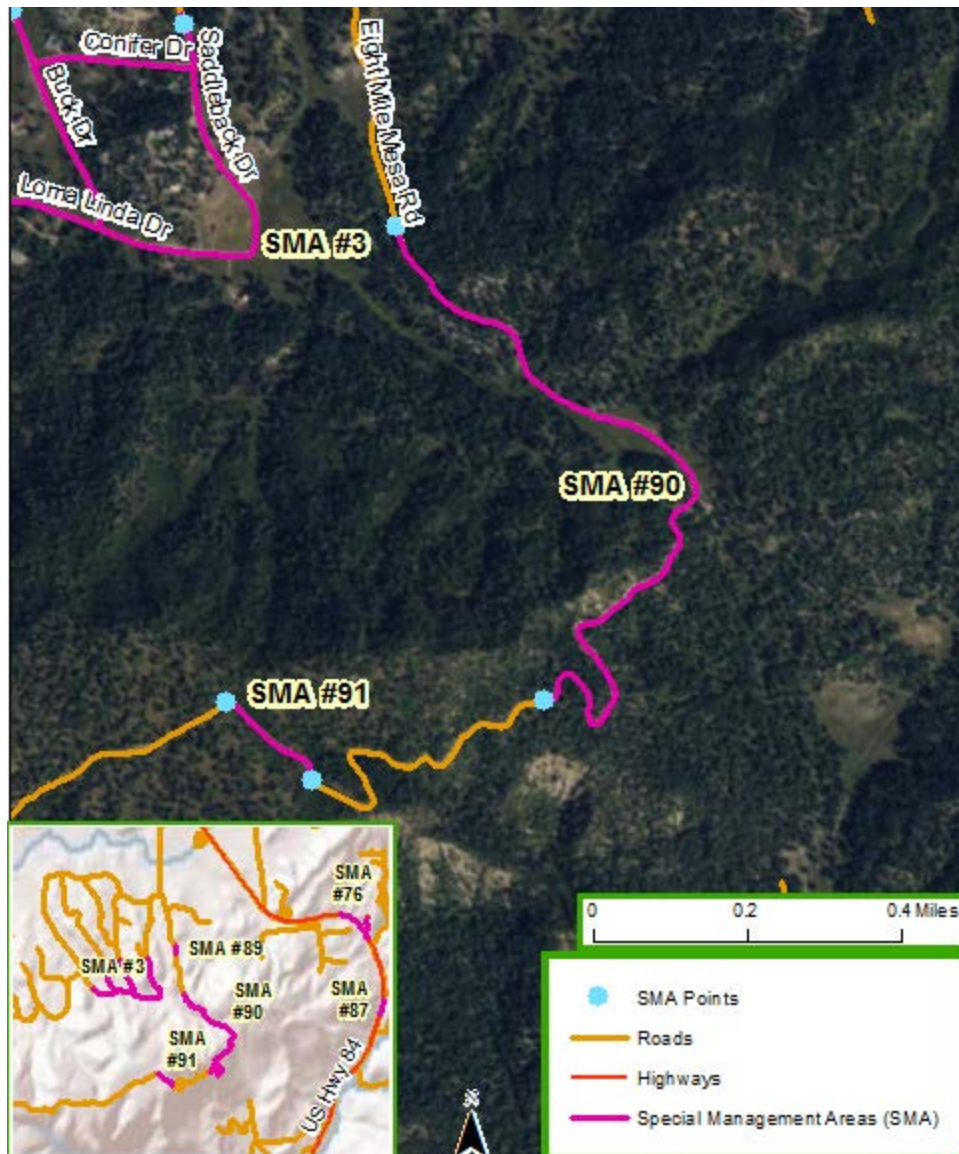
Special Management Area (SMA) Number	SMA #76
Road Name	US Highway 84
Route Type (Municipal, County, State, Other)	United States
CDOT Region	5
Road Manager	Federal Highway Administration
Land Owner	Private
% of rare plant occurrence in SMA	1.92%
County	Archuleta
Mower Blade Height	
No-Mowing Dates	



Special Management Area (SMA) Number	SMA #87
Road Name	US Highway 84
Route Type (Municipal, County, State, Other)	United States
CDOT Region	5
Road Manager	Federal Highway Administration
Land Owner	USFS, Private
% of rare plant occurrence in SMA	0.30%
County	Archuleta
Mower Blade Height	
No-Mowing Dates	



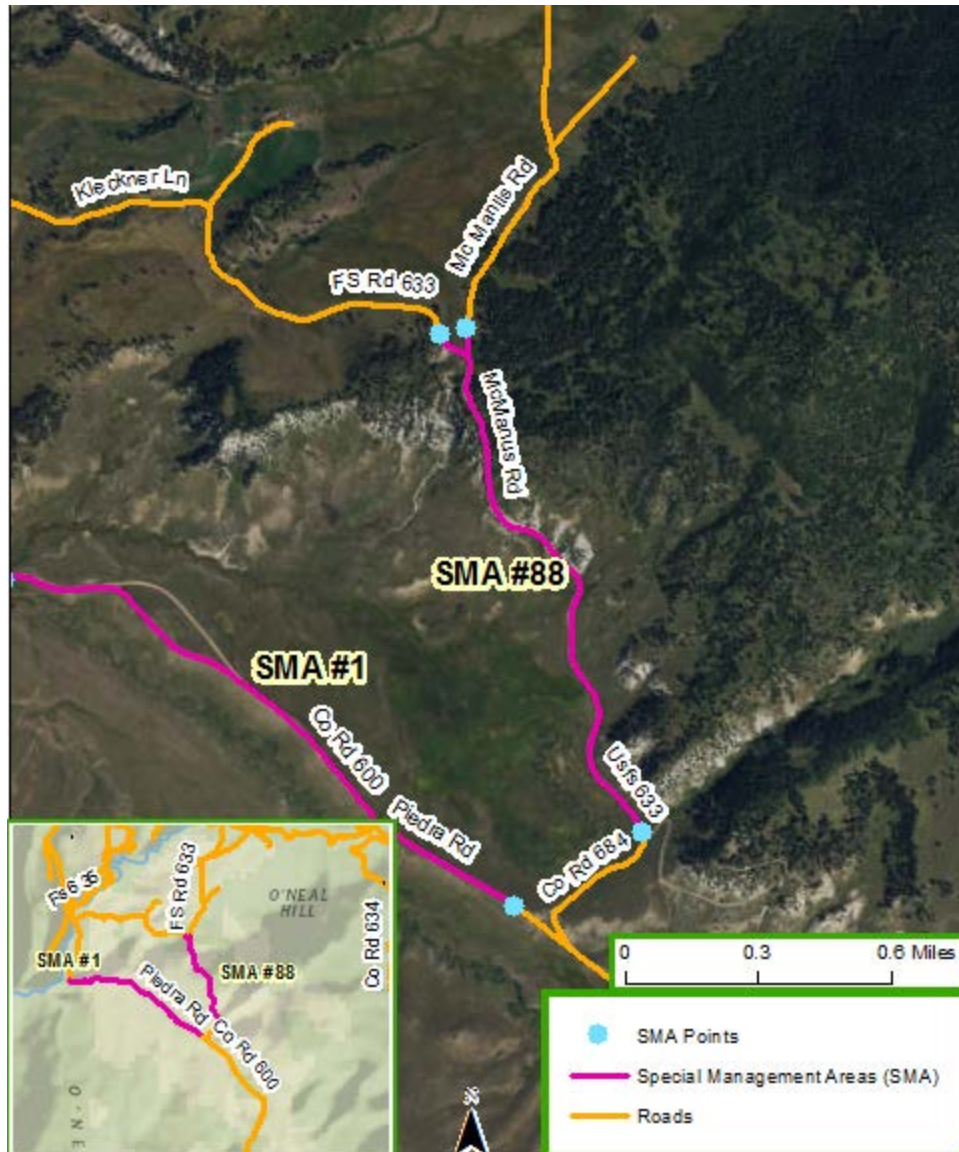
Special Management Area (SMA) Number	SMA #89
Road Name	Eight Mile Mesa Rd
Route Type (Municipal, County, State, Other)	Municipal
CDOT Region	5
Road Manager	No Data
Land Owner	USFS
% of rare plant occurrence in SMA	0.18%
County	Archuleta
Mower Blade Height	
No-Mowing Dates	



Special Management Area (SMA) Number	SMA #90
Road Name	Eight Mile Mesa Rd
Route Type (Municipal, County, State, Other)	Municipal
CDOT Region	5
Road Manager	No Data
Land Owner	USFS
% of rare plant occurrence in SMA	1.58%
County	Archuleta
Mower Blade Height	
No-Mowing Dates	



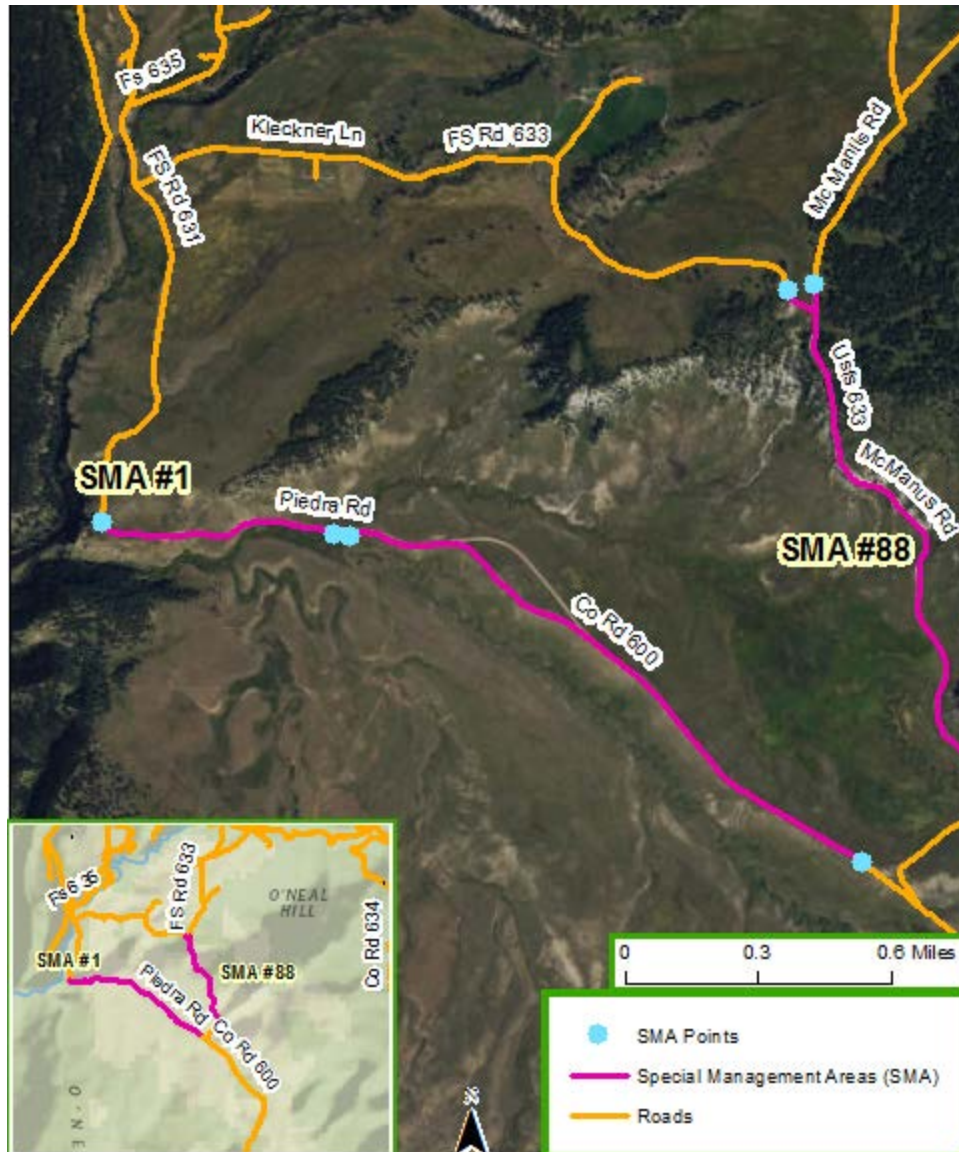
Special Management Area (SMA) Number	SMA #91
Road Name	Eight Mile Mesa Rd
Route Type (Municipal, County, State, Other)	Municipal
CDOT Region	5
Road Manager	No Data
Land Owner	USFS
% of rare plant occurrence in SMA	0.64%
County	Archuleta
Mower Blade Height	
No-Mowing Dates	



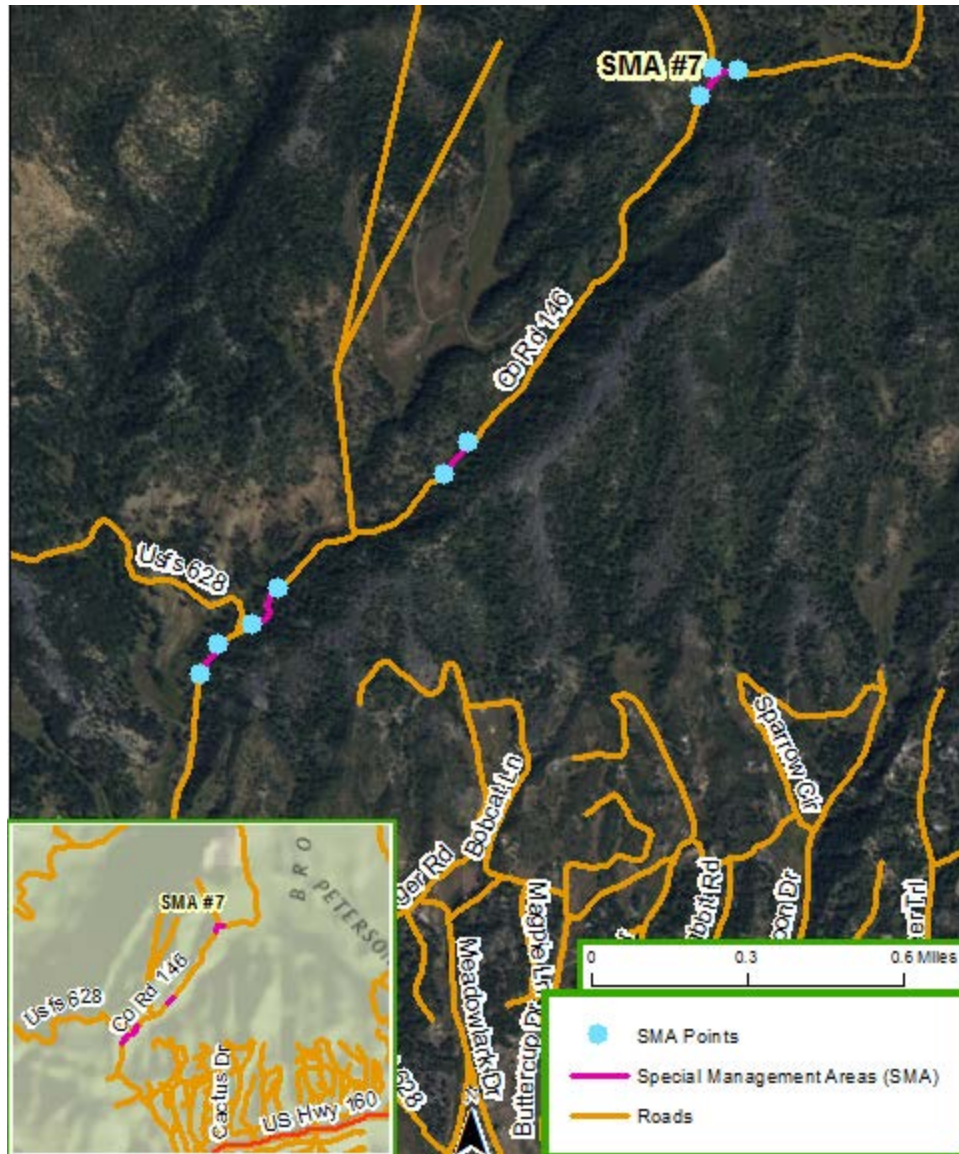
Special Management Area (SMA) Number	SMA #88
Road Name	Mc Man US Rd, Klackner Ln, Forest Service Rd 633
Route Type (Municipal, County, State, Other)	Municipal, County, Other
CDOT Region	5
Road Manager	Archuleta
Land Owner	USFS, Private
% of rare plant occurrence in SMA	2.46%
County	Archuleta
Mower Blade Height	
No-Mowing Dates	



Special Management Area (SMA) Number	SMA #2
Road Name	No Data
Route Type (Municipal, County, State, Other)	No Data
CDOT Region	5
Road Manager	No Data
Land Owner	USFS, Private Conservation
% of rare plant occurrence in SMA	0.07%
County	Archuleta
Mower Blade Height	
No-Mowing Dates	



Special Management Area (SMA) Number	SMA #1
Road Name	Forest Service Rd 631
Route Type (Municipal, County, State, Other)	County, Municipal, Other
CDOT Region	5
Road Manager	Archuleta
Land Owner	USFS, Private
% of rare plant occurrence in SMA	2.46%
County	Archuleta
Mower Blade Height	
No-Mowing Dates	



Special Management Area (SMA) Number	SMA #7
Road Name	USFS Rd 628, County Rd 146
Route Type (Municipal, County, State, Other)	County, Other
CDOT Region	5
Road Manager	Archuleta
Land Owner	USFS, Private
% of rare plant occurrence in SMA	8.17%
County	Archuleta
Mower Blade Height	
No-Mowing Dates	



Special Management Area (SMA) Number	SMA #3
Road Name	Saddleback Dr, Loma Linda Dr, Conifer Dr, Buck Dr, San Juan Dr
Route Type (Municipal, County, State, Other)	Municipal
CDOT Region	5
Road Manager	No Data
Land Owner	USFS, Private
% of rare plant occurrence in SMA	5.03%
County	Archuleta
Mower Blade Height	
No-Mowing Dates	



Special Management Area (SMA) Number	SMA #6
Road Name	County Rd 500, Trujilo Rd
Route Type (Municipal, County, State, Other)	County, Municipal
CDOT Region	5
Road Manager	Archuleta
Land Owner	Private
% of rare plant occurrence in SMA	49.17%
County	Archuleta
Mower Blade Height	
No-Mowing Dates	