Ron Stewart Preserve at Rabbit Mountain

Elk and Vegetation Management Plan

2017-2020

Approved by Boulder County Commissioners on August 22, 2017
Amended June 15, 2021 (see pages 19, 20, 26, 27)

Boulder County Parks & Open Space

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Introduction

This document presents the history of elk presence at Ron Stewart Preserve at Rabbit Mountain Open Space (Ron Stewart Preserve). It describes the population increases since the late 1990s and the impacts the elk are having on the native biodiversity of Ron Stewart Preserve. It outlines the elk-human conflicts that have arisen since the elk population has increased. It further describes actions taken by Colorado Parks and Wildlife (CPW) and Boulder County Parks and Open Space (BCPOS) to measure and mitigate these impacts. Finally, it presents recommendations for management of elk with the goal of getting elk to move from Ron Stewart Preserve, and re-establish seasonal migration, thus reducing the negative impacts of too many elk using Ron Stewart Preserve.

Background

The Rabbit Mountain elk subherd is a segment of the St. Vrain elk herd residing in northern Boulder and southern Larimer counties. Elk immigrated to Ron Stewart Preserve and Indian Mountain sometime in the mid-1990s after being absent from the area for decades, and more likely since the early 1900s. Radio telemetry data from elk captured on Heil Ranch Open Space during 1998 and 2003 indicate that the Heil Valley subherd was the original source of this Rabbit Mountain herd. The Rabbit Mountain population initially grew slowly to about 30 animals by the mid-2000s. Elk numbers remained at around 10-30 animals until about 2010, when the herd's numbers burgeoned to at least 100 animals by 2013 and to over 300 in 2016 (Figure 1).

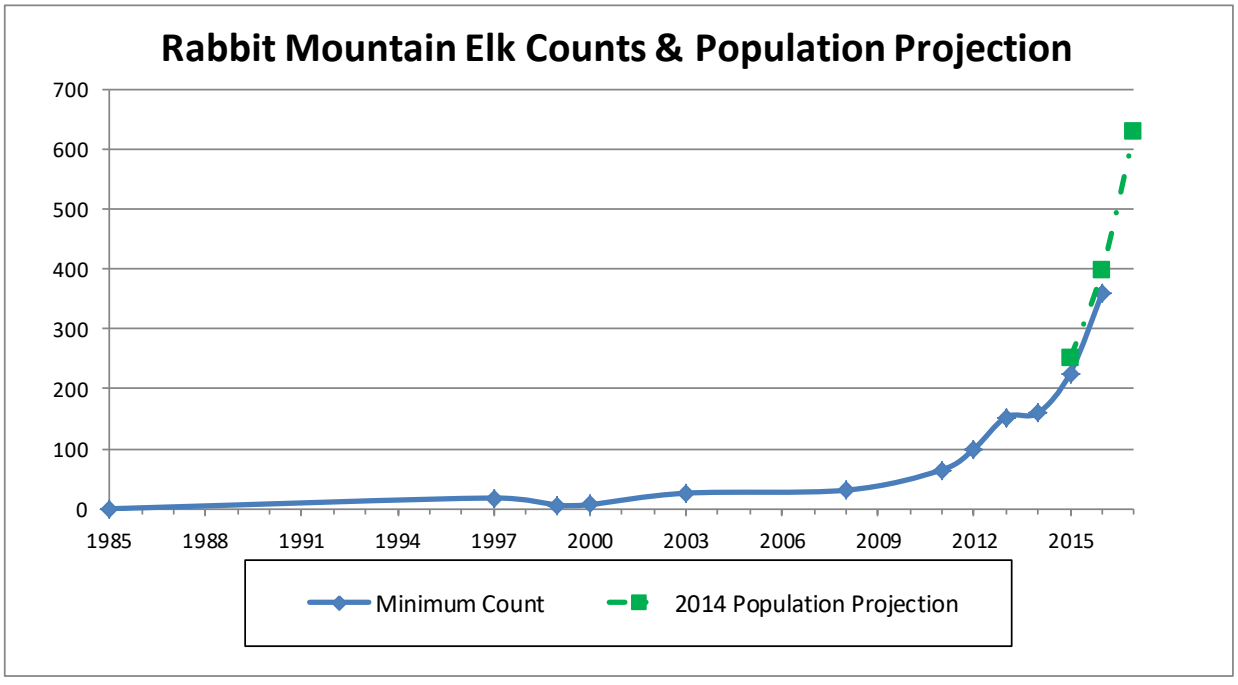

Figure 1. The Rabbit Mountain elk herd minimum counts and projected population growth. Population projection was prepared in 2014 and subsequent minimum counts included as available (e.g., 2015 and 2016).

When elk first appeared on Ron Stewart Preserve, hunting on nearby private land adequately controlled population growth. However, the elk have learned to avoid hunters by using areas where hunting is not allowed. Female elk, which make up most of the Rabbit Mountain herd, have ceased the seasonal migration to higher elevation summer range and now stay on or around

Ron Stewart Preserve year-round. The most recent telemetry studies confirmed that the herd does not migrate and found that the elk spend the day on Ron Stewart Preserve and Indian Mountain Open Space and move to adjacent agriculture fields each night (Figure 2).

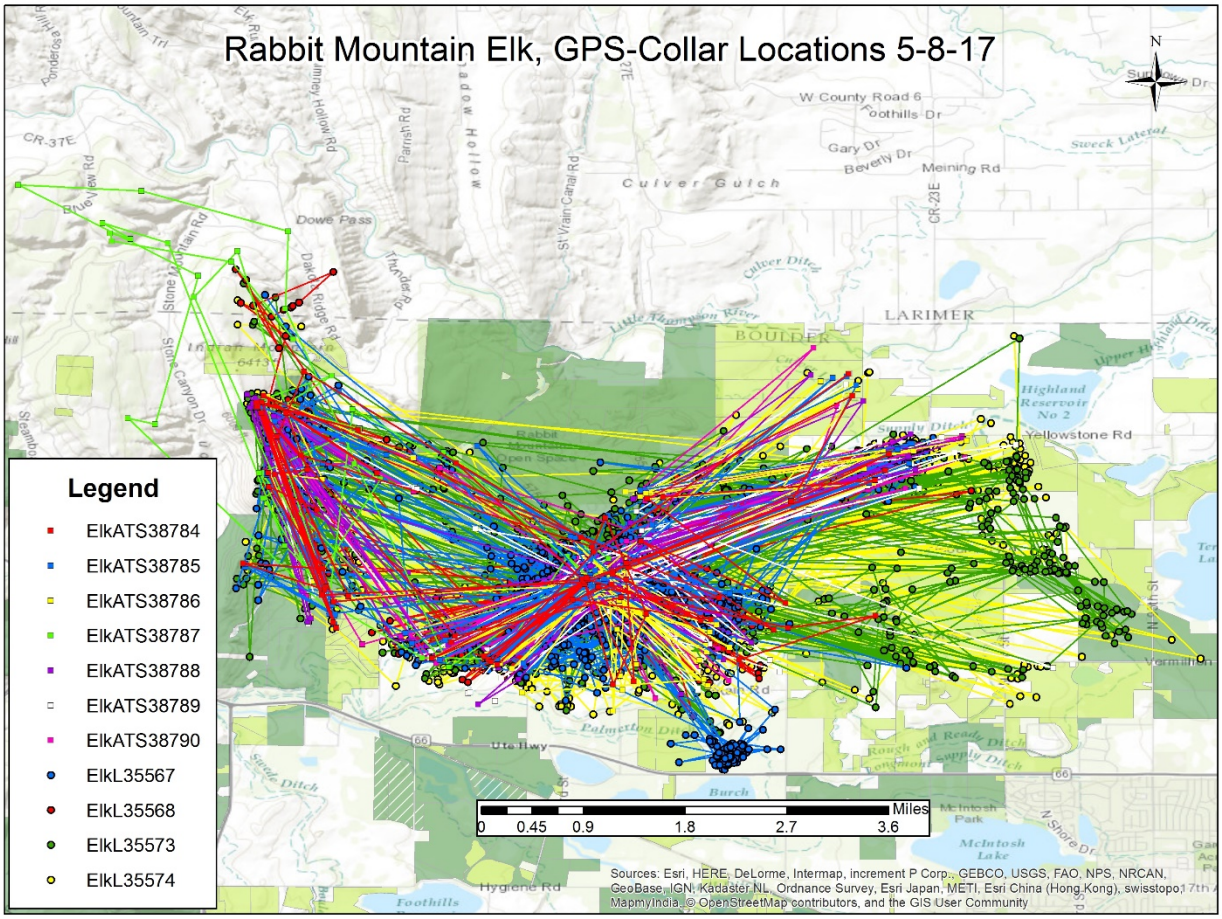

Figure 2. Telemetry locations of four female elk from the spring of 2015 to the spring of 2016.

High Biodiversity at Ron Stewart Preserve at Rabbit Mountain

Colorado Natural Heritage Program (CNHP) inventoried Boulder County in 2007 and 2008 to assess the county's biodiversity. This survey identified areas with the highest biodiversity significance based on rare, threatened, and endangered species and habitats:

> "The foothills of Boulder County harbor the highest concentration of globally rare biodiversity elements. There are two foothills areas with outstanding biodiversity significance (B1), Rabbit Mountain and Red Hill South of Lyons, which achieve B1 ranks due to their concentration of four or more globally critically imperiled to globally imperiled (G1-G2) element occurrences that are in excellent or good (A- or B-ranked) condition. These elements include foothills natural communities, several mountain mahogany shrublands, and two Piedmont grassland communities. Additionally, embedded within these areas are shale outcrops with globally imperiled Bell's twinpod (etc.). Rabbit Mountain and Red Hill South of

Lyons are the only areas in Boulder County where foothill shrublands contribute significantly to the vegetation mosaic on the landscape" (CNHP, 2009).

There is also significant biodiversity in the reptiles found at Ron Stewart Preserve (Ehrenberger et al. 2015) revealed that of 33 species of snakes found in Colorado, nearly one-third (nine species) are found on Ron Stewart Preserve. These species are dependent on the vegetation and habitat found on the mountain.

Vegetation Monitoring Summary

Native plants on open space are experiencing extensive damage by browsing, grazing and trampling, even down to mineral soil in elk bedding areas. In mid-July 2016, Plant Ecology staff at BCPOS conducted vegetation monitoring at Ron Stewart Preserve to assess vegetation cover and diversity in the three prominent habitats; grassland (meadow), shrubland, and forest.

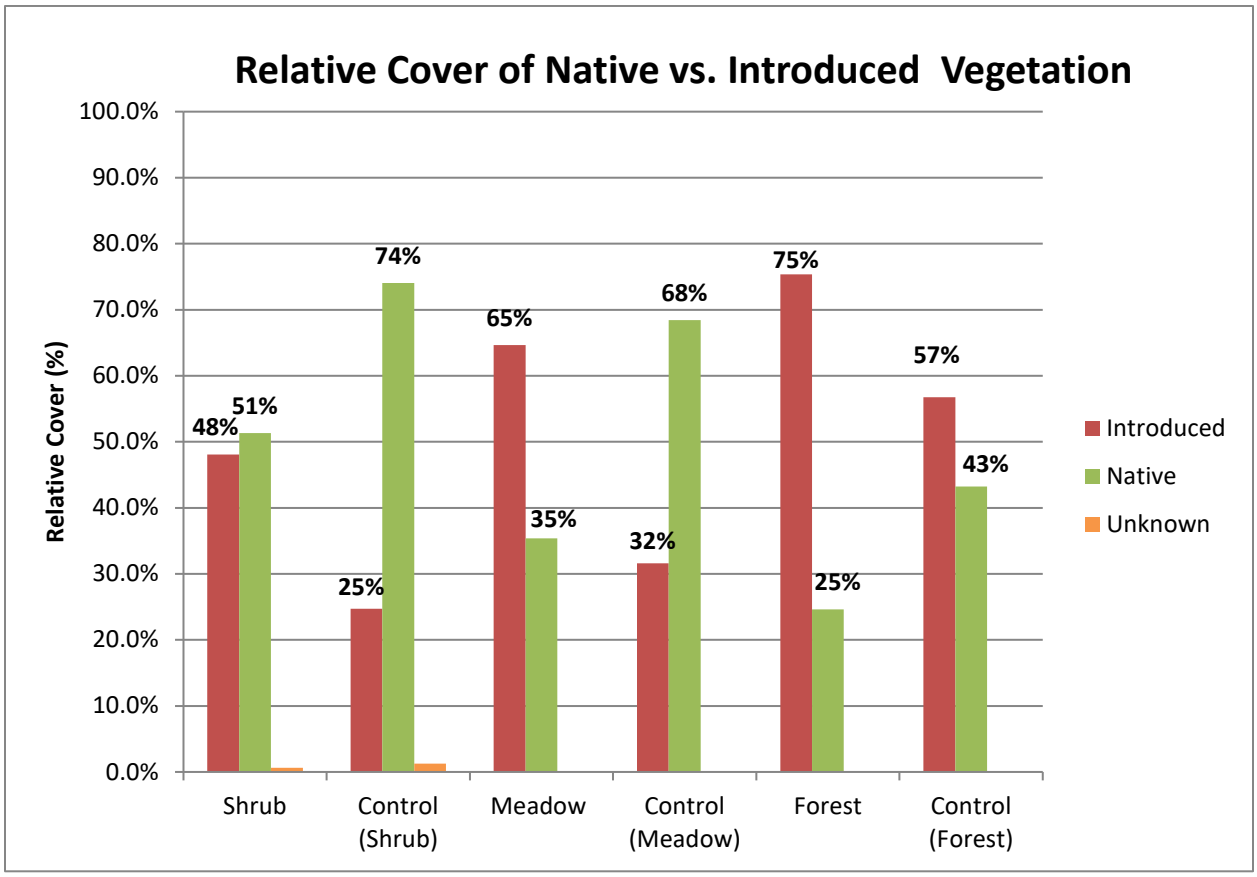

Figure 3. Relative Cover Native vs. Introduced Vegetation

Preliminary results showed differences in introduced (weeds) vs. native vegetation cover between affected (elk use) and control (no elk use) transects. Control transects had higher percentages of native species cover than the affected transects across all cover types. In addition, introduced species had higher cover in all elk use areas. (BCPOS, 2016)

These preliminary results are consistent with visual assessments of on-the-ground conditions within the approximately 500 acres being heavily used by elk. While the herd does not seem to be foraging extensively on Ron Stewart Preserve, their presence (loafing, standing, trailing, clipping, some browsing) has impacted habitat quality. The disturbance to the soil from these actions has led to an increase in nonnative plant species, most notably cheat grass (*Bromus japonicus* and *Bromus tectorum*). These invasive species proliferate in disturbed areas and out-compete native species.

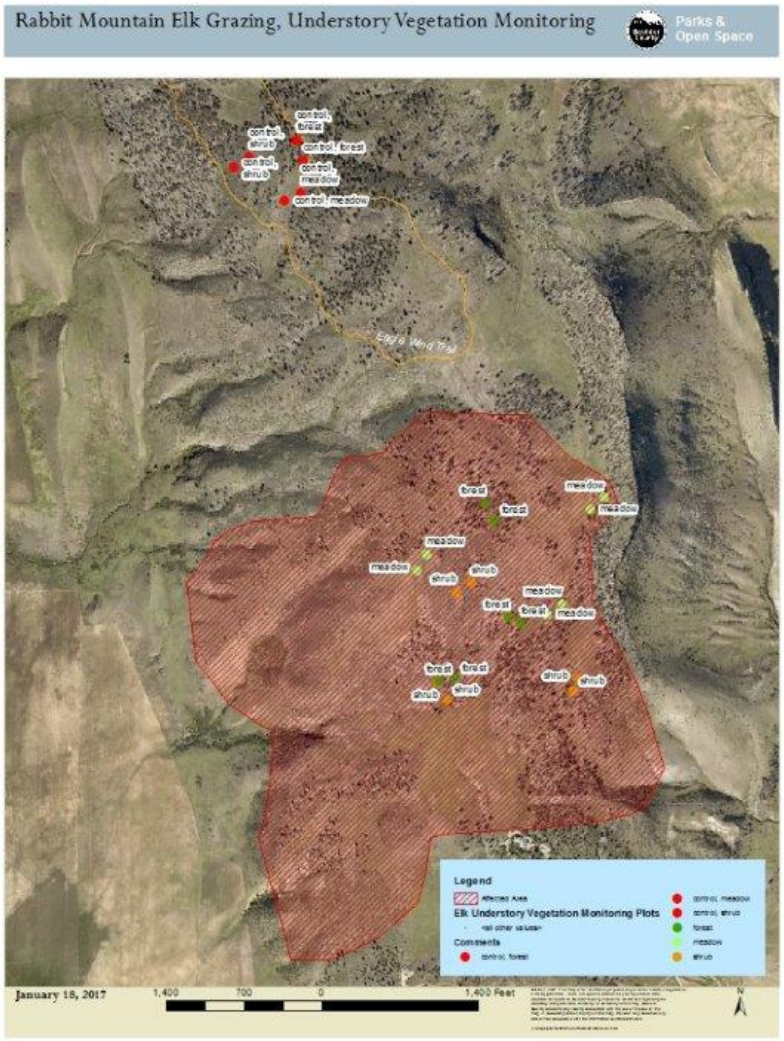

Figure 4. Vegetation Monitoring Transect Location with Core Area shown in red.

Shrub Utilization Study Summary

The biologically diverse shrub communities mentioned by CNHP are comprised of both three-leaf sumac (*Rhus trilobata*) and mountain mahogany (*Cercocarpus montanus*). The dominant of the two is the mountain mahogany, which is a deciduous, many-branched shrub that can grow to over six feet in height. Mountain mahogany is utilized by both deer and elk as important winter forage. BCPOS shrub monitoring assessed only this species.

In 2016, wildlife staff established monitoring transects in the heavily used elk core area, on the periphery of the core area, and outside of the core area (control transects). The results indicate that the shrubs are being heavily impacted in the high elk use area (BCPOS, 2017) (Figures 5, 7).

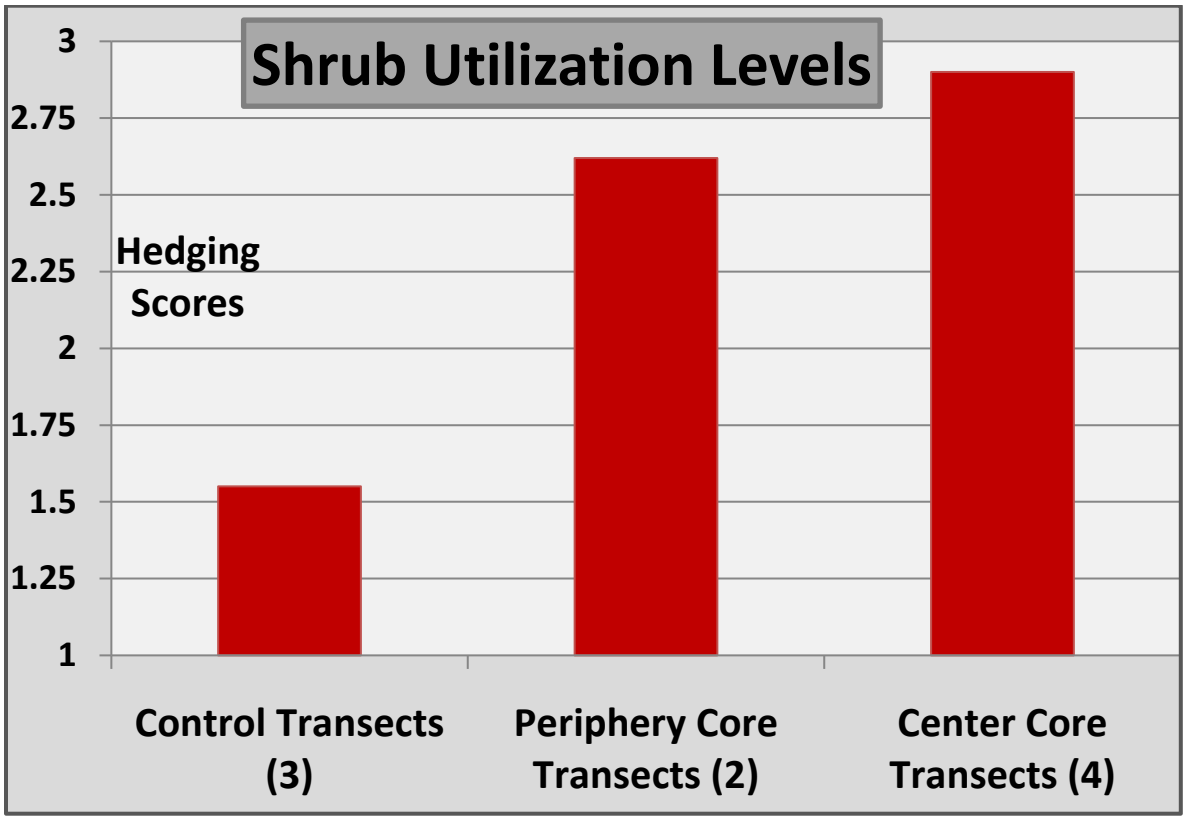

Figure 5: Averaged Shrub Utilization Levels

Figure 6. Photo Documentation of Shrub Utilization Study Transect Areas

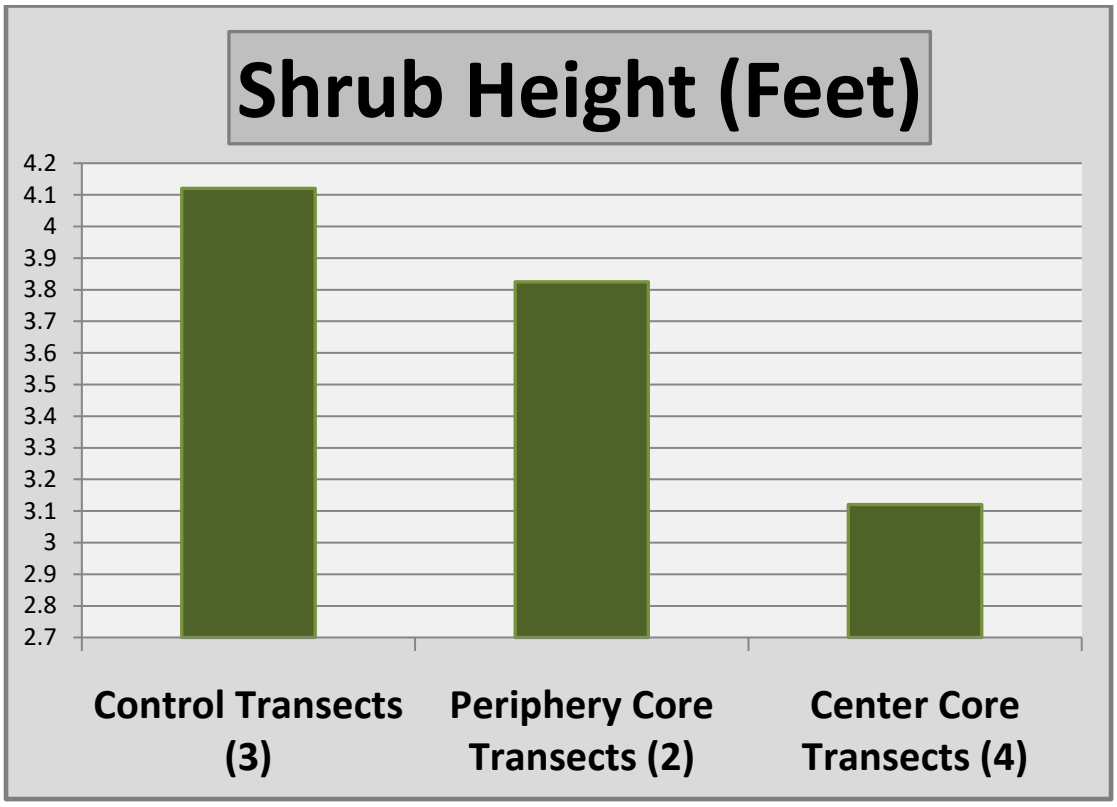

Figure 7. Averaged Shrub Heights per Transect Group

Comparing the transects, the pattern of use shows heavier utilization in the core area, with a gradient of use from core to periphery to control. However, as this was the study's pilot year, more control transects will be added to increase sample size to better inform statistical analysis (BCPOS, 2017).

However, these preliminary results show that elk are shaping the shrub component in the core use area through heavy utilization. It is acceptable and expected to have areas of high ungulate use across a landscape. However, with the growth trajectories recorded for this herd, increased habitat damage, including potential loss of shrubs, is expected in the core area over time. The disturbance being caused to this valuable habitat area will take many years to recover if elk populations are not managed now, and will require management actions such as weed management and restoration efforts.

Elk-Human Conflicts

In addition to elk-intensive use of natural plant communities, elk-human conflicts increase each year. The elk from Ron Stewart Preserve have caused damage to growing crops including corn, alfalfa and grass hay, orchards, ornamental trees and shrubs, standing forage and hay stacks, fences, agricultural equipment such as irrigation lines, and a variety of personal property including sheds and outbuildings. Colorado Parks and Wildlife (CPW) is liable for damage by elk to agricultural products and fences (C.R.S. 33-3-103 and 33-3-104). In the last four years alone (2012-2015), CPW has paid $56,727 in damages to agricultural crops caused by the Rabbit Mountain elk herd where official claims were filed and an increasing number of landowners indicate they may file game damage claims in the future.

Summary of Elk Impacts

Since 2003, elk numbers on Ron Stewart Preserve have increased from 25 to over 300, over a ten-fold increase. The elk have developed use patterns where they spend the daylight hours on Ron Stewart Preserve and move to private lands at night to feed on crops. They avoid hunting pressure on private lands and do not migrate. Their current range is six square miles. This large number of elk has heavy impacts on the native biodiversity of Ron Stewart Preserve by trampling and browsing vegetation. In addition, human-elk conflicts in the surrounding area are on the rise. For these reasons, CPW has approached Boulder County to find a solution for this increasing problem.

Plan Goal and Objectives

Goal:

Manage a sustainable elk population on Ron Stewart Preserve and surrounding areas through adaptive management.

Objectives:

1) Re-establish seasonal migration patterns where the elk migrate to higher elevation summer range for three to five months each year and do not concentrate year-round on Ron Stewart Preserve.

2) Reduce impacts to grassland sites, shrub stands, and forested areas in the high-use area of Ron Stewart Preserve. Curtail any expansion of high-use areas from the current core area.

3) Maintain an elk herd of 30-70 animals on Ron Stewart Preserve based on historic numbers. The lower end of the range is for non-migratory elk. The upper end if seasonal migration is re-established and elk use Ron Stewart Preserve for winter range. (See Figure 1).

4) Continue to work with agricultural producers and landowners to minimize elk damage to private property and elk-human conflicts to the extent possible.

Actions Taken to Mitigate the Elk Impacts

- CPW has issued game damage hunting licenses to landowners, provided panels to protect stacked hay, and facilitated hazing efforts on private lands with agricultural damage since 2003.

- CPW and BCPOS staff established a working group in August 2013 to discuss the herd status, examine natural resource and agricultural damage caused by the high density, non-migratory elk population, and possible remedies.

- In 2014, CPW created a special elk hunting subunit around Ron Stewart Preserve to concentrate elk harvest and hunting pressure on the over abundant elk around Ron Stewart Preserve, while reducing the risk of overharvesting elk in other areas of the St. Vrain elk herd. To date, liberal season dates and license quotas are allocated each year. The appropriate number of licenses for the subunit is reviewed annually.

- CPW, with assistance from BCPOS, captured four cow elk and deployed GPS collars in March 2015 to study the herd's movements and demographics (Figure 2).

- CPW, with assistance from BCPOS, captured seven more elk on Ron Stewart Preserve (for GPS collars) in February/March 2017, and as of March 2017, have captured an additional seven cows at Heil Valley Ranch.

- Based on new radio telemetry data and to fully encompass the range of the Rabbit Mountain elk subherd, the subunit was expanded in 2016. Approximately 20 antlerless elk were harvested during the 2015 season, which is not enough to stabilize the elk population growth trajectory (Figure 1). In addition, intensifying hunting pressure on private land surrounding open space may be further concentrating elk on open space (which is not open to hunting) and intensifying resource damage.

- BCPOS tested hazing in fall-winter 2015-2016.

- BCPOS established elk habitat monitoring in 2016 and will continue in 2017. Wildlife staff established six shrub transects documenting use levels on mountain mahogany in the core area used by the elk. In 2016, Plant Ecology staff established nine vegetation cover and composition transects in the core area and three outside (controls) documenting impacts from prolonged presence of elk (results summarized above).

- CPW and BCPOS gave a presentation describing the Rabbit Mountain elk herd situation to the Regional Elk Working Group in Estes Park in October 2015 to solicit input for possible remedies.

- BCPOS and CPW presented to the Boulder County Parks and Open Space Advisory Council (POSAC) on April 29, 2016. POSAC gave direction to work on an elk management plan.

Management Options Considered

Status Quo

At present, the elk population at Ron Stewart Preserve continues to increase. If no management action occurs, resource damage on Ron Stewart Preserve will continue and expand. The availability of agricultural crops to the south and east adjacent to refuge on Ron Stewart Preserve ensures that the herd will not self-regulate according to resource availability. Therefore damage to crops will increase as the elk numbers increase. Other types of conflict will continue as well (fence trampling, elk-vehicle collisions, damage to landscaping and fruit trees). CPW and BCPOS agree that management action is needed.

Fertility Control

The Environmental Protection Agency (EPA) has regulatory authority over fertility control agents for use in free-ranging wildlife under the Federal Insecticide, Fungicide and Rodenticide Act (1947). Although two fertility control agents have been approved for use in feral horses (PZP and GonaCon) and one in white-tailed deer (GonaCon), the EPA has not approved any fertility control agent for use in free-ranging elk populations. As a result, currently there is no legally available fertility control agent that could be considered for management of elk using Ron Stewart Preserve.

Even if a fertility control agent, such as GonaCon, was legally available for use in elk, it would require capture and treatment of a large portion of the breeding-age female elk population (>100 animals currently) at least every other year. Under the most favorable conditions, fertility control would prevent population growth, but not reduce the herd size. Based on recent experience capturing and collaring 4 females in 2015 and 7 females in 2017, capture and treatment logistics are an insurmountable barrier to fertility control. These elk are wary and cannot be approached within dart gun range and bait is not as effective as in normal circumstances due to the lack of persistent snow cover and the abundance of alternate food sources. In addition, human infrastructure and high velocity winter winds preclude effective helicopter capture of such a large number of elk.

Fertility control would not facilitate meeting this plan's goals because of the immediate need to reduce impacts on native plant communities and biodiversity caused by overabundant, resident elk. Elk are long lived, with female life spans of 15-20 years. As a result, it would require a decade or more before fertility control would result in any population reduction and then only in the absence of immigration from other nearby elk subpopulations, such as Heil Valley Ranch or Chimney Hollow. Also, fertility control agents would not promote greater movement of the elk herd or a return to seasonal migration. In addition, there is no evidence in the literature to indicate that fertility control techniques can be effectively applied on a scale large enough to limit population growth rates of open populations of free-ranging elk (Walter et al. 2010, Powers et al. 2014, Powers and Moresco 2015).

There are also ecological, behavioral and natural selection concerns, both known and unknown, associated with fertility control agents in free-ranging wildlife to be considered. Female ungulates treated with PZP experience multiple estrus cycles (which is not a common occurrence under natural circumstances), prolonging the breeding seasons and stress on treated and untreated animals (Powers and Moresco 2015). Fertility control may affect timing of mating and birthing seasons, and longevity of treated animals (Powers et al. 2014, Powers and Moresco 2015).

For these reasons, BCPOS and CPW conclude that fertility control is not a solution for management of the Rabbit Mountain elk herd. (See Appendix A for additional information.) However, BCPOS will work with researchers to determine if fertility control could be used in a research setting to keep elk numbers down once the plan's objectives are reached.

Trap and Transplant

Chronic wasting disease (CWD) occurs in both elk and deer on Ron Stewart Preserve and within the St. Vrain Elk herd. CWD, and potential transmission of other diseases, is reason not to transplant elk from Ron Stewart Preserve to areas far enough away to ensure elk will not return. In addition, Colorado elk herds are near or above population objectives, so finding a suitable release location is problematic especially for elk habituated to feeding on agricultural crops. Cost and logistics as described in the Fertility Control option are also restrictive for such an extensive capture operation. For these reasons, CPW and BCPOS conclude trap and transplant is not a viable option.

Professional Culling

While this method can potentially be effective at reducing ungulate populations, it is in opposition to state statute 33-1-101 (4) C.R.S which states that hunting will be the primary method of effecting necessary wildlife harvests. Agency and professional culling is also counter to the North American Model of Wildlife Conservation (Organ et al. 2012).

Past CPW experience involving agency culling for CWD management and a public survey of Evergreen residents regarding elk management options (Chase et al. 2002) indicates that the public prefers public harvest over professional culling in Colorado. In BCPOS' on-line survey of public input on this plan, of 353 respondents, only seven, or less than 2% suggested professional culling.

Culling is much more costly to implement. Estimates range from $900 (White Buffalo personal communication) to $4,700 an animal (Powers et al. 2016). It would require a significant amount of staff and volunteer time.

The State and CPW does not currently have a statewide standard for application and implementation of a contract or municipal culling program for overabundant ungulates. There is no process for requesting a permit. This would take time and any permit, thus action on the herd, would not happen this year. Therefore, CPW and BCPOS conclude that agency or professional culling is not a viable option. (See Appendix B for additional information.) Rocky Mountain National Park (RMNP) employed agency directed volunteer culling because hunting is not allowed by federal legislation. CPW assisted RMNP because necessary removals could not be achieved through a public hunting program.

Fencing

Temporary limited fencing can be an effective tool to aid in native plant recovery in areas overgrazed/trampled by elk when employed in conjunction with population reduction and distribution management options. BCPOS will use fencing as a part of managing the vegetation in conjunction with any other actions taken.

All fencing would be built to be wildlife friendly (allow movement of other species). However, monitoring would need to occur to prevent unfenced areas from damage as the elk are excluded from the fenced area. Fencing of the pine stands, used by the elk for bedding, would force elk into other areas and would be expensive. Standard 8' game fencing on wood posts is likely to cost between $15-30/meter. Electric fence for elk has also been used with high efficacy (high tensile and braided hotwire). The high tensile 5-7-strand fence costs $10-12/meter ($25-30,000 for the large field exclosure). Electric braid fencing costs $10-12/meter as well. BCPOS would determine the best alternative to fence the highly impacted native vegetation on Ron Stewart Preserve.

Fencing of agricultural fields was considered, but the number of properties and diversity of crops being utilized by the elk make this option cost prohibitive and has unacceptable ecological and esthetic consequences. While to date, CPW has paid game damage on only two corn fields, radio telemetry and landowner's complaints indicate elk are using grass pastures and grass and alfalfa hay fields as their primary agricultural forage. If the one or two corn fields are fenced, it will likely increase intensity of elk damage on other agricultural crops, which in turn would prompt landowners to call to fence their hay field and/or file for game damage payments. The larger of the two cornfields that sustain repeated damage is 27 ha with a perimeter of 2500m ($70,000 exclosure at the high end).

From a statewide perspective, CPW does not support (nor fund) the use of large-scale fencing due to impacts to wildlife movement corridors and sustained costs. Fencing one field can lead to use of other fields and request for fencing by adjacent landowners and it is not possible to fence all affected fields. In addition, funding fencing on private property sets a precedent that would not be sustainable in the Ron Stewart Preserve area and in other areas of the state. (See Appendix C for more details.)

If the elk herd population size is not reduced simultaneously, fencing will only move overabundant elk to other areas prompting new areas of damage to crops, landscape and native plants.

Crop Alternatives

Changes to the types and rotation of agricultural crops may impact game damage payments. Farmers could be approached with the option to plant alternate, less palatable crops and compensating for the difference in worth (Cattanach et all, 1991). Fallowing an acre of corn may cost around $600-750/ac ($50,000 for one year of the large acreage cornfield). The cost would be less if a substitute crop were planted.

Elk are a highly mobile and adaptable species with a wide ranging diet. Currently, the Rabbit Mountain herd utilizes native grass and shrubs, grass pastures, grass and alfalfa hay fields, corn, triticale and stacked hay as forage. In other areas of Colorado, CPW has noted elk damage to a

variety of crops, including but not limited to, pumpkins, organic potatoes, growing wheat and beans.

In the closing weeks of 2016 and early 2017, radio telemetry locations indicate the Rabbit Mountain herd use of agricultural crop fields has expanded east of N95th almost to US Hwy 287 involving dozens of landowners. Most of these landowners grow grass and alfalfa hay that elk are feeding on. Of note, grass hay grown in the Hygiene and Longmont area is well known as superior horse hay and is priced accordingly. Also of note, in 2016, one of the fields that had previously held corn that received annual game damage payments changed to alfalfa and triticale. Elk continued to utilize the field extensively, and although a game damage claim was not filed, the producer indicates a claim will be forthcoming in 2017 if elk damage continues.

CPW and BCPOS agree that alone this option will not solve the Rabbit Mountain elk herd situation because it does not reduce elk numbers. While CPW would welcome decreases in game damage payments, based on experiences with elk crop damage around Colorado, CPW concludes that crop alternatives will likely not be able to be implemented at a scale which will significantly contribute to an overall solution. However, conversations with farmers will continue in order to find a comprehensive solution to the elk issue.

Hazing

Hazing of elk can cause elk to move at least temporarily, but the literature and experience shows it is labor intensive and elk eventually habituate over time (Walter et al. 2010). In addition, hazing does not result in direct population reduction of overabundant elk. CPW may be liable for damage to real and personal property by elk while being moved by CPW (C.R.S 33-3-104(b)).

BCPOS tested hazing on Ron Stewart Preserve during the fall and winter of 2015-2016. BCPOS staff visited the southern portion of Ron Stewart Preserve 20+ times from July 2015 through March 2016. The elk always chose to move away from the staff, be they one or many. In nearly all cases elk ran away as a large group. Some of the time they chose to cross the grass flats, N. 55th Street, and the mine west of Ron Stewart Preserve to Indian Mountain, without pursuit from staff. Staff was able to influence the direction of travel in most cases. Radio-collared animals returned to Ron Stewart Preserve in usually one-to-three days (as long as six days) if they crossed the mine to Indian Mountain. No noisemakers, dogs, horses, cracker shells, gun shots, etc. were required to make the elk move.

BCPOS and CPW proposed to continue to use hazing to move elk from Ron Stewart Preserve in conjunction with the public hunting. Elk can be hazed off Ron Stewart Preserve towards Indian Mountain on days that Ron Stewart Preserve is open to the public. This combined effort may result in more elk disturbance and encourage elk movement. Also, during February and March, after hunting season and before the elk calving begins, staff can continue to use hazing to encourage migration to the north and west.

Public Input and Opinion

BCPOS published the draft elk management plan in March online with proposed limited public hunting. Staff accepted public input on the draft for one month. Of 353 respondents to the survey, 231 (66%) support the plan, 26 (7%) support the plan with modifications, and 96 (27%) don’t support the plan. The largest number of comments (17%) supported the plan because of

concern for the natural resources that are being impacted by too many elk. The largest objection to the plan was opposition to hunting on county open space (9%).

BCPOS staff presented this draft plan to the Parks and Open Space Advisory Committee (POSAC) public hearing on April 27, 2017. Public testimony was heard representing all sides of this issue. POSAC requested that staff provide more information on the alternatives considered at the May hearing. Staff modified the plan and reposted it for the public. BCPOS received 57 more comments on the plan (some had commented on the original plan). Of these, 75% supported the plan.

A survey conducted by Responsive Management finds that 77% of Americans support hunting. The survey indicates 83% support hunting for population control, 81% support hunting for wildlife management, 71% support hunting to protect property, but only 28% support it for harvesting a trophy (Responsive Management Report, 2015).

At the May 25, 2017, POSAC hearing on this draft plan, POSAC voted 3-3 on a motion to support the plan.

Frequently Asked Questions

Is this a ploy by Colorado Parks and Wildlife to generate revenue?
No. In Colorado, big game populations are managed for specific population size objectives, which are approved in a public process by the Parks and Wildlife Commission. The number of licenses issued is determined by size of the population relative to the objective. If the population is above the objective, more licenses are issued. If the population is below the objective, fewer licenses are issued. Finally, it is likely that the implementation of a public harvest program on Ron Stewart Preserve and Indian Mountain will result in fewer licenses issued than are currently issued after the refuge situation is removed and the elk population reductions are realized.

Do other Municipalities use public harvest to manage wildlife?
Yes, several open spaces and municipalities have public harvest programs to help manage wildlife populations. Below is a list of some programs on the Front Range.

- Jefferson County's Centennial Cone for deer and elk (http://jeffco.us/open-space/parks/centennial-cone-park)
- Larimer County's Red Mountain Open Space for elk, deer and pronghorn (http://larimer.org/parks/red_mountain_hunting.htm)
- The Green Ranch at Golden Gate State Park for elk (http://cpw.state.co.us/placestogo/parks/GoldenGateCanyon/pages/huntinggreenranch.aspx)
- The City of Elizabeth Deer Management Program (http://www.townofelizabeth.org/deer-management-program.html)

BCPOS Management Recommendations

BCPOS proposes to use a combination of approaches to address the natural resource damage occurring on Ron Stewart Preserve due to the large, non-migratory elk herd. Staff proposes to include fencing, hazing, coordinated hunting with adjacent landowners, and a limited public harvest program on Ron Stewart Preserve and adjacent open space properties.

Public Harvest Program

The problem of elk overpopulation and its impacts on the biodiversity of Ron Stewart Preserve, and the limited effectiveness of many alternatives, lead BCPOS to consider a public harvest program for resource management. This is not a recreational program. Outlined below is an implementation plan of this option. Specifics will be determined by the Hunt Coordination Team (CPW: District Wildlife Manager, Terrestrial Biologist, and Hunt Coordinator, BCPOS: Wildlife Biologist and Park Ranger).

Hunting has proven to be highly effective in managing wildlife populations and their distribution (Organ et al, 2012). Harvest of elk and deer for food on land that is now Ron Stewart Preserve is a traditional human use dating back to Native Americans over 10,000 years ago. The pros and cons of this option rely heavily upon the method in which it would be implemented. CPW and BCPOS staff time would be necessary. This option would require minimal cost to CPW and BCPOS, provided that participants are required to purchase an elk hunting license, provide their own equipment and volunteer their time. All harvested animals will be properly prepared and all edible parts will be removed from the property as legally required.

The mechanisms for licensure allowing animal harvest already exist via established CPW processes. A public harvest program would be in compliance with state statute 33-1-101(4) C.R.S that articulates the state will use hunting as the primary method of effecting wildlife harvest and is compatible with the North America Model of Wildlife Conservation (Organ et al. 2012).

1) Implement a public harvest program that prioritizes public safety using trained, skilled and licensed volunteers to harvest female elk on Ron Stewart Preserve and Indian Mountain Open Space. Continue to facilitate hunting on adjacent private lands using targeted, liberal elk licensing strategies.

2) Install temporary fencing in limited areas on Ron Stewart Preserve to allow for recovery of native plants on Open Space. Elk exclusion fence, as has been used on other BCPOS property, may be needed in the most heavily impacted area.

3) Capture and deploy up to 10 GPS collars on Rabbit Mountain elk herd in winter 2017 to monitor the results of management actions and facilitate adaptive management.

4) Employ adaptive management in the public harvest, fencing, and hazing practices, including hunting on private land and continued discussions about crop alternatives.

5) Implement techniques to accelerate vegetation recovery. Native vegetation impacted by elk overuse may take years to recover even after elk numbers are reduced to objective.

2017 Plan Implementation

Following is the plan for a safe public harvest program on Ron Stewart Preserve. Updates on this program, and significant changes to this approach, will be brought to POSAC and the Board of County Commissioners in 2018.

What: Limited Antlerless Elk Harvest

Who: GMU 20 Rabbit Mountain subunit (Hunt Code E-F-020-L3-R) antlerless rifle license holders, except Private Land Only licenses. Two to three hunters per week, each with up to two companions and one vehicle (only on access road). In future years the number of hunters may increase or decrease depending on safety and effectiveness. No motorized vehicles will be allowed off road.

How: Lottery type-access system administered by BCPOS. Firearms (rifles) only, foot and horse or llama travel only.

When: September 11, 2017 – January 31, 2018

- September 11 (after Labor Day to accommodate high visitor use) – December 14 (All areas, including eagle closure.)
- December 15 – January 31 (areas outside eagle closure only)
- Per week - No more than three days per week. In 2017 it will be Monday through Wednesday. This could be modified or reduced depending on hunting success and elk movements in future years.
- Property will be open one hour before sunrise to one hour after sunset. Hunters can hunt only one-half hour prior to sunrise and one-half hour after sunset per CPW regulation.

Where: Ron Stewart Preserve, Indian Mountain, and the Cushman property

- No hunting within the 300-yard buffer around property edges and open space facilities (kiosks, trailheads, and designated parking areas).
- No activity will occur within eagle closure area after December 15.
- Hunting permitted on Indian Mountain and Cushman seven days/week. These properties are closed to the public therefore hunting on these parcels doesn't pose a safety risk or displace park visitors. This additional pressure could be beneficial in getting the elk to move out of the area. Further consideration of hunting on other closed agricultural properties will be evaluated as a part of the adaptive management process.
- June 2021 Amendment: BCPOS tenant property east of Ron Stewart Preserve in the Rabbit Mountain management area.

Proposed Access:

- Top of Ron Stewart Preserve (drive in to top on the access road).
- Corner of N 75th Street and Woodland Road
- Corner of N 55th Street
- Driveway to Money property

Mandatory Hunter Orientation:

- Training and property orientation: See Appendix D for an agenda for orientation and training.
- Hunt Coordinator to lead program: This person would get calls for check-ins, success reporting, and end-of-season success reporting.
- Signed agreement from hunter
- Mandatory reporting
- Use of non-lead bullets
- No posting of harvested elk photos on social media or other electronic media
- No dogs

Wildlife Issues on BCPOS Tenant Property (June 2021 Amendment)

BCPOS agricultural leases currently prohibit tenants from any form of wildlife control, including non-lethal methods, such as hazing, or lethal methods, such as hunting. Firearms are prohibited on open space; therefore, tenants cannot use damage tags administered by CPW and are not allowed to solicit assistance from local hunters. Tenants may also be ineligible for game damage compensation via CPW for failing to meet specific criteria. For tenants to qualify for game damage compensation, CPW requires that landowners do not unreasonably restrict hunting for the problem species on the property, restrict public land access, or lease hunting rights.

Due to these restrictions, tenants often suffer significant economic impact under BCPOS management policies, and requests for compensation for documented losses are often paid by BCPOS. Payments can present a considerable drain to BCPOS operating budgets and resources and can create a strain on BCPOS-tenant relationships.

To address elk and other wildlife conflicts on tenant lands east of Ron Stewart Preserve, such as the Darby property, BCPOS tenants experiencing elk-specific game damage will be eligible for lethal removal assistance from hunters in the elk management program. Only hunters who have successfully completed the CPW/BCPOS hunter proficiency and orientation will be eligible.

Who: BCPOS tenants experiencing elk-specific game damage will be eligible for lethal removal assistance from hunters in the elk management program. Only GMU 20 subunit (hunt Code E-F-020-L3-R) antlerless rifle license holders who have successfully completed the CPW/BCPOS hunter proficiency and orientation will be eligible.

How: Tenants sustaining elk damage will coordinate with BCPOS staff and CPW to request hunters for lethal hazing. CPW and BCPOS will determine appropriate methods to maintain safety conditions for tenants and adjacent property owners.

When: Aug. 15 – Jan. 31 (through Feb. 15 with game damage tag).

Where: BCPOS tenant property east of Ron Stewart Preserve in the Rabbit Mountain management area.

Fencing

The purpose of fencing is to exclude areas on Ron Stewart Preserve that are hardest impacted by elk use and to reduce further damage to the vegetation. Fencing will prevent elk from

concentrating in these areas and encourage them to move. Potential fencing types and designs for use by private landowners to deter or prevent elk use are outlined below. Specifics will be determined by the Fencing Team (BCPOS: Wildlife Biologist and Plant Ecologist).

Elk Use of Ron Stewart Preserve Resulting in Resource Damage
The expanding elk herd has impacted Ron Stewart Preserve in a couple different ways. The elk herd at Ron Stewart Preserve currently congregates in a core use area south of the Eagle Wind Trail. Bedding areas and shaded forest patches have suffered the most from elk use. Elk travel routes down off the mountain have created game trails devoid of vegetation. These trails are subject to erosion and also are a ready substrate for invasive plants. Some seeps and springs have also become impacted by heavy use. BCPOS staff has monitoring transects documenting impact to shrub stands and meadow areas both inside and outside the core elk use area.

Elk Use Areas of Ron Stewart Preserve for Exclusion
Apart from being an overall refuge from hunting, several key habitats make Ron Stewart Preserve attractive and productive elk habitat. Fencing portions of these areas could alter the attractiveness of Ron Stewart Preserve as summer or year-round habitat. These habitats include shaded forest and riparian patches, and watering sites. Large-scale fencing or lengthy public-private border fencing is not being considered due to ecological impacts, costs, and aesthetics.

Projected Benefits and Impacts of Fences
Fencing (and seeding) of the shaded forest patches will allow them to heal from repeated bedding, trailing, and waste elimination by large numbers of elk. It will also force elk to find different places to bed down. Resource impacts will shift, but impacts to the fenced areas will be reduced and permit regrowth of the vegetation. Fencing these areas will be coordinated with some of the Vegetative Monitoring Plots. Fencing of watering sites to exclude elk would also exclude them from other mammals (deer, carnivores), and is not recommended at this time.

Sites identified for Fencing
The multi-year collected radio telemetry data and accumulated staff field experience has identified several areas that would benefit from fencing.

Location	Res Damage	Attraction	Fence	Schedule
Northern pine pocket	X	X	Y	SPR 2018
Southern pine pocket	X	X	Y	SPR 2018
Superhighway Seep	X	X	TBD	
Big Spring		X	N	
Money Spring	X	X	TBD	

The prospective fenced area of the northern pine pocket is around 6 acres in size. The one for the southern pine pocket is around 3.5 acres (see map below). Woven wire mesh fencing or 4” field fencing attached to a combination of existing trees and added t-posts is the likely the best fencing solution for such small remote areas. Material costs for the two exclosures would be approximately $2800 and $2100. They will be erected in the spring of 2018 after the hunting season with staff and volunteers. Contracted costs would be much higher. Fencing activity would also serve to disturb elk in the area.

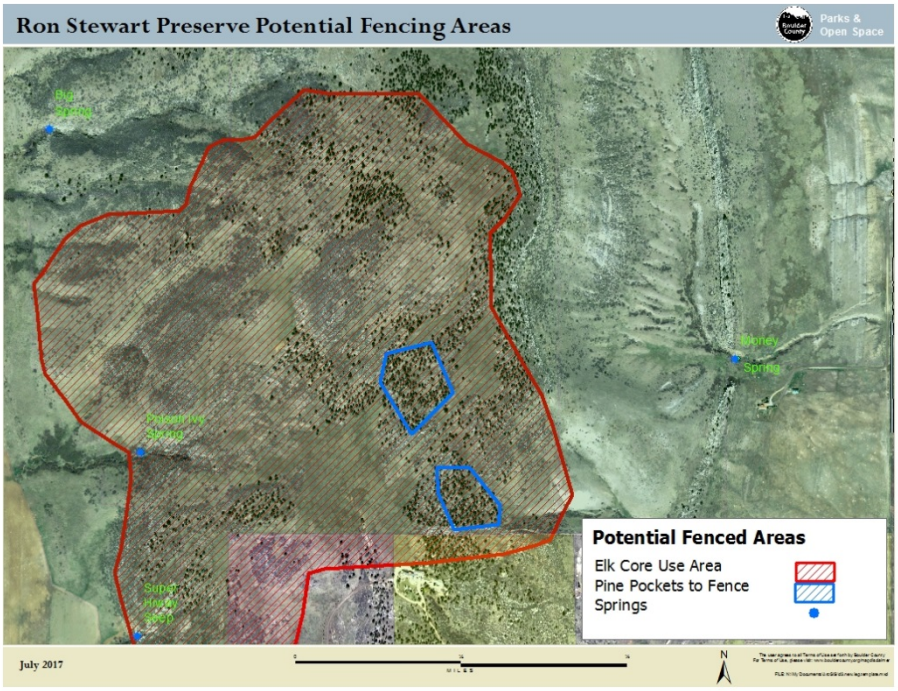

Figure 1. Proposed Fenced Areas at Ron Stewart Preserve

Fencing Options for Private Landowners

There are several fencing options for landowners presented in the Fencing Appendix of the Ron Stewart Preserve Elk and Vegetation Plan. These range from eight-foot-tall exclusionary 'game fence' to shorter electric fencing to wooden elk jumps in wire fence-lines to take the pressure off those fences and keep them intact.

Evaluation of Fencing

Through observation and telemetry data, the impacts from functional fencing will be visible immediately if they successfully exclude elk from the impact areas. These data will also show how far the elk move away from these sites. Fenced areas need to remain in place for at least five years to help aid in the vegetation restoration, to deny the attractive sites from elk, and to keep them from being re-disturbed after seeding. Other problem areas may be identified through field work and staff time in the area. They would be added to the list of sites and then prioritized for funding and implementation. Fencing concerns will remain a permanent discussion point in the scheduled meetings of the Ron Stewart Preserve at Rabbit Mountain Elk and Vegetation Management Team.

Hazing

The purpose of hazing is to contribute to the disturbance factor experienced by elk in the Ron Stewart Preserve area. This elk herd currently exists in an environment with very little disturbance, choosing to congregate in the non-trail portions south of the Eagle Wind Trail, often in large group(s). This 'relative calm' helped create the conditions that led to the explosive population growth and increasing conflicts. But, the elk are easily agitated by human presence in the core use area. It is anticipated that the combination of human presence provided by hunters

and that provided by others/hazers over a prolonged time period will cause some segment of the herd to leave the area, seasonally or permanently.

Hazing in this context is any combination of people and potential noisemakers (voices, pyrotechnics, etc.) used to create a disturbance that causes movement in elk. The first step is to use people. Usually, a single person approaching to within 150 yards will cause movement and agitation in groups of elk on Ron Stewart Preserve. Sometimes this movement is a short distance. Sometimes it results in movements from a half mile to even two miles across the valley floor to the west. The result is animals spending less time in the core area. If people alone no longer cause the elk to move, staff will use pyrotechnics such as cracker shells, bird bombs or blanks fired from firearms. Staff will continue to evaluate the most effective tools for hazing.

Re-establishment of some migration behavior is one of the four primary objectives of the Ron Stewart Preserve at Rabbit Mountain Elk and Vegetation Plan. Migration results in several beneficial outcomes. Animals spend less time in the core use area of Ron Stewart Preserve, reducing habitat impacts. Animals spend more time on other public and private lands, especially those elk that initiate migration to the west, where they may be subject to harvest and spend less time on private/agricultural lands. And prolonged hazing (along with hunting) creates the perception of uncertainty that no area in the Ron Stewart Preserve area will function as a safe area, perhaps encouraging less time on the mountain or an inclination to migration. Any reduction in the number of animals in the Ron Stewart Preserve area contributes to achieving all four objectives.

Specifics will be determined by the Hazing Team (BCPOS: Wildlife Biologist and Resource Manager, CPW: Senior Terrestrial Biologist).

Elk Hazing During the Hunting Season
While hunting will be the primary disturbance on Ron Stewart Preserve during the hunting season (September – January), hazing will be used during this time frame when elk behavior indicates that additional measures are needed to move the elk. If additional pressure on the elk is warranted, options will be considered by the Hunt Coordination Team including changing hunter activity and pressure and/or alternatively initiating various hazing techniques. Any hazing that occurs on the mountain will be in the non-hunting portion of the week (Thurs-Sun) to avoid influencing hunter opportunity. Staff will haze during unfilled weeks or during weeks where hunters choose not to hunt on Ron Stewart Preserve proper unless it is not necessary. However, not hazing every week may also serve to confound animals by establishing more uncertainty. When hazing during the hunting season is used, specifics will be determined by the Hunt Coordination Team. The hunters will be informed of the plan specifics so that safe separation of hunters and hazers will be maintained, and hazing will be authorized by CPW as required by state statute.

Elk Hazing After the Hunting Season
Hazing will be the primary disturbance on Ron Stewart Preserve after January 31. Staff (and perhaps volunteers) will haze animals as needed, through mid-May. This will serve to maintain some level of disturbance in the area for about 8 months in the effort to make Ron Stewart Preserve less attractive as a habitat. Hazing could occur on consecutive days, and could end up

moving animals out of the county or back-and-forth to and from Ron Stewart Preserve. Fence building and other activities in the high use area may also disturb the elk herd. This hazing will serve to disperse the habitat impacts across the landscape during green-up. The intensity of hazing will increase in late April and May in an effort to encourage migration westward. Hazing will cease in mid-May to avoid detrimental impacts to calving cows.

Elk Hazing Evaluation

Hazing results will be catalogued by the team after each effort to note how effective the hazing was (how many animals moved, how far, and in which direction). The team will also use the telemetry data to see how long animals remained off the mountain. Some adjustments may be made during the hazing period to raise or lower the frequency or intensity of hazing based on the responses of the animals or on feedback from other teams or the public. The hazing program will be evaluated after cessation in June. A summary report will be written and available to help guide future management. It will help document the time elk spend on Ron Stewart Preserve, as well as whether or not animals engaged in migration or other movements. Hazing (in some form) may continue for at least the three-year life of the overall plan.

Data Collection

The purpose of data collection is to understand how management actions affect elk use of the greater Ron Stewart Preserve area and inform managers about changes in management activities that will improve elk management and vegetation recovery. This includes the means and methods to monitor elk use (elk numbers, movements, seasonal migration, concentration areas, and shifting habitat use), as well as the vegetative responses to any changes in the parameters of the elk population related to hunting seasons and the public harvest program. The monitoring efforts will include collecting information on: elk use within the greater Ron Stewart Preserve area, elk distribution (through GPS collars), and the effects of hazing, hunting, and the public harvest program on elk use of the area. It will also collect information from various vegetative and shrub plots in use and control areas on Ron Stewart Preserve open space habitat.

Specifics will be determined by the Data Collection Team (BCPOS: Wildlife Biologist, Plant Ecologist, CPW: Senior Terrestrial Biologist, Terrestrial Biologist.)

Elk Use of Ron Stewart Preserve and the Surrounding Area

For the initial three-year cycle of the plan, monthly coordinated ground surveys will be conducted in the greater Ron Stewart Preserve area (Ron Stewart Preserve, Indian Mountain, Dowe Flats, and private lands east and south of Ron Stewart Preserve) from August through April. These surveys will provide minimum counts of elk in the area. The annual high count during the December – March period will be used to evaluate progress toward the plan objective of 30-70 elk on the mountain. Coordinated surveys will be conducted at dawn or dusk by a team of observers to maximize the detection of elk moving onto or off of Ron Stewart Preserve, Indian Mountain, and other BCPOS properties. Surveys will attempt to collect information on all groups of elk which have radio-collared elk and are within the greater Ron Stewart Preserve area. If a large proportion of the radio-collars are not detected during the survey, but known to be in the area, additional surveys might be attempted during that month. Information collected during the monthly surveys includes:

- Minimum numbers of elk in the area

- Classification information (sex and age composition)
- Collars observed during the surveys
- Group numbers and size
- Elk distribution
- Private land use
- Evaluation of minimum counts before and after the public harvest management program has been implemented

Distribution and Movement

For the initial three-year cycle of the plan, GPS collars deployed on the seven elk marked in 2017 will be used to monitor elk distribution and movements as affected by:

- Hunting seasons (annually evaluate pre- and post-season distribution)
- Public harvest program on BCPOS properties
    - Evaluate time-spent on BCPOS properties before and after public harvest management program implementation
    - Evaluate time spent in core use areas before and after public harvest management program implementation
    - Evaluate time spent on BCPOS properties during the public harvest program
- Agriculture production (monitoring elk use of the adjacent fields both during the growing season vs. dormant season and monitoring what crops they are damaging via game damage claims)
- Fencing
- The eagle closure
- Season of year
- Elk life history (e.g., calving and the rut)
- Hazing (number of days of hazing, methods used, staff resources, movements of the elk, length of time elk stayed out of the core area)

GPS collars will also be used to monitor mortality sources. If GPS collars fail or are lost to the monitoring program due to hunting, road strikes, etc., or a major shift in distribution occurs, capture efforts will be re-instituted to maintain a ratio of one collar per 30-50 elk based upon the highest annual winter count.

Hunting and Public Harvest Management Program Effects on Elk Use

Mandatory reporting from hunters participating in the public harvest program will also be collected to provide information on elk use as related to the harvest program. The information collected will provide information on:

- Hunting effort on BCPOS properties (number of hunters and days hunted)
- Harvest success/number of elk harvested
- Harvest location
- Elk distribution related to hunting effort (related to Distribution and Movement above)
- Behavior of elk

In addition, CPW will survey all hunters in the sub-unit (EF-020-L3-R) for their success. This unit encompasses the greater Ron Stewart Preserve area.

Vegetation Monitoring

BCPOS has established vegetation plots (for herbaceous and for shrubs) to set baseline information and to be able to monitor vegetative responses to elk hunting, hazing, fencing, and harvest pressure. There are currently 18 vegetative plots of treatment and controls, and 12 shrub plots of treatment and controls. These surveys have been conducted in 2015 and 2017, and will be conducted every other year for at least two more cycles (2019 and 2021) as vegetation recovery and composition change will be slow to change.

- BCPOS Plant Ecology staff reads transects in summer (July and August)
  - These transects read species composition and vegetative cover
- BCPOS Wildlife staff reads shrub transects in late fall (October through December)
  - These transects read plant vigor, height, and two-dimensional cover

Additional monitoring may be established if use areas change and to monitor vegetative recovery related to fenced areas.

Reporting

BCPOS telemetry, counts, and use data will be summarized quarterly (August 1, November 1, February 1 (post-hunt), and April 1). Vegetative monitoring will be summarized annually after the monitoring is completed (February 1).

Adaptive Management

BCPOS, in conjunction with CPW, will use adaptive management methods to manage the elk and vegetation of Ron Stewart Preserve. Adaptive management begins by setting objectives and implementing strategies to reach those objectives. The next steps are monitoring the elk and vegetation responses and evaluating the results of monitoring. Finally, BCPOS and CPW will determine changes that will help achieve the objectives. Below is the adaptive management plan. Specifics will be determined by the Adaptive Management Team (BCPOS: Wildlife Biologist and Resource Manager, CPW: Senior Terrestrial Biologist).

Goal and Objectives: Manage a sustainable elk population on Ron Stewart Preserve and the surrounding areas by re-establishing seasonal migration, maintaining a herd of 30-70 elk, reducing impacts to the native ecosystem, and reducing elk-human conflict.

Implement: Hunting, fencing, and hazing

1. Public harvest program implementation is described above. For the first year, BCPOS will use hunters who already have the sub-unit tags for the Ron Stewart Preserve area. These hunters have the option of requesting at least a week to use their tag to help Boulder County manage the herd on Ron Stewart Preserve.
   a. To address elk and other wildlife conflicts on tenant lands east of Ron Stewart Preserve, staff requested an amendment to restrictions on tenant-leased land. BCPOS tenants experiencing elk-specific game damage will be eligible for lethal

removal assistance from hunters in the elk management program. Only specific subunit license holders who have successfully completed the CPW/BCPOS hunter proficiency and orientation will be eligible (approved June 2021).

2. Fencing is described above in the section on page 20. BCPOS will be responsible for installing and maintaining fencing on Ron Stewart Preserve.
3. Hazing will be used from February through April as described in the section on page 22 above. In addition, regular natural resource management work, such as fence construction and repair, weed and timber management, etc. can be scheduled from February through August on Ron Stewart Preserve to discourage elk from returning to unnatural concentrations and sedentary behavior. With monitoring of elk populations on Ron Stewart Preserve, hazing may be used at other times of the year.

Monitor: Elk populations and vegetation

1. Elk populations. Coordinated elk counts will be conducted at least once per month from September through April for three years. The benchmark to evaluate progress toward the objective herd size of 30-70 elk will be the annual high count during winter (December-March). CPW will conduct counts for one year. BCPOS will continue the monthly counts for subsequent years.

2. Radio collars. Elk movements and time spent within the Ron Stewart Preserve-Indian Mountain area will be monitored using the seven satellite GPS collars deployed in early 2017. The collars will allow detection of timing and location of seasonal migratory movements as well as daily movements with the assumption that each collar represents the movements of a group of elk and not just the collared individual. During monthly counts and during anecdotal observations, the number of elk associated with each collar will be recorded to inform representation of overall herd movements. In addition to overall elk numbers, the amount of time those elk spend within the Ron Stewart Preserve/Indian Mountain area correlates to impacts to the plant community and the number of human-elk conflicts. If elk remain sedentary within the currently documented limited home range, then sustainable elk numbers will be closer to 30. If the majority of the elk return to seasonal migration, then up to 70 animals is acceptable.

3. Game damage and human-elk conflict monitoring. The number and amount of game damage claims and the number and type of human-elk conflicts will be recorded by CPW beginning with the approval of this plan (August 2017). It is anticipated that the number of human-elk conflicts and game damage claims will decline as elk numbers are reduced.

   However, other factors affect game damage and conflict reporting. When prices for agricultural products are high, game damage claim amounts increase even if the actual physical damage to crops may be reduced. In years of reduced production, such as with drought, producers are more likely to report game damage and other conflicts with elk because of tighter profit margins. Due to these and other confounding factors, game damage and human-elk conflicts will be monitored as part of the adaptive management approach, but benchmarks for changing strategies are not predetermined.

4. Hunting Success. While elk numbers and movements are key determinants of success in meeting plan objectives, hunter harvest of elk will be monitored for Game Management Unit 20, for the smaller subunit which contains Ron Stewart Preserve, and on the BCPOS properties open to the elk public harvest program. The GMU 20 harvest estimate will provide point estimates for bull and cow harvest with associated confidence intervals. The subunit estimate will be a point estimate for cow harvest. These estimates will inform future hunting license allocations to maintain the overall St. Vrain elk herd and the number of elk using the Ron Stewart Preserve-Indian Mountain area at or moving toward respective population objectives. Since the benchmark objectives are related to elk numbers and distribution, there are no benchmarks for hunter success.

   BCPOS will monitor the number of hunters who implement the hunt on open space properties, and collect data on how many days each hunter spends attempting to hunt on open space properties, whether they were successful at harvesting an elk, and where it was harvested. This information will be collected and presented at annual updates to POSAC and the BOCC. CPW will monitor the success rate of hunters in the larger subunit (E-F-020-L3-R) and in GMU 20. These will help staff compare success rates on BCPOS properties verses in the larger units. It may also indicate whether hunting on Ron Stewart Preserve moves the elk off their refuge and hunters are more successful within the larger unit. CPW annually assesses the herd size within the GMU.

   Vegetation Recovery. Since vegetation is the most visible indicator of ecosystem health, BCPOS will continue monitoring vegetation signs of recovery in the most heavily impacted core use area. Staff has collected data over three years which include vegetation diversity and health in the impacted area and in non-impacted areas for comparison. Staff will compare photo points and vegetation measurements in these areas and expect to see increased shrub growth, more plant diversity, and reduced bare ground cover with fewer animals concentrating in these areas. BCPOS will compare photos and vegetation metrics once every two years. This will include collecting information in the fenced areas. In addition, weeds are currently more prevalent in the core elk-use area. Staff will actively treat weeds in these areas, which will help reduce their negative impacts on native vegetation, and may serve as disturbance to the elk that remain in the core use area. Vegetation recovery will take too long to use for changing hunting strategy in the next three years, but over the next five years and beyond staff expects to see trends moving toward more native plants, less bare soil and fewer weeds.

Evaluate

1. The high count of elk from December through March will be used to evaluate progress toward the objective of 30 to 70 elk.
2. Movements of satellite GPS collared female elk will be evaluated to detect seasonal migratory movements and time spent on Ron Stewart Preserve, Indian Mountain, and associated private lands. Based on counts and anecdotal sightings of elk associated with each collar, the proportion of the subherd exhibiting similar movements will be evaluated to determine progress toward the objective of seasonal migration and less sedentary behavior.

3. BCPOS staff will continue long-term monitoring of the vegetation response to reduced elk use and fencing.

Adapt

1. Within the first hunting season, BCPOS and CPW staff will be monitoring all aspects of this management action. Depending on how the elk react to these actions, BCPOS may modify several aspects of the program such as changing the days of the week or the number of hunters allowed. The main goal of elk dispersal tactics is for them to move north and west of Ron Stewart Preserve. This is where there are other elk in the game management unit that still migrate. Radio telemetry will show if elk are moving in this direction. If elk are moving north and west, CPW and BCPOS will continue with management actions until the numbers of stationary elk on Ron Stewart Preserve are at the objective.

   The first winter counts after implementing this management will indicate whether elk numbers on Ron Stewart Preserve are decreasing, staying the same, or rising. If they are decreasing, methods are working to achieving the objectives and BCPOS will continue with the same management for the following year. If they are staying the same or increasing, BCPOS and CPW will determine whether changing the days of the week, increasing the number of hunters on the property per week, and/or adding hazing during the hunting season would increase pressure on the herd. BCPOS will also consider modifications to the hunting times of the day depending on the reports of hunter success. If hunters are primarily successful at one time of day or another, staff may direct hunting to these times.

   If elk are moving east rather than north and west, this will take management modifications. Staff will count elk on other BCPOS properties if radio collars and sightings show they are dispersing onto Boulder County agricultural lands further east. If they are finding refuge on other county-owned land, BCPOS may need management on these lands, like hazing and other disturbances to prevent a repeat of the Ron Stewart Preserve refuge. If there are indications of what makes the elk move one direction or another (such as what direction hazing comes from), BCPOS will utilize these methods for encouraging the elk to go north and west and join other elk in the GMU 20 herd.

   If elk become adapted to the hunting schedule BCPOS will change the schedule. If elk are avoiding the area from Monday through Wednesday for three out of four consecutive weeks, staff may switch days of the week, maintaining three days of closure. Staff will consider having the hunting days on Ron Stewart Preserve spread out, rather than three in a row. Visitor use will be a main factor in how BCPOS decides what days to direct hunting. BCPOS will always try to minimize the amount of recreationists impacted by the property closure.

2. Annually. If elk numbers are not at objective goal after the first year, BCPOS will take one or more of the following measures. BCPOS will keep the status quo on hunting, hazing, and fencing plans. If there are significant declines in elk numbers and the elk are moving north and west, the management actions are moving BCPOS toward the

objectives, but BCPOS needs to continue management until the goal is attained. This is one of the reasons for a three-year plan, it may take more than one year to see elk behavior changes and numbers decline.

BCPOS may also modify hunter numbers to increase the pressure on the elk. BCPOS and CPW may increase hunters if it is determined that hunting success and safety can be maintained and the mountain can handle three to four hunters per week. BCPOS will not increase the number of days that the property is closed to the public to more than three days per week. This may increase the time elk stay off Ron Stewart Preserve and encourage them to join herds further north and west. These modifications could happen after the first year or in subsequent years as elk behavior changes.

If numbers stay high and there is a shift in where the elk use Ron Stewart Preserve, BCPOS may need to add more fencing to protect sensitive areas and encourage elk to move out. This may also be true of Indian Mountain and Cushman, two properties where BCPOS will also be managing elk in the first several years. If elk find new refuge on these properties, staff will consider adding fencing and using hazing to impact elk use. Also, staff will assure that the fencing is being effective. Staff may need to modify the design or reinforce it over the course of this plan.

If hunting is successful at getting the elk to move, and elk numbers are decreasing, staff will look at ways to minimize impacts to users. Hunting hours could be modified. For example if hunters are most successful in the mornings, hunting may be limited to morning hours, allowing the park to be opened in the afternoons. All modifications will prioritize minimizing the number of days that the property is closed to the public. Staff will seek a variety of outside experts in addition to CPW to review management and progress toward achieving goals.

3. When elk numbers are at objective. If the objectives are met within the first year primarily due to movements, then BCPOS will maintain the hunt the second year to prevent the elk from returning to concentrate on Ron Stewart Preserve. Using the hunting data, staff may determine where best to direct hunters for efficiency and may modify times of day that hunters access the mountain.

   If fencing is effective at keeping the elk out of the most impacted areas, staff will assure that the fencing is maintained. If fencing is not having an effect on elk use because there are so few elk on the mountain, fencing will be maintained for a few more years, but no additional fencing would be installed. Additional fencing prevents movement of other wildlife, is costly, and could restrict other management objectives like forest management. The minimum amount of fencing necessary will be used to protect the vegetation and encourage elk dispersal.

   If hunting is effective at dispersing the herd, additional hazing may not be needed on Ron Stewart Preserve or on the adjacent BCPOS properties. Staff will not add hazing during the hunting season in this scenario.

BCPOS staff will continue to investigate the feasibility of birth control as a potential tool for managing elk. Local researchers, and state and federal agency experts will be contacted to determine if collaborative research is possible. BCPOS staff will continue to monitor state and federal regulations as they pertain to birth control in large ungulates as well.

If objectives are met during the second or third year after plan implementation, then staff will scale back hunting to a maintenance hunt to keep the numbers in check. The goal of this is to keep the elk from concentrating on Ron Stewart Preserve and Indian Mountain in the future. Staff will consider reducing hunting to one or two months per year and determine if the same schedule of three days per week is needed, or whether this could be modified to reduce property closures. If the length of hunting is reduced, staff will continue to monitor elk numbers with the radio collars and monthly counts and adjust as necessary in the future if elk numbers again begin to climb.

After three years, if elk numbers and movements are at objective, the vegetation recovery is progressing, and human-elk conflicts are declining, then BCPOS will re-assess what combination of tools and management actions (e.g., fertility control, fencing, hazing, and hunting) can maintain the desired conditions while managing for other natural resource and recreation values at Ron Stewart Preserve.

Communications Plan

The objective of the plan communications is to provide interactive sharing of information with all stakeholders that clearly states the scope and goals of the plan, measurements of success, and methods to accept feedback and mitigate impacts on identified target audiences. Specifics will be determined by the Communications Team (BCPOS: Communications Specialist, Education & Outreach Supervisor, and Ranger Supervisor CPW: PIO, Wildlife Officer).

Content

Key message: Limited hunting has been approved based on the immediate need to address elk-related damage to the sensitive vegetation and the size of the herd at Ron Stewart Preserve. This plan defines the hunting of female (cow) elk in the Rabbit Mountain herd as a resource management tool only. It does not create a new policy allowing recreational hunting on Boulder County open space properties.

Topics: Plan goals, management tools, implementation, measurements of success, adaptations, and plan updates.

Target Audiences & Platforms

General Public.

Platforms: local news, website, onsite educational displays and programs, social media, email list

1. Online: website www.BoulderCountyOpenSpace.org/elkmanagement (including form for public to submit questions), Facebook, Twitter, Instagram, online news stories; posting current and ongoing updates, including end-of-season report).

2. Publications: Images quarterly magazine, Volunteer Newsletters, local newspapers
3. Meetings: POSAC and BOCC public meetings update reporting on first year in April/May 2018
4. Onsite:
    - Roadside electronic sign on Hwy. 66 announcing closure
    - Trailhead displays and education tables, August & September 2017
    - Flyers at trailhead kiosk
    - Safety border signs at perimeters of Ron Stewart Preserve, Indian Mountain, and the Cushman property

Neighbors.
Platforms: local news, website, onsite displays, direct mail, updates to sign-up email list
1. Trailhead displays and education tables, August & September 2017
2. Direct Mail, August 2017
    - Letter to neighbors within one-half mile of property boundaries (Ron Stewart Preserve and Indian Mountain) explaining plan and offering hunt coordinator contact information to discuss any concerns, issues, desire to invite hunters to their private land.

Hunters.
Platforms: local news, website, direct mail, onsite orientation, shooting proficiency test
1. Direct mail, phone call reminders, and email to hunters that qualify for the current year hunt.
2. Hunters interested in accessing private land for hunting: CPW will coordinate between hunters and private landowners.
3. Onsite: All hunters who draw a Ron Stewart Preserve Access Permit will be required to attend a shooting proficiency test and onsite orientation.
4. Website: www.BoulderCountyOpenSpace.org/elkmanagement, current and ongoing updates on 2017 eligibility and plans for future years.

Media.
Platforms: news releases, website, social media, BCPOS & CPW PIO relationships
1. Prepare statements as predictable.
2. On-camera and radio interviewees include commissioners' office, BCPOS, and CPW PIOs.
3. Expect media to interview and quote public, including supporters, neighbors, hunters, and non-supporters.

Interagency Coordination.
Platforms: Subcommittees (Public Communications, Hunting Logistics, Hazing, Fencing, Adaptive Management, Data Collection) and whole-team check-ins

1. Coordinated communications from CPW & BCPOS to target audiences
2. CPW Wildlife Officers and BCPOS Rangers to establish consistent enforcement plans, including treatment of closure violations, wildlife harassment, and hunter harassment
3. Consistent and ongoing communications between CPW & BCPOS project progress and adaptive management

BOCC Updates.
Platforms: PMIs and annual public meetings

1. Periodic updates at PMIs on public feedback and adaptations to elk management
2. Weekly email updates to BOCC on progress during the hunting season including monthly elk counts.
3. POSAC and BOCC public meetings update reporting on first year in May 2018 and annually thereafter for the three-year term of this plan

Plan Duration

This is a three-year plan to manage the elk and vegetation of Ron Stewart Preserve. After three years, staff will update the plan with lessons learned and modifications for the future. The update will be reviewed by POSAC and approved by BOCC. Staff will continue to seek input from experts on elk management including Rocky Mountain National Park, the National Park Service, and CSU wildlife scientists.

When the Ron Stewart Preserve at Rabbit Mountain Management Plan is completed (sometime in the next two to five years) key aspects of elk and vegetation management will be included in that plan.

Literature Cited

Boulder County Parks and Open Space. 2016. Vegetation Monitoring at Rabbit Mountain. 2016. 12pp.

Boulder County Parks and Open Space. 2017. Rabbit Mountain Browse (Schmutz) Vegetation Monitoring. 2015-2016. 10pp.

Cattanach, A. W., A. G. Dexter, and E. S. Oplinger. "Sugarbeets." Sugarbeets. Alternative Field Crops Manual, University of Wisconsin, July 1991. Web. 25 July 2016. https://www.hort.purdue.edu/newcrop/afcm/sugarbeet.html

Chase, L. C., W. F. Siemer, and D. J. Decker. 2002. Designing stakeholder involvement strategies to resolve wildlife management controversies. Wildlife Society Bulletin 30:937-950.

Colorado Natural Heritage Program (CNHP). 2009. Survey of Critical Biological Resources in Boulder County, Colorado. 415pp. http://www.cnhp.colostate.edu/download/documents/2009/BoulderCoReportFINAL_6-26-2009.pdf

Ehrenberger, J, Urbanek, K, and Mathies, Adaptation Environmental Services, and Rocky Mountain Biological Services. *A General Herpetofauna Assessment And Mapping Of Hibernacula At Rabbit Mountain.*

Organ, J. F, V. Geist, S.P. Mahoney, S. Williams, P. R. Krausman, G. R. Batcheller, T. A. Decker, R. Carmichael, P. Nanjappa, R. Regan, R. A. Medellin, R. Cantu, R. E. McCabe, S. Craven, G. M. Vecellio, And D. J. Decer. 2012. The North American Model of Wildlife Conservation. The Wildlife Society and The Boone and Crockett Club Technical Review 12-04. 47pp.

Powers, J. G., R. J. Monello, M. A. Wild, T. R. Spraker, J. P. Gionfriddo, T. M. Nett, and D. L. Baker. 2014. Effects of GonaCon Immunocontraceptive Vaccine in Free-Ranging Female Rocky Mountain Elk (*Cervus elaphus nelsoni*). Wildlife Society Bulletin: 38: 650-656.

Powers, J. and A. Moresco. 2015. Review of ungulate fertility control in the National Park Service: outcomes and recommendations from an internal workshop – February 2012. NPS Natural Resource Report. 110 pages. https://www.nature.nps.gov/publications/nrpm/nrr.cfm

Power, J, R. Kahn, W. Whitworth, J. Mack and B. Bobowski. 2016. Elk Management in the National Park Service. Two case studies in the use of public volunteers. Natural Resource Rep. NPS/NRSS/BRO/NRR-2016/1119 24pp.

Responsive Management Newsletter – Survey on public opinions about hunting http://www.responsivemanagement.com/download/RM_ENews/RM_HuntPublic_newsletter.pdf

Walter, W. K., M. J. Lavelle, J. W. Fischer, T. L. Johnson, S. E. Hygnstrom, and K. C. VerCauteren. 2010. Management of damage by elk (Cervus elaphus) in North America: a review. Wildlife Research. 37:630-646.

Appendices

Appendix A: Efficacy of Fertility Control for Managing Rabbit Mountain Elk FAQ

What fertility control agents are approved for use in free-ranging elk populations?
Fertility control agents must first be approved by the Environmental Protection Agency (EPA) and then by individual states before application in management situations. No agents have been approved for elk by the EPA or any states.

Have fertility control agents been tested in elk?
Porcine zona pellucida (PZP) and GonaCon have been tested in captive and in free-ranging elk. Both agents are effective in reducing pregnancy rates, although, they are less effective in free-ranging elk than in captive elk. To date, neither fertility control agent is used or has proven to be effective at managing population size in free-ranging elk.

What free-ranging animals are PZP and GonaCon approved for?
PZP is approved for use in feral horses. GonaCon is approved for use in feral horses and white-tailed deer.

What are the health or behavioral effects in treated animals?
Females treated with PZP continue to have estrus cycles, but most often fail to become pregnant. As a result, the breeding season may be extended in members of the deer family from a few weeks to several months. The presence of PZP treated female elk may result in bull elk continuing to bugle, tend harems and fight other males past the normal September-October breeding season. The extended breeding behavior could result in social stress and reduced body condition for animals within the herd. For these reasons, PZP is not the preferred fertility control agent for members of the deer family. In contrast, females vaccinated with GonaCon showed a decrease in sexual activity and breeding behavior, although they were maintained as part of the harem. Behavioral effects of any type of fertility control have not been well studied in free-ranging elk.

What is the treatment method for GonaCon in white-tailed deer?
GonaCon must be hand injected in deer. At this time, it is not approved for use in elk. At the time of approval, an appropriate treatment method would be determined.

How often would female elk need to be treated if GonaCon was approved?
A study in Rocky Mountain National Park indicated that GonaCon was effective at reducing pregnancy rates in female elk for one to two years post treatment (Powers et al. 2014). Thus, female elk would need to be treated at a minimum every other year. It is unknown if after multiple treatments, they would be permanently infertile or maintain infertility for an extended period.

What proportion of an elk herd would need to be treated to prevent population growth?
Population modeling for other deer and elk herds indicates that a large proportion (80% or more) of breeding age female elk would need to be treated once every one to two years.

How much would it cost to administer GonaCon in the Rabbit Mountain elk herd if it were legalized for use in elk?
The GonaCon vaccine itself costs approximately $50 per dose. However, the main cost associated with using GonaCon, or any fertility control agent, is associated with the time, money and logistical constraints associated with capture and vaccination of elk. In most of Colorado, cost for helicopter capture of elk ranges from $600-$1000 per animal or more in difficult capture conditions.

The Rabbit Mountain elk are wary, unapproachable and their range remains snow free most of the winter due to down slope (Chinook) winds making capture difficult. In addition, the amount of human infrastructure in the area and the frequent high velocity winter winds precludes effective helicopter capture techniques. Based on the 2017 capture effort to radio-collar seven female elk on Ron Stewart Preserve, the fertility control cost estimate would be up to $2,000 per elk including personnel time, vehicle mileage, bait, capture drugs, equipment (syringes, needles, ear tags, visual collars, etc.) and equipment repair (jab sticks, Clover traps). The high proportion of the elk herd that would require capture, treatment and marking will add significantly to this cost due to unintended recaptures of previously treated animals.

This equates to approximately $200,000 per 100 elk. Current estimates put the number of breeding age female elk on Ron Stewart Preserve at 125-160.

Would it be logistically possible to capture 80% of the female elk in the Rabbit Mountain herd?
Rabbit Mountain elk cannot be approached within darting range (<60m) on foot or in a vehicle, unlike elk further north in and around Loveland, Estes Park and Rocky Mountain National Park. Bait has reduced effectiveness due to the lack of persistent snow cover in the area and the abundance of alternative food sources including crops, stacked hay and landscaping. Helicopter capture is precluded due to human development and frequent high velocity winter winds. Several weeks of effort were required to capture and collar 4 elk in 2015 and again for 7 elk in 2017, so it is not logistically possible to capture so many individual elk each year within this particular herd.

If fertility control could be administered to 80% of the elk every other year, how long would it take to see a population reduction?
Elk are long lived with female elk often reaching 15-20 years of age. While fertility control might “freeze” population growth, it would take a decade or more to see any reduction in elk numbers. Fertility control is not an effective population reduction technique.

What about immigration or emigration with other elk herds?
Immigration of elk from the nearby Heil Valley Ranch elk subherd to Ron Stewart Preserve has been documented by radio telemetry and the Chimney Hollow elk herd is also nearby. As a result, untreated female elk would periodically join the Rabbit Mountain herd diluting the treatment effect. Conversely, some treated elk would disperse from the Ron Stewart Preserve area losing the benefit and investment in these treated animals. These types of inter-population

movements add further to the expense and logistical challenges of using fertility control as a management tool.

Are there ecological effects of fertility control agents in elk?
Potentially. Changes to natural selection, effects on social structure and behavior, timing of mating and birthing season, changes to longevity, impacts to migration all need to be studied before use as a management tool in free-ranging native populations (Powers et al. 2014, Powers and Moresco, 2016).

Is fertility control recommended for the Rabbit Mountain elk herd?
Even if a fertility control agent were legally available, its use would not help reach the Ron Stewart Preserve Elk at Rabbit Mountain Management Plan goals because of the immediate need to reduce impacts on native plant communities and overall biodiversity by overabundant, resident elk. Elk are long lived, with female life spans at 15-20 years. Thus it would require a decade or more before fertility control alone would result in any population reduction and then only in the absence of immigration from other nearby elk subpopulations, such as Heil Valley Ranch or Chimney Hollow. Fertility control agents would not promote greater movement of the herd or a return to seasonal migration. Indeed, there is no evidence in the literature to indicate that fertility control techniques can be effectively applied on a scale large enough to limit population growth rates of free ranging elk or other cervids (Walter et al. 2010, Powers et al. 2014, Powers and Moresco 2015).

Literature Cited:

Powers, J. G., R. J. Monello, M. A. Wild, T. R. Spraker, J. P. Gionfriddo, T. M. Nett, and D. L. Baker. 2014. Effects of GonaCon Immunocontraceptive vaccine in free-ranging female Rocky Mountain elk (*Cervus elaphus nelson*). Wildlife Society Bulletin 38(3). 650-656.

Powers, J. and A. Moresco. 2015. Review of ungulate fertility control in the National Park Service: outcomes and recommendations from an internal workshop – February 2012. NPS Natural Resource Report. 110 pages. https://www.nature.nps.gov/publication/nrpm/nrr.cf.

Walter, W. K., M. J. Lavelle, J. W. Fischer, T. L. Johnson, S. E. Hygnstrom, and K. C. VerCauteren. 2010. Management of damage by elk (*Cervus elaphus*) in North America: a review. Wildlife Research. 37:630-646.

Appendix B: Culling vs. Hunting

Rocky Mountain National Park
Elk & Vegetation Management Plan Fact Sheet

https://www.nps.gov/romo/learn/management/elkveg_fact_sheet.htm

- A variety of conservation tools are being used in (the RMNP) plan implementation including fencing, vegetation restoration, and culling. Culling is the primary conservation tool that is being used for lethal reduction of the herd. In future years, the park, using adaptive management principles, could reevaluate opportunities to use elk redistribution, wolves, or fertility control as additional tools.

- The actual number of animals the NPS may cull, and the costs, will vary each year based on annual population surveys and hunter success outside the park. The level of management action taken to control the population size is adjusted annually based on the current population size estimates. Based on adaptive management, actions to control the population will be taken to manage for a population size within the range specified in the ROD (600-800 elk in the park subpopulation and 1,000 to 1,300 elk in the Estes Park subpopulation) and to meet vegetation objectives.

- National Park Service personnel are responsible for culling operations. To augment NPS personnel, authorized agents assist in culling operations under the direct supervision of NPS personnel. Cost, efficiency, and effectiveness are the factors that determine when additional personnel are needed. For purposes of this plan, "authorized agents" can include: professional staff from other federal, state, or local agencies or Indian tribes, or qualified volunteers. The NPS selects and supervises all personnel, including qualified volunteers. Short term closures can be implemented while culling activity is occurring.

- Cullers, including NPS personnel and authorized agents, are certified in firearms training, specially trained in wildlife culling, and are required to pass a proficiency test in order to qualify and participate in culling activities. Cullers are expected to work in teams under the supervision of a NPS team leader to insure humane dispatch and quality meat recovery.

- Culling activity has occurred during the winter months, early in the morning, to minimize impacts on park operations, visitors, private inholdings, and neighbors

- What is the difference between hunting and culling?
  Hunting is not allowed in Rocky Mountain National Park and is not a part of the elk management plan. Hunting is a recreational activity that includes elements of fair chase and personal take of the meat. Hunting is administered by the state fish and game agency. Culling is used as a conservation tool to reduce animal populations that have exceeded the carrying capacity of their habitat.

  Culling is done under very controlled circumstances in order to minimize impacts on park

operations, visitors, private inholdings, and neighbors. Culling is an efficient and humane way to reduce herds of animals that are habituated to the presence of humans.

- Why was public hunting considered but dismissed as an alternative?
  Hunting is prohibited in the park by law. In 1929, Congress prohibited hunting within the limits of Rocky Mountain National Park. Public hunting within the park raises several issues:
    1) It would significantly change the visitor experience in the park. Visitors expect to come to Rocky Mountain National Park and not encounter hunters.
    2) It would require changing the law that has been in place in the park since 1929.
    3) It would significantly displace the existing recreational use of park visitors and would compromise visitor safety.

- Park managers selected culling of elk, using specially trained park staff and authorized agents, to reduce the elk herd and minimize the impacts on park operations, visitors, private inholdings, and neighbors. For over 90 years, visitors have expected that recreational activities can take place in Rocky Mountain National Park without interference from hunting. Hiking, horseback riding, snowshoeing, and skiing in the backcountry are very popular activities along with sightseeing and wildlife viewing along the park's roadways.
- The NPS recognizes that public hunting is an important recreational activity and wildlife management tool in Colorado. Currently, hunting is permitted on approximately 98% of the federal lands in Colorado, including lands managed by the U.S.D.A. Forest Service (Forest Service), the Bureau of Land Management, and numerous national wildlife refuges throughout the state. Further, the NPS recognizes and supports Colorado Parks and Wildlife's (CPW) use of hunting for management of wildlife in areas outside and adjacent to the park.

_____End of RMNP Fact Sheet_____

Other FAQs for Ron Stewart Preserve at Rabbit Mountain Culling

What were the resources necessary to carry out this culling program?

RMNP had volunteer sharp-shooters, who passed a proficiency test, work alongside parks and CPW staff to take out the elk. Two teams of four people each carried out the culling, with additional volunteers and staff retrieved the animals, field dressed them and transported them. CPW distributed the meat through a lottery system. Volunteer sharp-shooters were not eligible for the lottery. The estimated cost was $4700/elk.

How many elk did they cull?

RMNP management plan estimated up to 200 elk could be culled. In the three years of implementation, 53 elk were culled.

How much would it cost to hire a company to cull the elk at Ron Stewart Preserve?
White Buffalo provides this service. They estimate it would cost at least $900 per elk. They are from out of state and would come for a period of time (perhaps two weeks) and conduct the culling and train staff to continue the effort.

Would culling be effective at Ron Stewart Preserve?
It is not certain if culling would be effective at Ron Stewart Preserve because the elk are skittish. Cullers may not have the opportunity to harvest large numbers of elk because they would move off the mountain and be inaccessible in a short (i.e. two-week) period. In order to meet the plan's objectives, culling would need to occur over an extended period of time, such as that proposed for the limited public hunting.

Appendix C: Fencing

Successfully fencing out animals as large and athletic as elk is a challenge. There are many variables to erecting fencing: terrain, proximity to roads/access, budget (construction and maintenance), landowner willingness, public acceptance, aesthetics, efficacy, materials choice, the logistics of construction (and maintenance), durability in the elements and over time, proximity to a power source (for long distance electric), and what is inside/across the fence. A good summary of elk damage issues is by Walter *et al* 2010. There are multiple citations of fencing and fence types, as well as some other techniques for ameliorating elk damage impacts and reducing elk populations.

BCPOS will install fencing around impacted sites inside the 500-acre core use area to reduce the vegetation degradation caused by the large number of elk. Outside of Ron Stewart Preserve, options include fencing high value crop areas, or fencing along the border of the property.

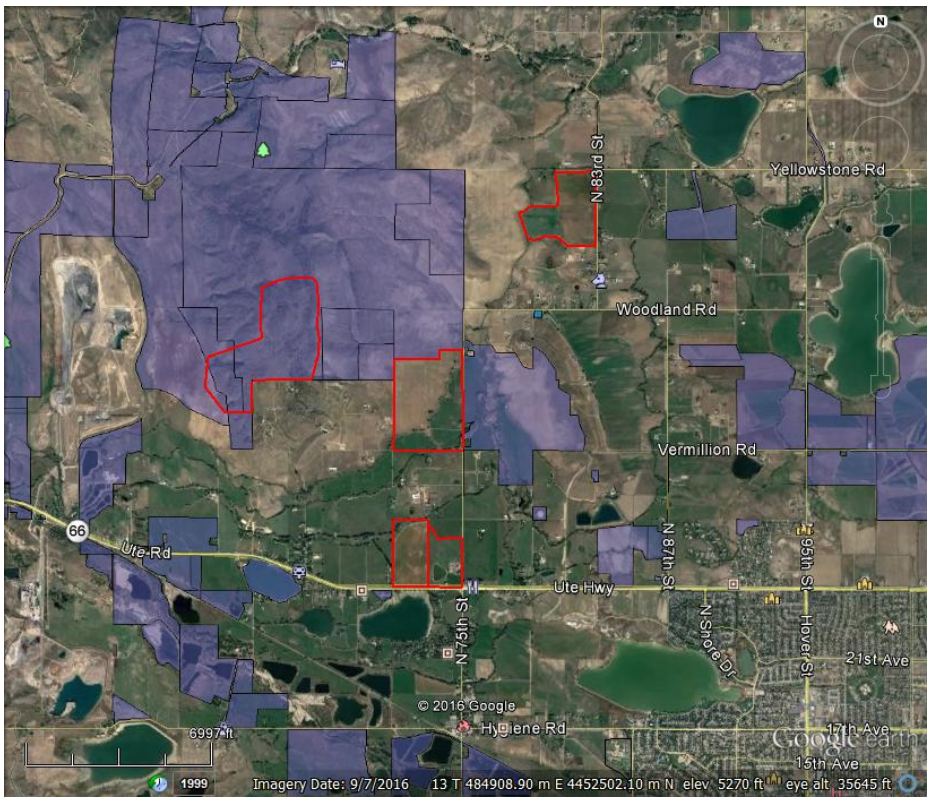

Figure 1. Areas that might be suitable for fencing to alleviate resource damage on Ron Stewart Preserve and crop damage on four private properties.

Individual landowners may or may not be receptive to having high fences along their boundaries. Any gaps in perimeter fencing would allow elk to pass through and access other private (and open space) residential or ranch parcels farther to the east. Figure 2 illustrates the numerous individual private properties in the area.

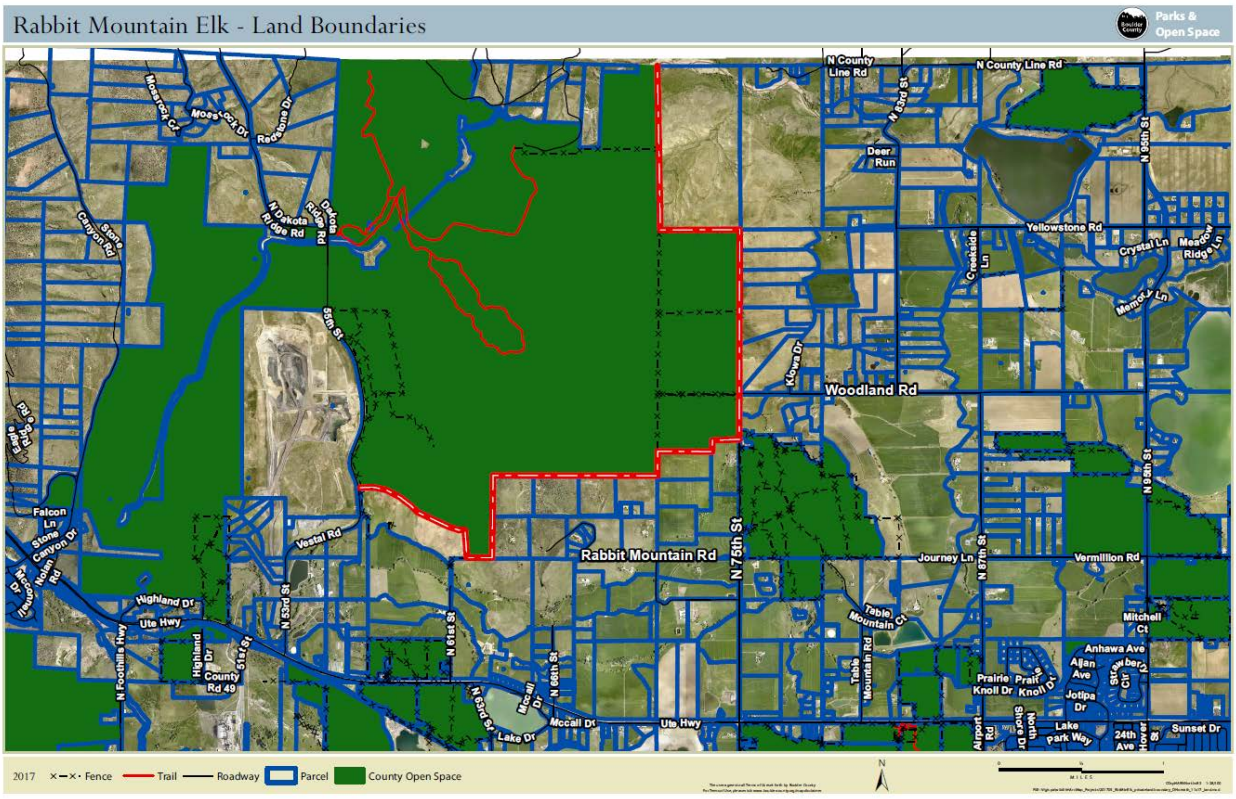

Figure 2. Private land boundaries on the Southeast side of Ron Stewart Preserve potentially subject to fencing.

An eight-foot game fence of woven wire mesh is the industry standard for highway Right's-of-Way. The heavy-duty mesh fence is attached to 6" x 12' wooden upright poles (necessary to support both the weight and the wind/snow/ice drag) at 16-24' spacing (Photo 1). This fencing excludes most terrestrial species, but can be tunneled under or even fitted with small, low openings. However, in most highway situations complete exclusion is desired for highway safety. Wildlife passage is restricted to small, unintentional gaps or culverts and bridges.

One landowner immediately adjacent to Ron Stewart Preserve installed some of this fence to protect their acreage and landscaping from deer (Photo 2). A new owner removed most of the fencing in 2016 (Photos 3 and 4), likely due to aesthetics. Rocky Mountain National Park used a variation of that fencing suited to their sites protecting aspen and willow. Their styles topped out at about 6' 6" and allowed for passage of small/short animals via a 16" gap above the ground (Photo 5). Their mesh was a lighter, square mesh targeting only elk exclusion and used metal pipes as posts, set in concrete.

BCPOS has created two similar, smaller exclosures using two different types of mesh at the Minnick and Reynolds properties (Photos 6 and 7). These exclosures were designed to preclude herbivory by livestock and elk on new aspen and lodgepole pines. Elk (or moose) did damage one of the exclosures at Minnick. This type of design has also been used outside Rocky Mountain National Park on a one hectare aspen patch (VerCauteren et al 2007). Staff also tried a log jack-leg fence at Reynolds Ranch, due to the ready supply of on-site logs and volunteer labor

(Photo 8). A third type of exclosure, using live trees as posts, has been successful at regenerating a small aspen stand at Walker Ranch (Photo 9).

CPW has a third design specifically for orchards and vineyards that uses a 7' panel on wood posts with an additional strand overhead at 8' (Figure 3). Electric fencing can be done in the 8' style, with fewer wood line posts or at a lower height (Seamans and VerCauteren 2006, Johnson *et al* 2014). Some electric fencing can be temporary or seasonal, allowing passage by wildlife at non-key times (for crops). Simple barbed wire livestock or Right-of-Way fencing is not tall enough to exclude elk (Photos 10-12).

Fencing costs will vary by scale and terrain.

<u>Exclusion Fencing</u>	
8' game fence	$3-4.50/ft ($15,000-$25,000/mile)
76" RMNP exclosures	$5200/acre (roughly $75,000/per exclosure)
5-7' electric fence	$3-4/ft
CPW orchard fence	$2/ft (old figure?)
<u>Small scale/resource Fencing</u>	
BCPOS E-Z Fence	$2500 for two 1/6th acre exclosures (materials only)
	$1500 for ½ acre exclosure (materials only)
	$3000-$7500/acre (materials only)
BCPOS mesh/tree fence	$850 for 5-6 acre exclosure (materials only)
VerCauteren *et al* mesh Fence	no published cost

Photo 1. Standard game fence along I-70

Photo 2. Existing portion of landowner eight-foot game fence adjacent to Ron Stewart Preserve

Photo 3. Removed portion of landowner eight-foot game fence adjacent to Ron Stewart Preserve. The small stubs are the remnants of the 12' posts.

Photo 4. Elk in the core area of Ron Stewart Preserve headed toward the old game fence on the boundary

Photo 5. Rocky Mountain National Park elk exclosure (CBS photo)

Photo 6. Aspen exclosure on USFS adjacent to BCPOS Minnick property

Photo 7. Aspen exclosure on Reynolds Ranch (1/2 ac in size)

Photo 8. Aspen exclosure (log fencing; one ac in size)

Photo 9. Mesh on trees exclosure fence at Walker Ranch

Photo 10. Elk crossing livestock fence near Ron Stewart Preserve.

Photo 11. Elk crossing through damaged Right-of-Way fence along US36

Photo 12. Damaged wooden rail fence near Ron Stewart Preserve (attributed to elk

Appendix D: Public Harvest Program Requirements and Training Topics

Background and Purpose of Management Action
Participants will learn about the history of the Rabbit Mountain elk herd and the unique and critical wildlife habitat that is Ron Stewart Preserve. Participants will gain a thorough understanding of the purpose and goals of the Ron Stewart Preserve Public Harvest Program and the importance of responsible natural resource management. All participants will be provided copies of the Ron Stewart Preserve at Rabbit Mountain Elk and Vegetation Management Plan.

Lay of the land
Participants will be given maps and will be advised on the following:

- Open space boundaries
- Eagle closure boundaries/dates
- No shooting zones/no access areas
- Access points
- Parking lots and trailheads
- Roads and trails

As part of their training, an on-the-ground tour will also be required prior to participation.

Contacts
Participants will be given a list of contacts including staff from BCPOS and CPW as well as numbers for the Boulder County Sheriff's Department and Colorado State Patrol.

Ethics
Participants will be instructed on expectations regarding ethics such as the discreet removal of harvested elk, what to do if they encounter someone (including surrounding landowners) while participating in the harvest program, proper treatment and care of habitat on the open space, etc.

Rules, Regulations and Laws
Participants will be advised that participation in the Ron Stewart Preserve Public Harvest Program is a privilege and not a right and that permits for participation may be revoked at the discretion of Boulder County and/or Colorado Parks and Wildlife staff.

Instructors will go over rules (see attached list). Instructors will also cover laws and regulations such as license/tagging requirements, manner of take (specifics on rifles and ammunition), legal hunting hours, proof of sex, requirements to pursue wounded game and provide harvested animals for human consumption, safety laws, etc.

Participants will be required to comply with all rules, laws and regulations including but not limited to those of Boulder County, Colorado Parks and Wildlife and the State of Colorado. Violation of any rule, regulation or law may result in the immediate revocation of the participants in the Ron Stewart Preserve at Rabbit Mountain Public Harvest Program Permit. In order to participate, participants will sign an agreement to report any violation of rules, regulations or laws immediately, whether they are intentional or accidental (e.g., participant shoots spike bull elk thinking it was a cow).

Special BCPOS Regulations and Guidelines:

1. All hunters must participate in an onsite orientation program and proficiency test prior to their designated access dates.
2. Access permits are valid only for the days indicated on permit.
3. All hunters must be 18 years of age or older.
4. Hunting is for antlerless elk only. Rifle only.
5. Hunters may enter the property one hour before sunrise and remain onsite until one hour after sunset.
6. Firearms must be unloaded when in the designated safety zone. Firearms may only be used within the designated safety zone to dispatch an injured animal.
7. Hunters are required to carry their hunting access permit at all times while hunting on Ron Stewart Preserve and adjacent Boulder County Parks and Open Space properties.
8. Each permitted hunter may be accompanied by two guests. Guests may not hunt or carry a firearm.
9. Parking is in designated locations only. Only one vehicle per hunting party is permitted. Parked vehicles must display a valid Boulder County Parks and Open Space parking placard.
10. Posting of photos taken during the Ron Stewart Preserve elk management program to social media sites is highly discouraged.
11. Elk must be field-dressed prior to removal from the hunting area. Gut piles must be at least 100 feet away from all trails or roadways.
12. Leave no trace. Hunters are required to pack out all of their waste.
13. All hunters will be required to complete an online post-hunt survey.
14. No motorized vehicles are allowed. Elk retrieval is by foot or horse only. Hunters may use designated fire roads for retrieval when appropriate. Wheeled game carts are allowed.
15. No Smoking.
16. No access will be permitted to the Ron Stewart Preserve golden eagle closure area after December 15.
17. No drones or UAS may be used.
18. No collared elk may be taken.
19. No pets are allowed.

Notifications and Important Contact Information:

1. Hunters must notify the hunting coordinator via voicemail or text message when they enter or exit the hunting area.
2. Hunters are required to report all unrecovered animals, injured animals that travel onto private property, regulation infractions, and unauthorized access/use of Ron Stewart Preserve and the surrounding hunting areas.

Safety

Instructors will give a thorough safety review including rules/regulations related to safety (see rules attached) and unique aspects of the Public Harvest Program (e.g. neighboring lands).

Media

Participants will be given instruction on how to handle contacts with the media should they encounter or be contacted by media personnel.

There will be no posting of news photos or stories relating to participation in the program on ANY social media outlets.

Liability Release
Participants will be required to review and sign a liability release prior to participating in the program.

Check-in, Check-out, and Harvest Reporting
Participants will be given instruction on how to check-in prior to entering the open space, how to check-out when they are ready to leave, and how to report hunting activities (number of days/hours hunted, harvest success, etc.), both of which will be required.

Private Property
Participants will be provided with instructions on what to do if they wound an elk that then runs onto private property. Permission from the owner of the private property MUST be obtained prior to pursuing the elk on said property.

Shooting Proficiency Testing
Participants will be given instructions on the shooting proficiency test (see attached) and directions to the range. Shooters will be instructed to sight-in their rifles prior to coming to the test.

Open Space Resources
Participants will be given notice that collecting items such as shed antlers, artifacts, plants, rocks, etc. from the open space is strictly prohibited and will be punished to the full extent of the law.

Mandatory Qualifications for Participation in the Ron Stewart Preserve Public Harvest Program

1. Must be at least 18-years-old
2. Must have passed an accredited hunter education program
3. Must have a valid, unfilled GMU 20, Hunt Code E-F-020-L3-R, cow elk license
4. Must be capable of passing a shooting proficiency test
5. Must use non-lead ammunition
6. Must have the knowledge and ability to field dress an elk
7. Must have the knowledge and ability to pack out edible portions of an elk distances up to one mile without the use of a vehicle
8. Must attend mandatory training and mandatory orientation field trip
9. Must check-in prior to entering the open space and check-out when done
10. Must complete hunting report to include information on hunting activity and harvest success
11. Must remain in full compliance with all rules, laws and regulations including but not limited to those of Boulder County, Colorado Parks and Wildlife and the State of Colorado. Violation of any rule, regulation or law may result in the immediate revocation of the Ron Stewart Preserve Public Harvest Program Permit.

Appendix E: Bibliography and References

Johnson, H. E. and J. W. Fischer, M. Hammond, P. D. Dorsey, W. D. Walter, C. Anderson, and K. C. VerCauteren. 2014. Evaluation of techniques to reduce deer and elk damage to agricultural crops. Wildlife Soc. Bull 408.

Oregon Department of Fish and Wildlife. http://www.dfw.state.or.us/wildlife/living_with/docs/deerelkfences.pdf

Rocky Mountain National Park/NPS.
https://www.nps.gov/romo/learn/management/elkveg_fact_sheet.htm

Rocky Mountain National Park/NPS. Final Environmental Impact Statement for the Elk and Vegetation Management Plan, Rocky Mountain National Park. 2007.

Seamans, T. W. and K. C. VerCauteren. 2006. Evaluation of Electrobraid© fencing as a white-tailed deer barrier. Wildlife Soc. Bull. 34:8-15.

VerCauteren, K. C., M. J. Lavelle, and S. E. Hyngstrom. 2006. Fences and deer damage management: a review of designs and efficacy. Wildlife Society
Bulletin 34:191–200.

VerCauteren, K. C., N. W. Seward, M. J. Lavelle, J. W. Fischer, and G. E. Phillips. 2007. A fence design for excluding elk without impeding other wildlife. Rangeland Ecol Manage 60:529-532.

Walter W. D., M. J. Lavelle, J. W. Fischer, T. L. Johnson, S. E. Hyngstrom, and K. C. VerCauteren. 2010. Management of damage by elk in North America: a review. Wildlife Research 37:630-646.