# RECOMMENDED BEST MANAGEMENT PRACTICES for Round-leaf Four o'Clock (*Oxybaphus rotundifolius*)

**Practices to Reduce the Impacts 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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Front Cover: *Oxybaphus rotundifolius* plants and habitat, from top to bottom,

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# INTRODUCTION

Round-leaf four o'clock (*Oxybaphus rotundifolius*) is a medium-tall plant in the Nyctaginaceae (Four o'clock Family) that is restricted to barren shale outcrops of the Smoky Hill Member of the Niobrara Formation in sparse shrublands or woodlands. Round-leaf four o'clock is considered to be imperiled at a global and state level (G2/S2, Colorado Natural Heritage Program 2015). 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 Round-leaf four o'clock 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 Round-leaf four o'clock 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 Round-leaf four o'clock, 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 ROUND-LEAF FOUR O'CLOCK (*OXYBAPHUS ROTUNDIFOLIUS*)

1. Gather mapped location information for Round-leaf four o'clock 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 Round-leaf four o'clock 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 UTMs 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 (Round-leaf four o'clock 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 June 1-July 31. If mowing is necessary during June 1-July 31, mow with as high of a blade height as practicable, and do not drive over/park on top of the plants.

6. If grading is necessary, following rain or other events that wash out roads, avoid burying the rare plants.

7. 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.

8. Locating signs away from Special Management Areas would benefit the Round-leaf four o'clock. If guardrails need to be installed/repaired, minimize impacts to the four o'clock to the greatest extent possible.

9. Minimizing and/or discouraging the use of vehicle pull-off and turn-around areas where the rare plants are present would also be beneficial. Proper signage, fencing, obstacles (boulders) are all possible solutions.

10. Transplanting is not recommended under any circumstances.

11. Develop monitoring plans for the roadside locations of Round-leaf four o'clock, 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 Round-leaf four o'clock 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) Round-leaf four o'clock sites.

# NOXIOUS WEED MANAGEMENT IN HABITAT FOR ROUND-LEAF FOUR O'CLOCK (*OXYBAPHUS ROTUNDIFOLIUS*)

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 Round-leaf four o'clock. 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.

# OTHER NEEDS AND RECOMMENDED GUIDELINES

Further inventory, monitoring, research, and conservation planning is recommended for the Round-leaf four o'clock 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 Round-leaf four o'clock 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 during June and July when the Round-leaf four o'clock 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 Round-leaf four o'clock (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

## *Oxybaphus rotundifolius*
## (Round-leaf four o'clock)

Nyctaginaceae (Four o'Clock Family)

Close up of Round-leaf four o'clock *(Oxybaphus rotundifolius)* in flower by Susan Spackman Panjabi.

Close up of Round-leaf four o'clock *(Oxybaphus rotundifolius)* emerging in leaf by Georgia Doyle.

Close up of Round-leaf four o'clock *(Oxybaphus rotundifolius)* flower by Peter Gordon.

## Ranks and Status

**Global rank**: G2
**State rank**: S2
**Federal protection status**: BLM Sensitive
**State protection status**: None

## Description and Phenology

Round-leaf four o'clock (*Oxybaphus rotundifolius)* by Marjorie Joy

**General description**: Round-leaf four o'clock (*Oxybaphus rotundifolius*) is 2-3 dm tall, erect to spreading, taprooted perennial with bright trumpet-shaped magenta flowers. The flowers occur in groups of three, and normally close by mid-morning. The almost round, basal leaves which give the plant its name are densely hairy, and are usually withering close to the flowering time. Flowering stems, which are also densely covered with short hairs, arise from axils where pairs of the ovate leaves join the stem. The bright pink flowers have 5 strongly exerted stamens with five notched petals and are about 1 cm in diameter. The fruit are obovoid, 4-5 mm long, and hairy (Spackman et al. 1997, Ackerfield 2015).

**Look Alikes**: *Oxybaphus multiflora* is much larger that *O. rotundifolius*, and has glabrous and glaucous leaves (Spackman et al. 1997).

**Phenology:** Flowers open pre-dawn and close usually by mid-morning in June, but with some flowering through mid-August (Spackman et al. 1997, Ackerfield, 2015).

## Habitat

Habitat of Round-leaf four o'clock (*Oxybaphus rotundifolius)* by Georgia Doyle.

Habitat of Round-leaf four o'clock (*Oxybaphus rotundifolius*) by David Anderson.

**Habitat description**:

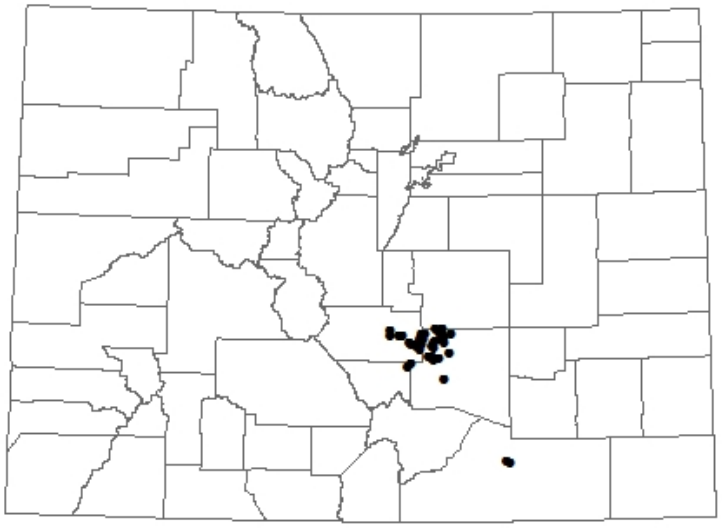
*Oxybaphus rotundifolius (Mirabilis rotundifolia)* is generally restricted to outcrops of the lower shale unit of the Smoky Hill member of the Cretaceous Niobrara Formation. The plant community is sparse shrubland or woodland with a barren aspect. Frequent associates are James' frankenia *(Frankenia jamesii)* and oneseed juniper *(Juniperus monosperma)*. Other associated species may

include: *Bolophyta (Parthenium) teraneuris, Oryzopsis hymenoides, Atriplex confertifolia, Eriogonum fendlerianum, Cryptantha jamesii, Zinnia grandiflora, Melampodiium leucanthum, Lesquerella ovalifolia, Gutierrezia sarothrae, Hoffmanseggia drepanocarpa* and *Lesquerella montana.*

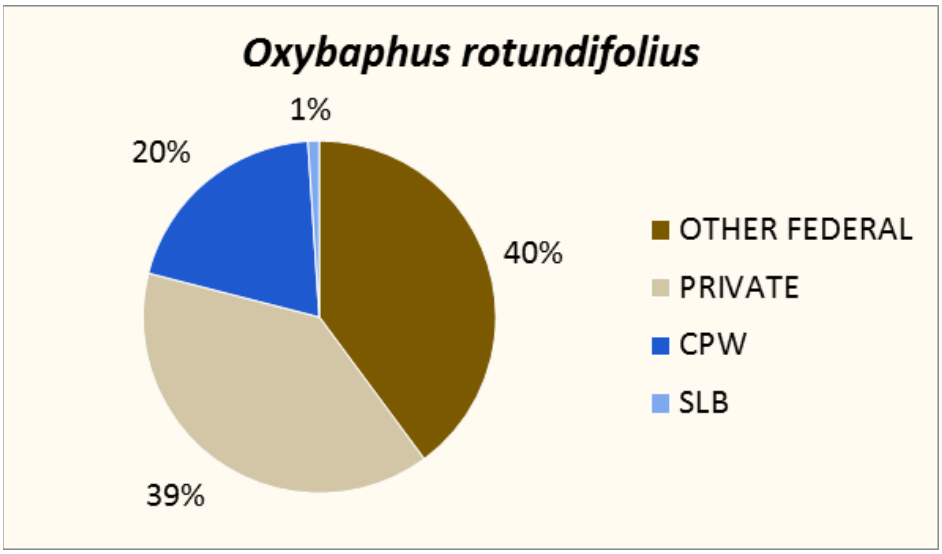
**Elevation Range**: 4,790 - 5,610 feet (1,460 – 1,170 meters).

## Distribution

**Colorado endemic:** Yes
**Global range:** Endemic to Colorado; known from Custer, Fremont, Las Animas, and Pueblo counties. Estimated range is 3,732 square kilometers (1,441 square miles), calculated in GIS in 2008 by the Colorado Natural Heritage Program by drawing a minimum convex polygon around the known occurrences.

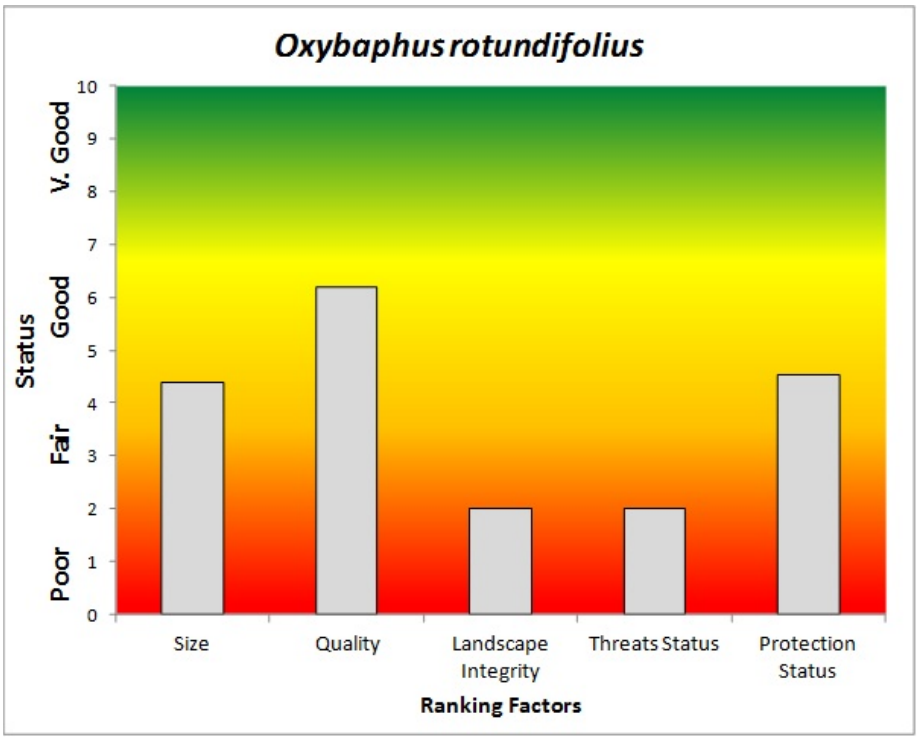


Distribution map of round-leaf four o'clock (*Oxybaphus rotundifolius)* in Colorado. This species is known from Colorado and nowhere else in the world.




Distribution of round-leaf four o'clock (*Oxybaphus rotundifolius*) in Colorado according to mapped land ownership/management boundaries (CNHP 2017, COMaP).

## Threats and Management Issues




Summary results of an analysis of the status of Round-leaf four o'clock (*Oxybaphus rotundifolius*) based on several ranking factors. This species was concluded to be "Weakly Conserved". From Rondeau et al. 2011.

Residential development is considered to be the primary threat at this time. The species is also threatened by road maintenance activities, and industrial activities including mining and cement plants. Campground construction heavily impacted one occurrence. Other occurrences were lost to

the construction and filling of Pueblo Reservoir, and the construction of Pueblo West housing development. Three sites are bisected by state highways (Colorado Natural Heritage Program occurrence records 2017). Predation by Hawk Moth Caterpillars (horn worms) may be a problem (pers. comm. Kelso 1996).

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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 the "No Mow Dates", mow with as high of a blade height as practicable, and do not drive over/park on top of the plants.
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

Maps and location specific information provided to project partners only.