

***DRAFT* KENOSHA PASS ELK HERD MANAGEMENT PLAN**

DATA ANALYSIS UNIT E-18

GAME MANAGEMENT UNITS
50, 500, 501



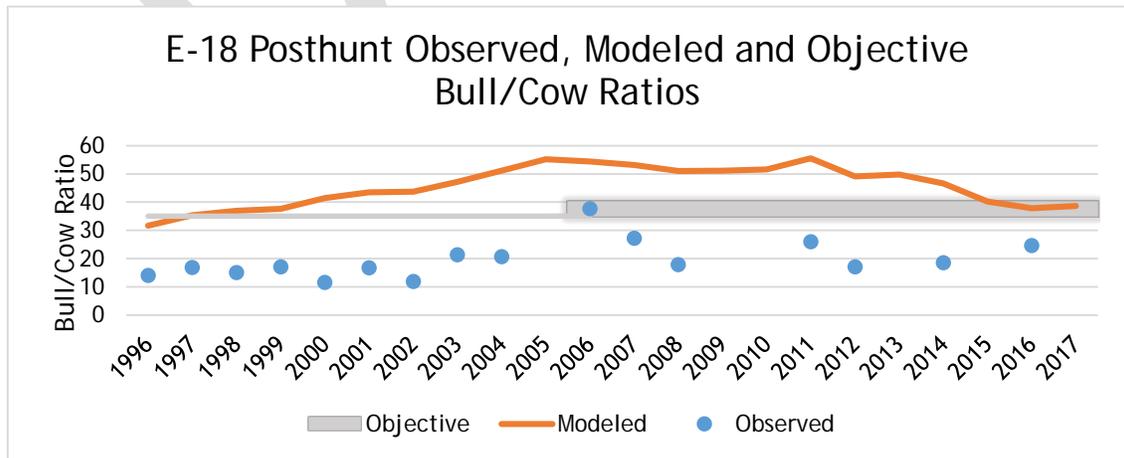
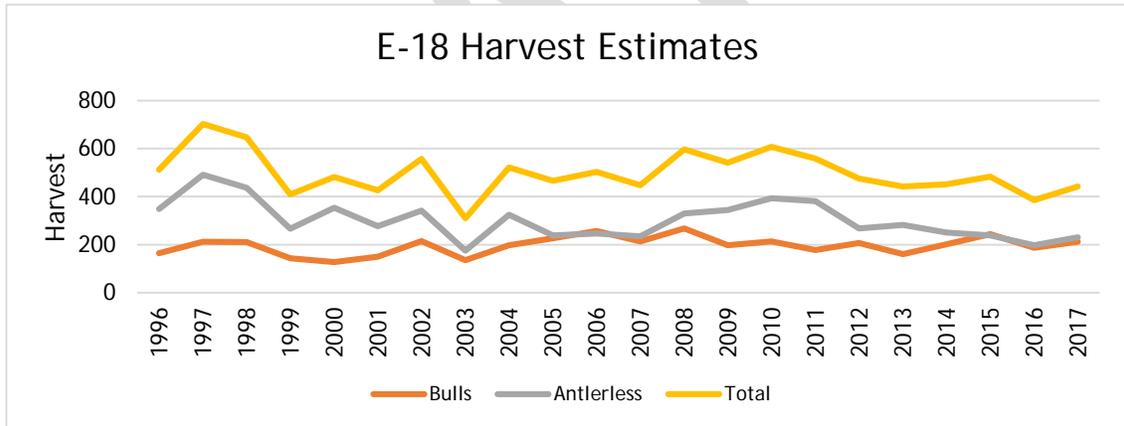
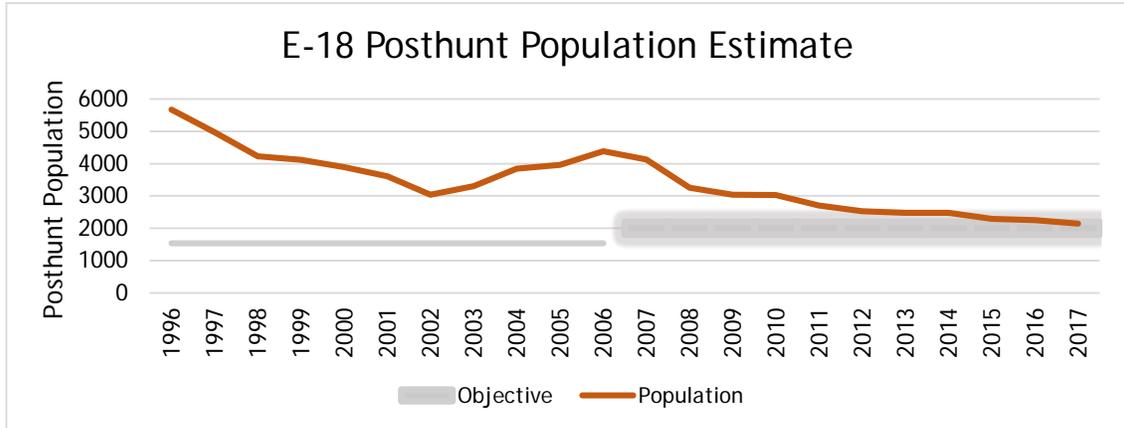
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EXECUTIVE SUMMARY Kenosha Pass Elk Herd, E-18

Game Management Units: 50, 500, and 501
 Land Ownership: 31% Private, 57% USFS, 4% BLM, 5% State of Colorado, 3% Other
 Post-hunt Population: Current Objective 1,800-2,200 2017 Model Estimate 2,100
 Proposed Objective 2,000-2,400
 Post-hunt Sex Ratio: Current Objective 35-40 bulls:100 cows 2017 Model Estimate 39
 Proposed Objective 35-40 bulls:100 cows



Background and Management Issues

The Kenosha Pass elk herd, Data Analysis Unit (DAU) E-18, is composed of game management units (GMU) 50, 500 and 501. E-18 is located within Jefferson and Park counties in central Colorado. The DAU is located in the northern portion of South Park. The DAU is approximately 3,012 km², of which, approximately 60% is public land open to hunting.

Population models indicate that the elk herd has been steadily declining to the population objective range for the last ten years. The models estimate the population has been within the current objective range for the last several years. The models also indicate that since 2010, the bull to cow ratio has been on a declining trend, but currently within the objective range at approximately 39 bulls: 100 cows. All elk hunting licenses are limited in number within E-18 and allocated through a drawing.

During the last herd management plan (HMP) development, conflicts with elk on agricultural lands were a concern. Management tools such as private land only (PLO) antlerless elk seasons, late antlerless elk seasons, distribution management hunts, and a game damage program through Habitat Partnership Program (HPP) have been utilized to address human-elk conflicts. Habitat improvement projects have helped reduce conflicts with elk on private lands by supporting more elk on public lands. Conflicts with elk that existed during the development of the 2006 HMP plan no longer are a significant issue in the DAU. The public desires an increased population.

Management Alternatives

Post-Hunt Population Objective Alternatives

Alternative 1: 1,600 - 2,000

Alternative 2: Preferred Alternative 2,000-2,400

The preferred alternative is a 10% increase from the current population objective. License allocation may decrease in the short term to grow elk numbers, but will result in more hunting opportunity in the long term. More elk on the landscape have the potential to increase human-elk conflicts. This alternative was selected because of the public's expressed desire to increase the elk population.

Alternative 3: 2,400 - 2,800

Herd Composition- Post-Hunt Sex Ratio Objective Alternatives

The modeled and observed sex ratio estimates will both be considered when managing for the sex ratio objective.

Alternative 1: 30 - 35 bulls: 100 cows

Alternative 2: Preferred Alternative 35-40 bulls: 100 cows

This alternative range is status quo with the current objective and will result in license allocation and the number of mature bulls in the population most similar to current numbers. This alternative is preferred by the public because it balances quality bull hunting with hunting opportunity.

Alternative 3: 40 - 45 bulls: 100 cows

Strategies for Achieving Objectives

Population- To maintain the population within objective, antlerless harvest will be adjusted as needed. This will be accomplished through allocations of antlerless elk licenses, primarily during the general elk rifle seasons.

Herd composition-E-18 license quotas have generally kept bull:cow ratios within the objective range of 35-40 bulls per 100 cows, and antlered licenses will continue to be allocated accordingly to keep the sex ratio within objective.

Strategies to Address Management Concerns

Elk distribution and conflicts-Management tools such as PLO and late antlerless licenses, distribution management hunts, and HPP's game damage program will be utilized to address elk distribution and conflicts on agriculture lands.

This herd management plan was approved by the Colorado Parks & Wildlife Commission on XXX 2019.

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INTRODUCTION AND PURPOSE

Colorado Parks and Wildlife (CPW) manages wildlife for the use, benefit and enjoyment of the people of the state in accordance with CPW's Strategic Plan and mandates from the Parks and Wildlife Commission and the Colorado Legislature. Colorado's wildlife resources require careful and increasingly intensive management to accommodate the many and varied public demands and growing human impacts. To manage big game populations, CPW uses a "Management by Objective" approach (Figure 1).

COLORADO'S BIG GAME MANAGEMENT BY OBJECTIVE PROCESS

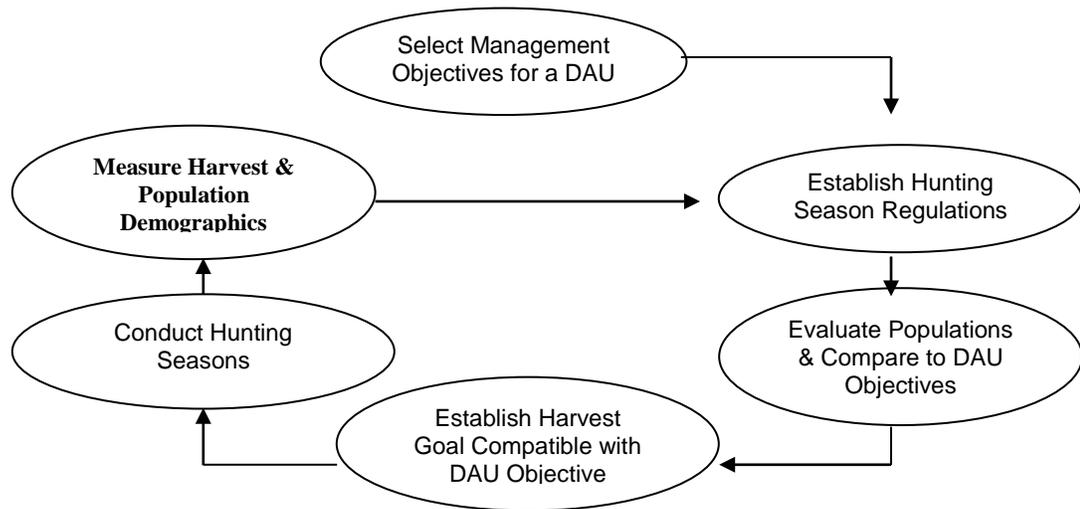


Figure 1: Management by Objective process used by Colorado Parks and Wildlife to manage big game populations by Data Analysis Unit (DAU).

Using this approach, big game populations are managed to achieve herd objectives established for a Data Analysis Unit (DAU). A DAU is the geographic area which encompasses the majority of the year-round range of a herd. The majority of individuals in a particular herd are born, live, and then die within their respective DAU. The boundary of a DAU attempts to delineate the seasonal ranges of a specific herd, while minimizing interchange of adjacent herds. Data Analysis Units may be divided into several game management units (GMUs) in order to distribute hunters and harvest within the herd DAU.

Management decisions within a DAU are based on the herd management plan (HMP; formerly DAU plans). Herd management plans identify issues, suitable habitat, limiting factors, conservation efforts, priority areas and provide herd management history. The primary purpose of an HMP is to establish 1) a population size objective range, 2) a herd composition objective range (i.e., the sex ratio or the number of males per 100 females), and 3) other population performance metrics for the herd. There are many factors that are considered

when selecting objectives for a particular DAU, including the social and biological carrying capacities of the area, population dynamics and the concept of sustained yield (Appendix A).

The selection of objectives drive important decisions in the big game season setting process, specifically, how many animals need to be harvested to maintain or move towards the objectives and what types of hunting seasons are required to achieve the harvest objective. The HMP describes the strategies and techniques that will be used to achieve the herd objectives. As such, the HMP is the basis for the annual herd management cycle. In this cycle, the size and composition of the herd is assessed and compared to the objectives defined in the herd management plan. Hunting seasons are then set and licenses are allocated to either maintain or move toward those objectives. Herd management plans are approved by the Parks and Wildlife Commission and are reviewed and updated approximately every 10 years.

During the herd management planning process, public input is solicited and collected by way of surveys, public meetings and comments to the Parks and Wildlife Commission in order to select the herd objectives. The capabilities of a herd are integrated with the concerns and ideas of various stakeholders including the United States Forest Service (USFS), the Bureau of Land Management (BLM), hunters, guides and outfitters, private landowners, local chambers of commerce and the general public. In preparing an HMP, CPW attempts to balance those biological capabilities of the herd and the habitat with the public's demand for wildlife-based recreation.

DESCRIPTION OF THE HERD MANAGEMENT AREA

Location

The Kenosha Pass elk herd, DAU E-18, encompasses an area of 3,012 km² in central Colorado, southwest of Denver and west of Colorado Springs (Figure 2). It includes game management units 50, 500, and 501. The DAU is bounded on the north by the Continental Divide and the North Fork of the South Platte River, on the east by the South Platte River, on the south by Colorado Highway 24, and on the west by U. S. Highway 285. The DAU includes the central and eastern portion of Park County and the south end of Jefferson County.

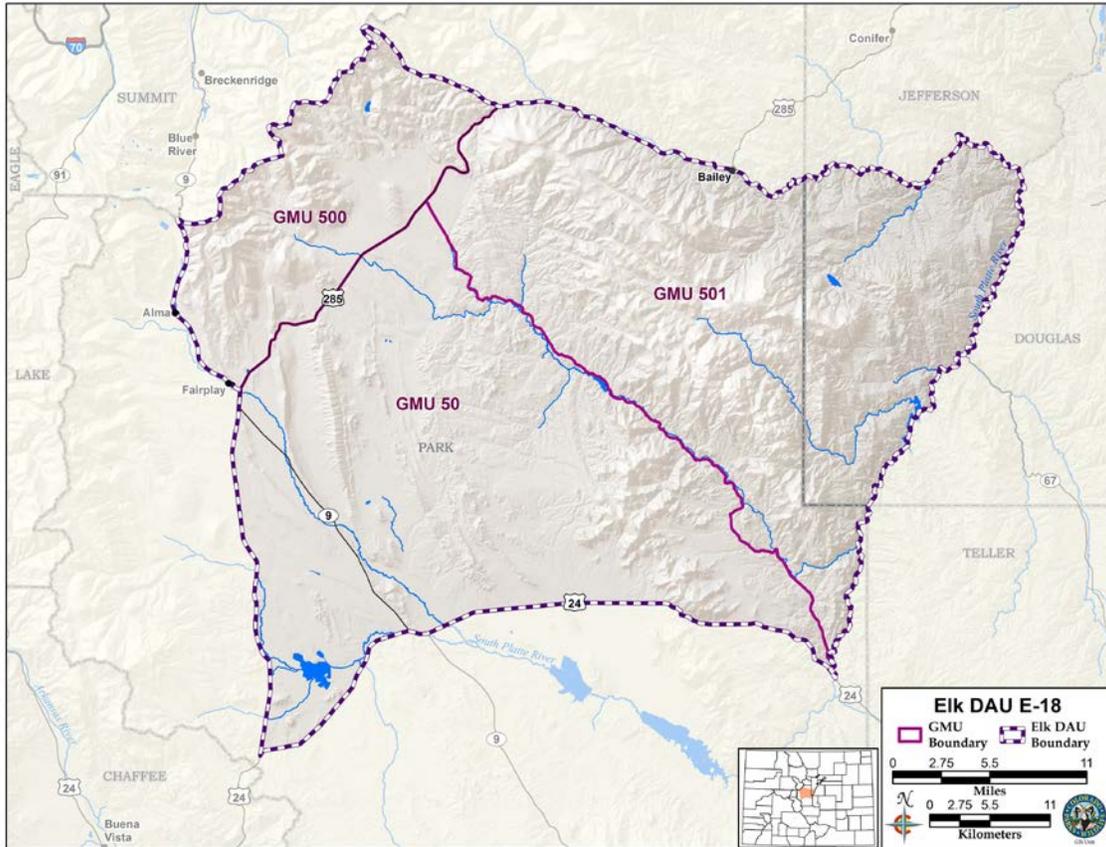


Figure 2: Geographic location of the Kenosha Pass elk herd, Data Analysis Unit (DAU) E-18, composed of Game Management Units (GMU) 50, 500, and 501.

Topography and Vegetation

Within the DAU is the South Park intermountain grassland basin. It is located around the headwaters of the South Platte River and formed by the Mosquito and Park Mountain Ranges in Park County. It is the southernmost high elevation mountain park located on the Front Range of Colorado. Elevation within the DAU ranges from 8,800' at the valley floor to over 12,000' along the Continental Divide.

The vegetative type varies across this DAU depending on elevation, climate, and aspect (Figure 3). For elevations over 11,500 feet, vegetation is alpine tundra which mainly consists of willows, grasses, forbs and sedges. As elevation drops (9,000-11,500), the next ecosystem is the subalpine forest which consists of densely forested areas of lodgepole, bristlecone and limber pine, spruce/fir, rocky outcroppings, aspens and grass dominated meadows. The dominant life zone (6,500-9,000 feet) within this DAU consists of ponderosa pine forest, Douglas-fir, and foothill shrub and grass species. Shrub species include mountain mahogany, chokecherries, currant, and shrubby cinquefoil. Plant succession to forested habitats within the last century has contributed to lower quality elk forage throughout some portions of the DAU. In contrast, the eastern portion of the DAU has experienced several wild fires over the last 20 years and habitat consists of early to mid-successional forest, shrub, grass and forb species. Forage species

richness increased post-fire and elk forage improved in quantity and quality. Mountain riparian ecosystems follow the major drainages where species of trees, such as cottonwoods, multiple willows species, and bog birch occur. Agricultural croplands occur along tributaries up to elevations of 9,500 feet and consist of native grass hay species.

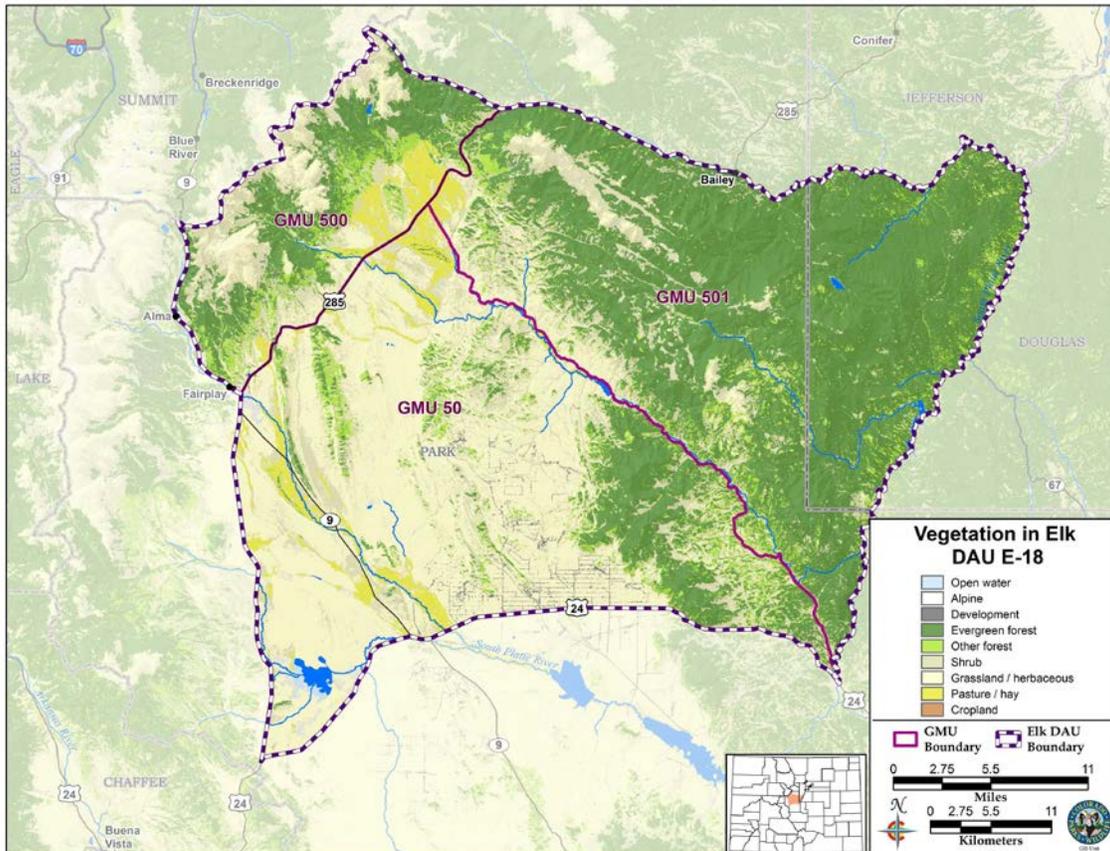


Figure 3: Vegetation types in the Kenosha Pass elk, Data Analysis Unit (DAU) E-18, composed of Game Management Units (GMU) 50, 500, and 501.

Climate and Precipitation

As with all of mountainous Colorado, the climate varies significantly with season, elevation, and aspect. Elevations below 7,500 feet are typically warm in the summer and the south slopes generally remain free of snow during most of the winter. Elevations between 7,500 feet and 9,500 feet have somewhat cooler and wetter summers with persistent snow cover on north aspects during the winter. South-facing slopes normally remain open or have minimal snow cover throughout the winter. Above 9,500 feet elevation the climate is much cooler and wetter during the summers and north slopes are snow covered all winter except for windswept ridges above timberline.

Annual precipitation is highly variable from site to site and ranges from ten inches per year in portions of South Park to over 25 inches at the highest elevations. Snowfall accounts for the majority of the precipitation in the DAU with

thunderstorms adding significant localized volumes in the summer. The bottom of South Park generally receives much less moisture than the surrounding mountains because of the rain-shadow effect from the Mosquito Mountains. Summer thunderstorms created by thermals over South Park generally travel to the east before releasing much precipitation.

Winter temperatures range from average daily lows of -3°F at Hartsel to 9° F at Grant and Cheesman in January. Summer temperatures vary from average daily highs of 75°F at Hartsel and Grant to 84°F at Cheesman Lake and Pine in July and August.

Land Status

The Kenosha Pass elk DAU encompasses 3,012 square kilometers (km²) (Table 1). Private lands total 908 km², or 31% of the DAU, while public lands and other non-private lands total 2,104 km² or 69%. The higher elevation portions of the DAU are in the Pike/San Isabel National Forest, divided between the South Park and South Platte Ranger Districts. National Forest lands total 1728 km² and comprise 57% of the DAU. Bureau of Land Management (BLM) lands are scattered across the bottom of South Park and are managed by the Royal Gorge field office. BLM lands total 138 km², which is 4% of the DAU. Land trusts, County, and non-governmental organization parcels are dispersed throughout South Park totaling 92 km², which is 3% of the DAU. CPW and State Land Board owns or manages 150 km², or 5% of the DAU (Figure 4). The primary purpose of several CPW properties is fishing recreational access and the remainder provide big game habitat and hunting recreation. CPW, with the assistance of the South Park HPP Committee, manages the forage on several properties to attract and hold elk to reduce conflicts on nearby private land that is used for livestock grazing or hay production.

Table 1: Land ownership (km²) within the Kenosha Pass elk herd, Data Analysis Unit (DAU), E18, by DAU and Game Management Unit (GMU).

GMU	Private	% Private	USFS	% USFS	BLM	% BLM	State	% State	Other	% Other
50	668	52%	293	23%	133	10.3%	142	10%	60	4.6%
500	127	30%	276	66%	5	1.2%	5	1%	7	1.2%
501	113	9%	1159	89%	0.00	0%	3	.1%	25	1.9%
Total DAU	908	31%	1728	57%	138	4%	150	5%	92	3%

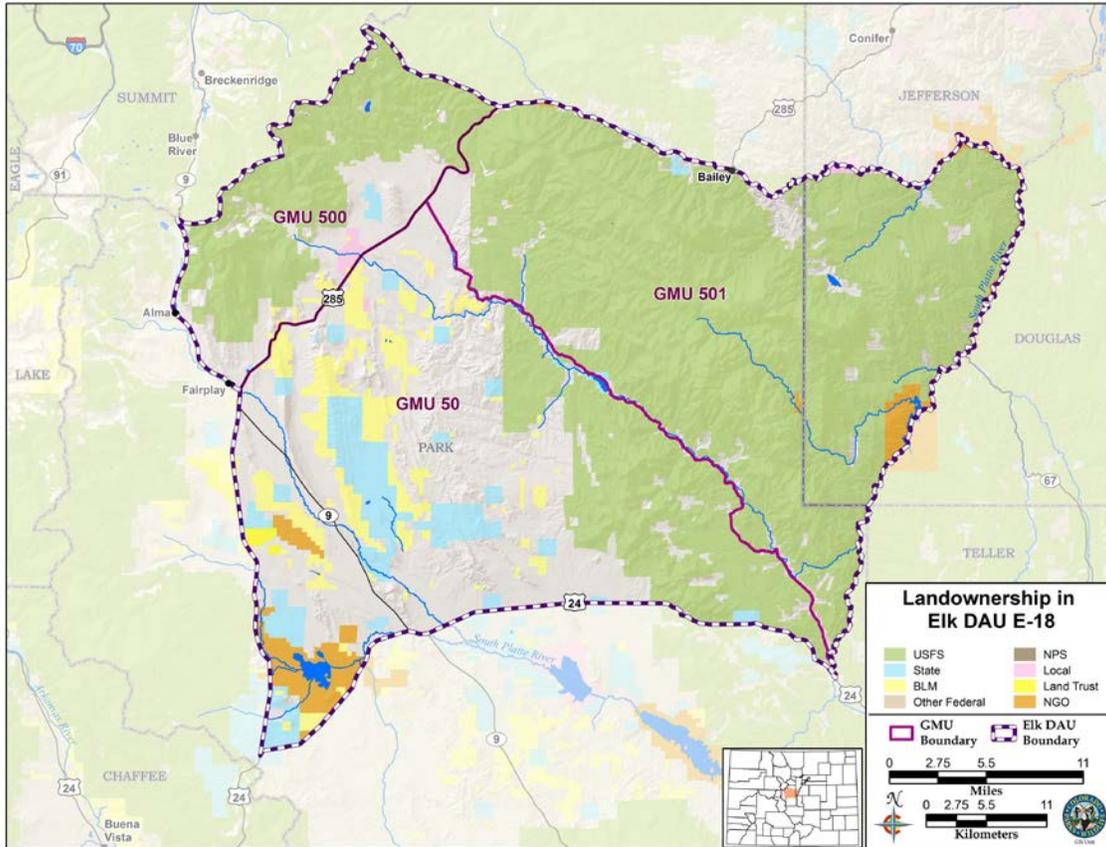


Figure 4: Land ownership within the Kenosha Pass elk herd, Data Analysis Unit (DAU) E18, composed of Game Management Units (GMU) 50, 500, and 501.

Land Use

Land use in this DAU has changed significantly in the last 25 years. Private lands have been converted from ranch lands to residential subdivisions. Significant areas of the most critical habitat for elk, winter range, was impacted and private lands have been subdivided into residential areas. Construction densities vary from one building per acre to one building per 40 acres. Construction density is nearing allowed density limits in many areas of the DAU.

Much of the lower elevation, non-subdivided private land consists of large acreage ranches. The agricultural practices are cattle and hay production. There are approximately 21 cattle allotments throughout the DAU on Forest Service lands of which 13 are active grazing allotments with 72 pastures. Grazing days average 146 days per allotment and 20 days per pasture. There are 1,375 cow/calf pairs under federally permitted use. The majority of utilization occurs within the months of June to October and livestock use is 8,633 AUMs (animal unit months). Significant private livestock grazing occurs in addition to grazing on Forest Service lands.

Recreational activity is high from hiking, fishing, hunting, off road vehicle use, and mountain biking. The proximity to Denver and Colorado Springs, along with access to public land, makes this area popular for recreationalists year round. The

headwaters to the South Platte River basin and its associated tributaries are one of the main tourism revenues for Park County. Three water storage reservoirs are located within or directly adjacent to the DAU: Antero, Tarryall, and Cheesman Reservoirs. Each reservoir attracts year round visitors for fishing, camping, bird watching, and hiking. Motorized recreation has increased substantially in this DAU on public land outside of wilderness areas in the last 15 years. The increased motorized recreation has led to the establishment of unauthorized roads which have fragmented landscapes and likely degraded habitat. The Lost Creek Wilderness Area is located within the center of E-18 along the Tarryall and Kenosha Mountain Ranges and encompasses 120,000 acres. The vegetative types include ponderosa and bristlecone pine, fir, spruce, aspen and alpine tundra. The Lost Creek Wilderness elevation range is 8,000 to 12,400 feet. There are over 130 miles of trails within the Lost Creek Wilderness and recreational use is high in the summer and fall months.

Several high speed and volume highways bisect or border the DAU. Highway 285 bisects the northern portion of the DAU and Highway 9 borders the west side. Both highways contribute to mortality.

Forage Production

During the 2006 E-18 HMP development, the Natural Resource Ecology Lab at Colorado State University analyzed forage production levels in this DAU utilizing the Habitat Assessment Model developed for the Colorado HPP program. Habitat use maps for this DAU and adjacent units within the South Park HPP committee's area (GMUs 50, 500, 501, 46, 461 and the east half of 49) were used to determine the extent of elk winter range. Average forage production volumes were established by soil type for the current precipitation conditions based on estimates from the Natural Resource Conservation Service, U.S. Department of Agriculture. A total forage production volume was calculated using these values. Because this volume is not totally palatable or physically available, this total was reduced by 10% to 30% to arrive at an available and useable forage total.

The effective and available forage volume was then reduced by 50% to provide for maintenance of landscape sustainability, basically, the "take half-leave half" range management principle. All domestic livestock forage requirements, based on the 10 year average of livestock numbers in the DAU, were then subtracted to arrive at the amount of forage available to sustain elk and deer. As a result of that analysis, the winter range was estimated to be able to support approximately 4,500 elk and 4,500 deer (range 2,700 to 6,400 of each species) in GMUs 50, 500 and 501 during average precipitation years. The forage production assessment from 2006 has not been recalculated but the evaluation is currently relevant. The current elk and deer population estimates for these units are 1,900 and 3,000 respectively, which is considerably below estimated forage capacity.

Seasonal Ranges and Elk Distribution

Elk occupy all habitats and areas of the DAU at some time of the year and the entire DAU is considered overall elk range. Overall elk range is defined as the area

which encompasses all known seasonal activity areas within the observed range of an elk population.

Densities are low in the open portions of South Park elevation habitats year-round, but especially during the summer when most elk move up to traditional calving and summering areas at higher elevations (Figure 5). The alpine areas provide ideal summer range because of the high quantity and quality of forage available and refuges from insects. Below the alpine, spruce/fir stands also provide excellent summer forage and security cover. Douglas fir, aspen, and aspen/conifer stands also provide productive understory, which provides forage and cover for elk, during the summer and fall. Lodgepole stands provide little forage, but good cover due to the high stand density.

During the winter, most elk move to lower elevation winter ranges as snow accumulates on the higher elevations and northern aspects (Figure 6). Because of the relatively mild and dry winters, winter ranges often extend to above 10,000 feet in elevation. Some elk, especially bulls, will use windswept ridges at even higher elevations during the winter. Approximately 49% of the DAU can and does serve as winter range in normal winters with some concentration occurring in preferred habitats (Table 2). During severe winter periods, which are unusual in this DAU, habitat utilization can be reduced to approximately five percent of the overall range.

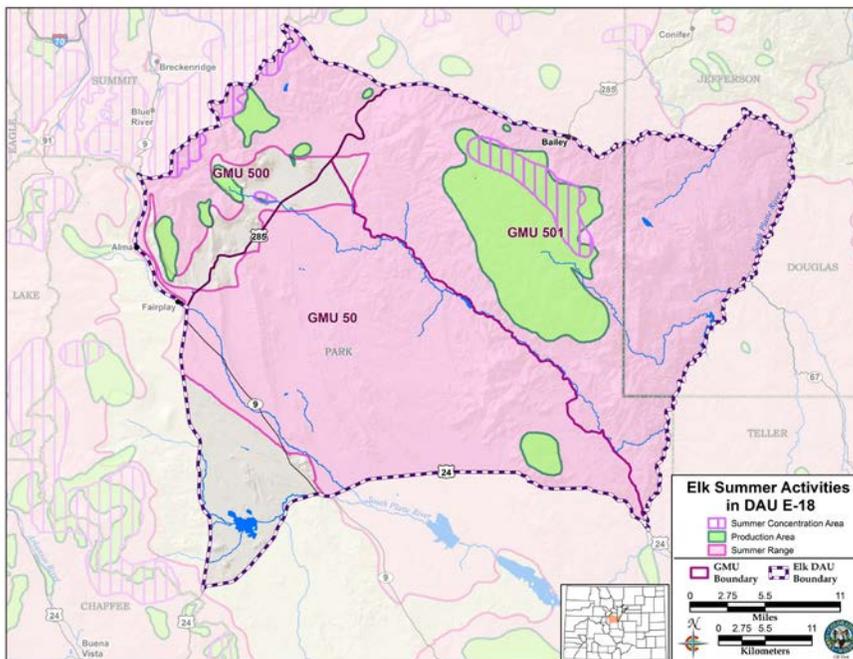


Figure 5: Elk summer ranges and production areas within the Kenosha Pass elk herd, Data Analysis Unit (DAU) E18, composed of Game Management Units (GMU) 50, 500, and 501.

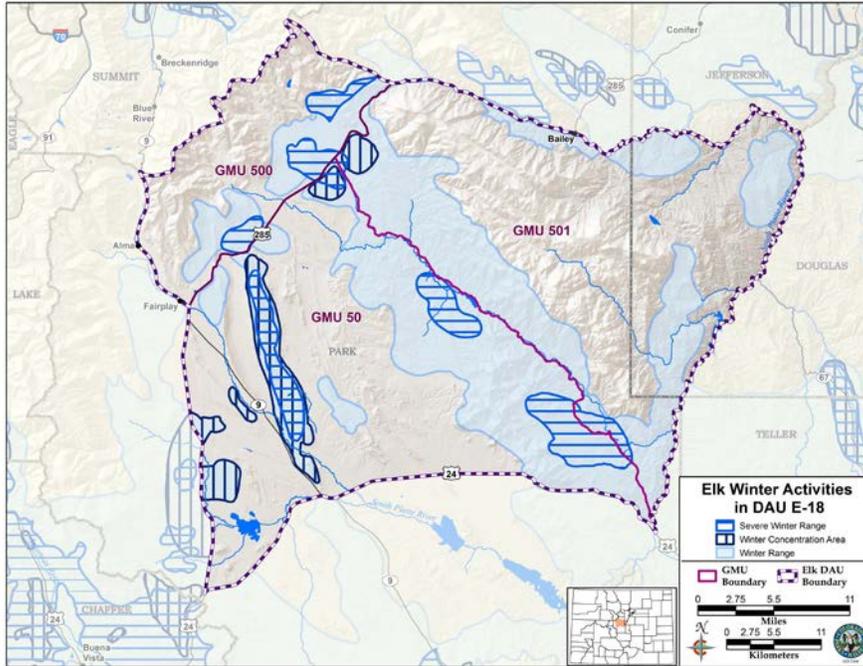


Figure 6: Elk winter range areas within the Kenosha Pass elk herd, Data Analysis Unit (DAU) E18, composed of Game Management Units (GMU) 50, 500, and 501.

Table 2: Elk summer range, production areas, and winter range areas (km²) within the Kenosha Pass elk herd by DAU and Game Management Unit (GMU).

GMU	Summer Range	Production Area	Winter Range	Severe Winter Range	Winter Concentration Area
50	1059	18	767	124	129
500	300	45	146	43	0.0
501	1288	330	550	65	46
DAU Total (% of DAU)	2547(88%)	393(13%)	1463(49%)	232(8%)	175(6%)

Radio telemetry studies conducted in the 1990s, funded by the South Park HPP committee and CPW, have shown significant immigrations of elk from adjacent GMUs outside of this DAU. Estimates range from 200-300 elk to as high as 700 elk entering the DAU each winter. Elk originating from GMU 37, south of Interstate 70, GMU 46 east of Kenosha Pass, and GMU 49 join herds in E-18 during the winter. Normally, this immigration occurs after the four regular rifle hunting seasons but winter conditions outside of the E-18 GMUs have also influenced the timing of elk movement. Since 1997, the post hunt population estimate for this DAU has included all elk within in the Kenosha Pass herd management area during winter aerial and ground inventories.

These wintering groups of elk often move into the bottom of South Park and adjacent winter ranges in response to forage quality. Forage in the portions of the winter range supporting grazing by domestic livestock, as well as higher use by the elk herd itself, is of higher palatability and digestibility than ungrazed areas

(Stoddart and Smith 1955, Savory 1988). Thus, the private and public lands supporting domestic livestock tend to attract elk use at a higher rate than those portions not providing grazing use (Anderson and Scherzinger 1975, Heitschmidt 1990, Grover and Thompson 1986). The areas without grazing, primarily private lands in subdivision or non-agricultural use, and portions of the public lands without grazing allotments, tend to have larger standing biomass of unused forage, but often this has poor nutritional value. Hence it is less attractive to elk when they have a choice (Frisina and Morin 1991, Frisina 1992, Severson and Urness 1994).

Wintering herds of elk can number 200 to 400 animals with these groups occasionally aggregating into a herd exceeding 1,000 elk. If large groups utilize or even pass through private agricultural lands, they can impact fences and residual forage. The South Park HPP committee has worked with CPW to address concerns and conflicts with elk by hiring elk hunting coordinators, providing fencing materials, and funding habitat projects.

Habitat improvement projects funded by HPP and Auction & Raffle Funding have been ongoing throughout the James Mark Jones State Wildlife Area (SWA) for the last 10 years. The James Mark Jones SWA is critical elk winter range that provides forage and refuge for a significant portion of the wintering elk in E-18. Improving habitat on the James Mark Jones SWA keeps elk on public land which reduces conflicts on adjacent agricultural lands and also provides public hunting opportunity. Additionally, CPW cow license allocation has targeted reducing conflicts with elk. Late cow elk season timing has been aimed at capturing immigrating elk within the DAU and private land only cow elk licenses have been allocated to reduce conflicts with elk.

Conflicts with Agriculture

While there have not been any game damage claims paid in the last ten years, concern for elk damage still exists. The number of elk in the population and the distribution of elk can affect the level of concern. At the current population objective, elk conflict concerns are low. HPP's assistance to landowners to prevent and mitigate damage by elk has been a significant factor in the lack of game damage claims and has addressed conflict concerns.

HERD MANAGEMENT HISTORY

Estimating numbers of wild animals over large geographic areas is a difficult and approximate science. Colorado Parks and Wildlife recognizes the difficulties of estimating the size of big game populations as a challenge in managing populations. Thus, the population objectives considered in this plan are given as ranges to reflect the fact that each year's population estimate may vary according to changes in hunting and survey conditions, survival rates, and annual weather conditions. The population estimates presented in this document should, therefore, not be considered a completely exact enumeration of the animals in the herd.

Colorado Parks and Wildlife uses a computer modeling process to estimate the size of elk populations in each DAU. The computer modeling programs used by CPW biologists have changed significantly since the early 1970's. Starting in 1999, spreadsheet models were implemented and then in 2008 the models were standardized based upon population modeling methods developed by White and Lubow (2002). All models work in the same manner and integrate multiple biological factors, including mortality rates, initial population size, sex ratio at birth, observed sex and age ratios, hunter harvest, and wounding loss. The models are aligned on post-hunt sex ratios observed during winter classification. Sex ratios can fluctuate annually, which can make model alignment a challenge. Obtaining the most precise sex ratio data can help improve model fit. When herd management plans are revised, a suite of population models is constructed and the best fitting model is selected.

Initially, this DAU consisted of one large GMU designated as unit 50. In 1972, GMU 50 was subdivided into GMUs 50 and 501 and in 1975 the DAU was further subdivided into the current arrangement of GMUs 50, 500, and 501. The entire DAU was established as limited elk hunting to manage hunter density. The DAU's proximity to the large pool of hunters on Colorado's Front Range caused the limitation in bull hunter numbers to reduce the possibility of over-harvest of the male segment of the population.

Since 1990, management of the population has been directed at a slow reduction of total numbers with a preponderance of the harvest on the female segment of the population to reduce the reproductive potential of the herd and thus the population. Annual harvest levels are directly influenced by weather and snow conditions during the hunting seasons. Experience has also shown that the law of diminishing returns applies to hunter numbers and density compared to total harvest. As hunter numbers increase, total harvest tends to decrease. This is believed to be a result of more elk being moved to areas where they are not available for harvest, earlier in the hunting seasons as hunter density increases, thus resulting in a decrease in total harvest. In response to this situation, CPW added late cow-only seasons to increase harvest levels without increasing hunter densities. The late cow seasons direct harvest at the reproductive segment of the population as well as at the immigrating portion of the population which are not in the DAU during the four regular rifle hunting seasons. From 2002-2014, there were two late cow elk seasons in each GMU. Starting in 2015, one of the late cow elk seasons was eliminated because the population was estimated within the objective and the higher cow elk harvest was not needed to bring the population down.

Starting in 2007, a private-land-only cow season was initiated to direct hunter efforts at the portion of the population that causes conflicts with livestock operators on their private lands. This hunting season is open from September 1st through January 31st so hunting pressure and harvest can move elk from specific private lands to reduce conflicts.

Post-Hunt Population Size

The estimated post-hunt population size has decreased over the last 10 years (Figure 7). According to population models, the post hunt population decreased from approximately 5,500 in 1996 to 3,000 in 2002. The population increased from the year 2002 to approximately 4,500 elk in 2006. The population has been on decline since 2006 due to increased license quotas and increased harvest in an attempt to bring the population down towards the objective.

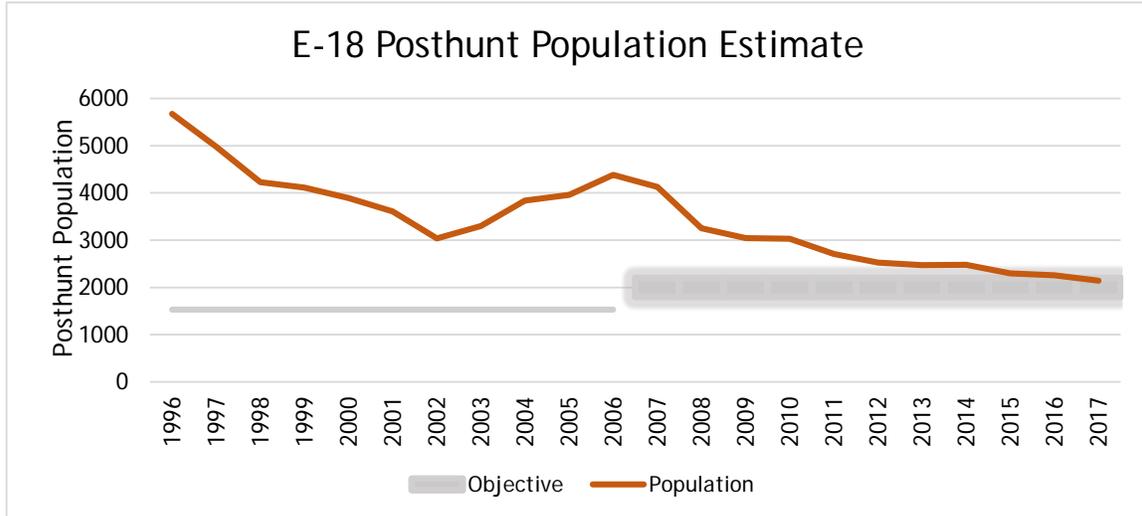


Figure 7: Post-hunt modeled estimate and objective population size from 1996 to 2017 of the Kenosha Pass elk herd, Data Analysis Unit E-18, composed of Game Management Units 50, 500, and 501.

Post-Hunt herd composition

Bull:Cow Ratio

The bull:cow ratio, expressed as the number of bulls per 100 cows, is used as an index of bull hunting opportunity and bull age at harvest (i.e., antler size). There are sixteen years of observed post-hunt sex ratio data between 1996 and 2017 (Figure 8). The observed bull:cow ratio and the model estimates follow the same general trends over the last twenty years. Observed bull: cow ratios and model estimates indicate an increasing trend from 1996-2005, a stable trend from 2005-2011, and then a decreasing trend from 2011-2016. Observed bull:cow ratios are biased low due to the tendency of mature bulls to winter in heavier cover and at higher altitudes which makes bulls harder to find and underrepresented in a survey. As mentioned above, population models are an estimate and an approximate science. Considering that observed bull: cow ratios are biased low, the true bull: cow ratio likely lies somewhere between the modeled and the observed estimates. However, CPW observations, license quotas, success rates, population modeling, and public comments, suggest that the bull: cow ratio has been declining toward the objective over the last five years.

Calf:Cow Ratio

The post-hunt calf:cow ratio, expressed as the number of calves per 100 cows, is used as an index of herd productivity. There are sixteen years of observed post-hunt age ratio data between 1996 and 2017, concurrent with the observed sex ratio data (Figure 9). The current 3-year average (2015-2017) is 48 calves: 100 cows, which is above average relative to other elk herds in Colorado at present.

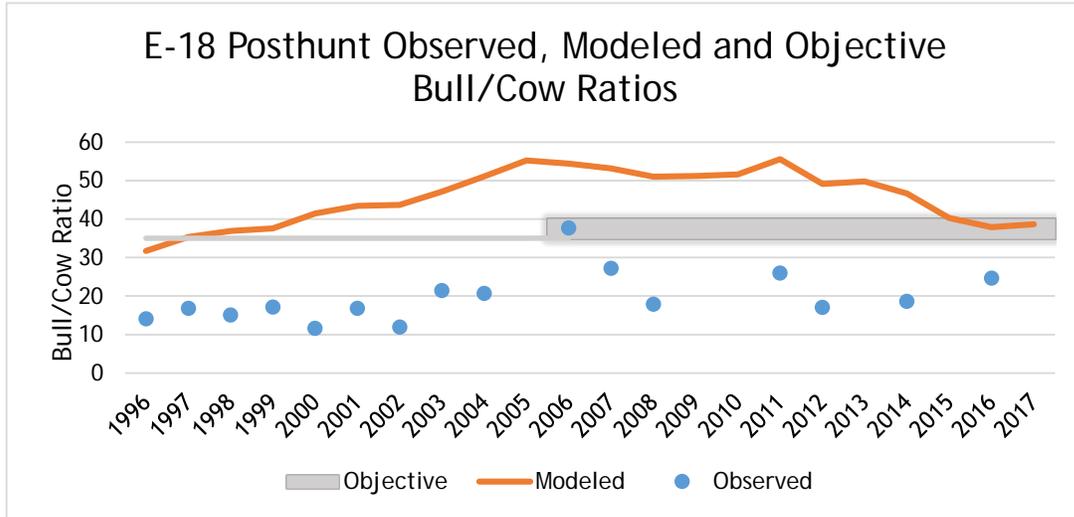


Figure 8: Observed, modeled and objective sex ratio from 1996 to 2017 of the Kenosha Pass elk herd, Data Analysis Unit E-18, composed of Game Management Units 50, 500, and 501.

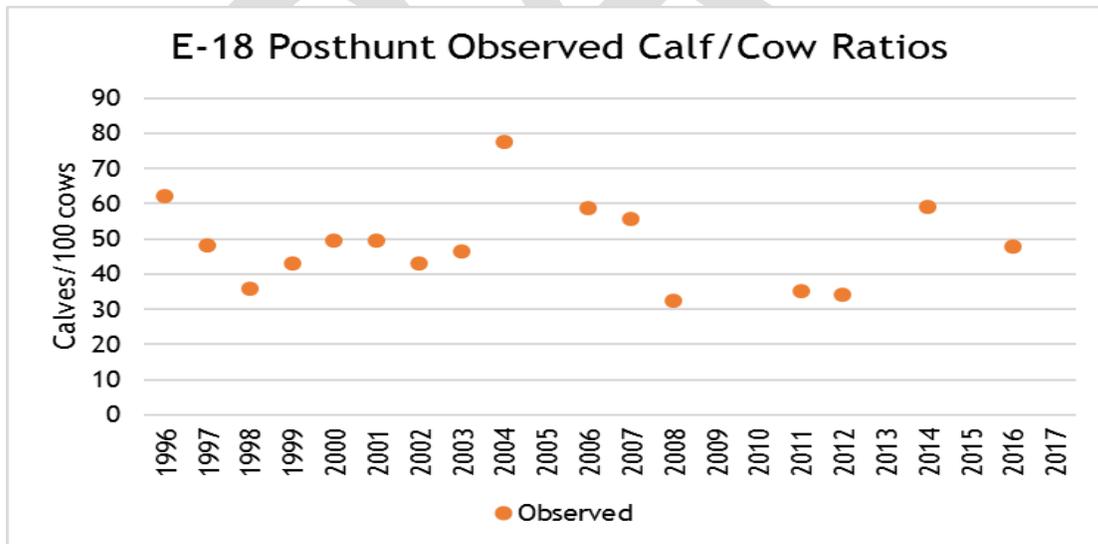


Figure 9: Observed age ratio from 1996 to 2017 of the Kenosha Pass elk herd, Data Analysis Unit (DAU) E-18, composed of Game Management Units (GMU) 50, 500, and 501.

Harvest and Hunters

License allocation

Licenses for the Kenosha Pass elk herd have been limited in availability since 1958. This means that over-the-counter licenses have not been available. Hunting

seasons in E-18 have included archery, muzzleloader, rifle, late antlerless, and antlerless private-land-only (PLO) seasons. In 1986, the Wildlife Commission approved the statewide implementation of three combined deer and elk rifle seasons to reduce hunter crowding. The adopted 1986 season structure encompassed E-18. From 2002-2015, each GMU within E-18 consisted of a single archery season, one muzzleloader season, four rifle bull seasons, three rifle antlerless seasons, two late cow seasons, and one PLO cow season. After 2015, all seasons remained the same, but only one cow late season was available in all GMUs. The PLO licenses are valid only on private lands from September 1st through January 31st.

The number of licenses issued in E-18 has varied over the last 20 years (Figure 10). The number of licenses was on an increasing trend from 1996 to 1999, decreasing from 2000-2002, and a stable trend from 2002 to 2008. The number of elk licenses available increased to the apex of 2,999 during the three years of 2008-2010. The increase in licenses available from 2005 to 2008, PLO seasons, and late seasons were all implemented to reduce the population. The number of licenses available has been on a decreasing trend from 2010 to 2017. After 2010, the number of licenses allocated was reduced because the size of the elk herd declined towards the population objective and concerns over human-elk conflicts declined.

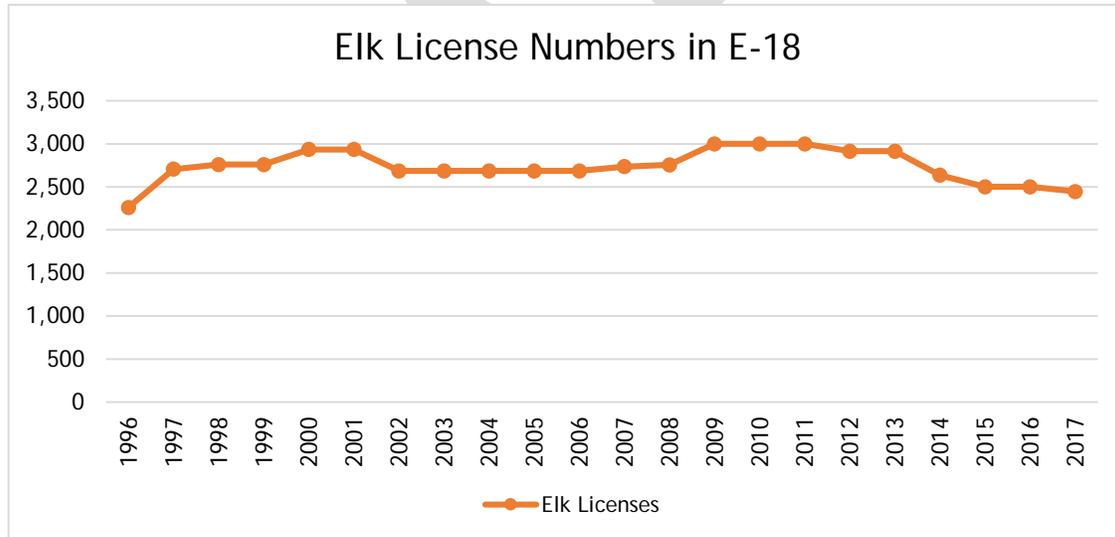


Figure 10: Elk licenses issued in the Kenosha Pass elk herd, Data Analysis Unit (DAU) E-18, composed of Game Management Units (GMU) 50, 500, and 501 from 1996-2017.

Harvest

Harvest varies through the years, due to weather and snow conditions during the hunting seasons and to certain degree license allocation (Figure 11). Bull harvest has mirrored license allocation and remained steady between 130 and 270 for the last 20 years. However, in an effort to achieve the population objective, antlerless harvest estimates have been more variable and have ranged from a high of 491 in 1997 and low of 197 in 2003 (Figure 12). Antlerless harvest has exceeded bull harvest for all but one of the last twenty years.

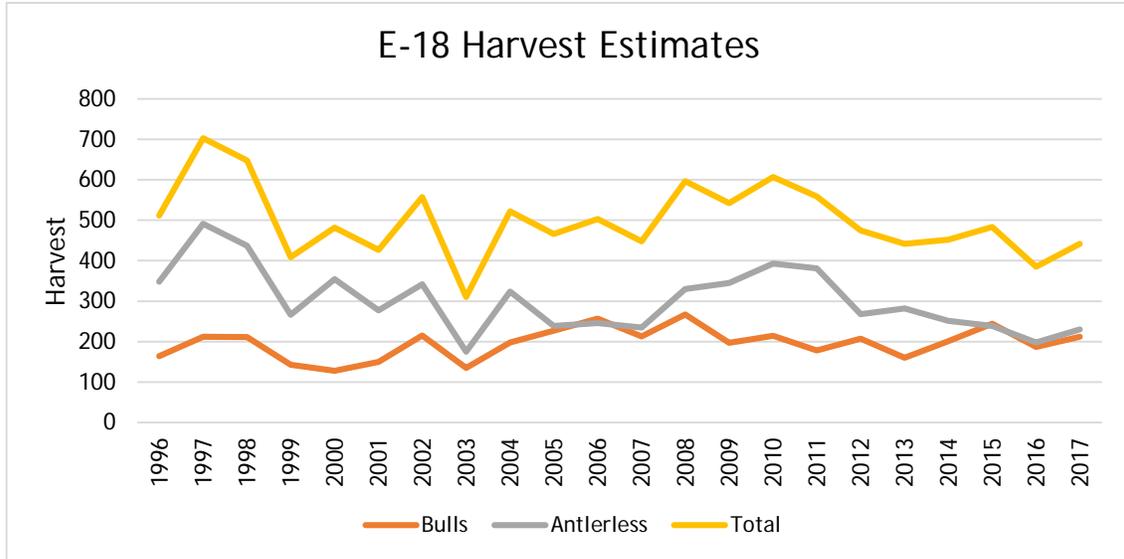


Figure 11: Estimated bull, antlerless and total harvest of the Kenosha Pass elk herd Data Analysis Unit (DAU) E-18, composed of Game Management Units (GMU) 50, 500, and 501 from 1996-2017.

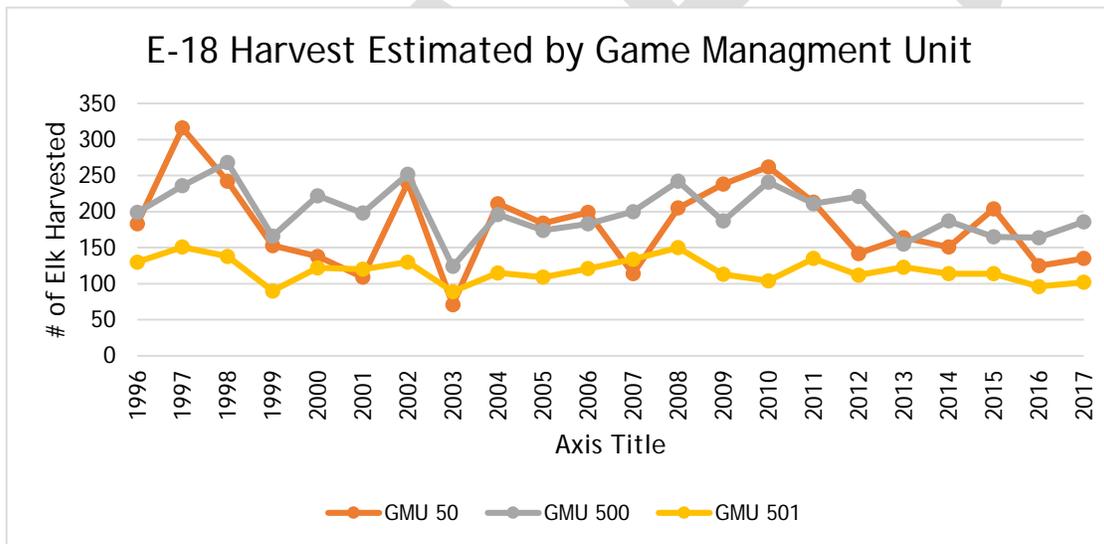


Figure 12: Estimated elk harvest for the Kenosha Pass elk herd Data Analysis Unit (DAU) E-18, composed of Game Management Units (GMU) 50, 500, and 501 from 1996-2017.

Hunter numbers

The number of licenses allocated determines the number of hunters in E-18 because all licenses are limited. The trend in the number of hunters in E-18 reflects the license availability (Figure 13). The number of hunters increased from 1996 to 2001 in response to an increase in license numbers. The number of hunters remained mostly stable from 2003 to 2008 when licenses remained nearly constant. From 2009-2017 as the elk population moved toward objective, license availability decreased and thus hunters afield has decreased overall.

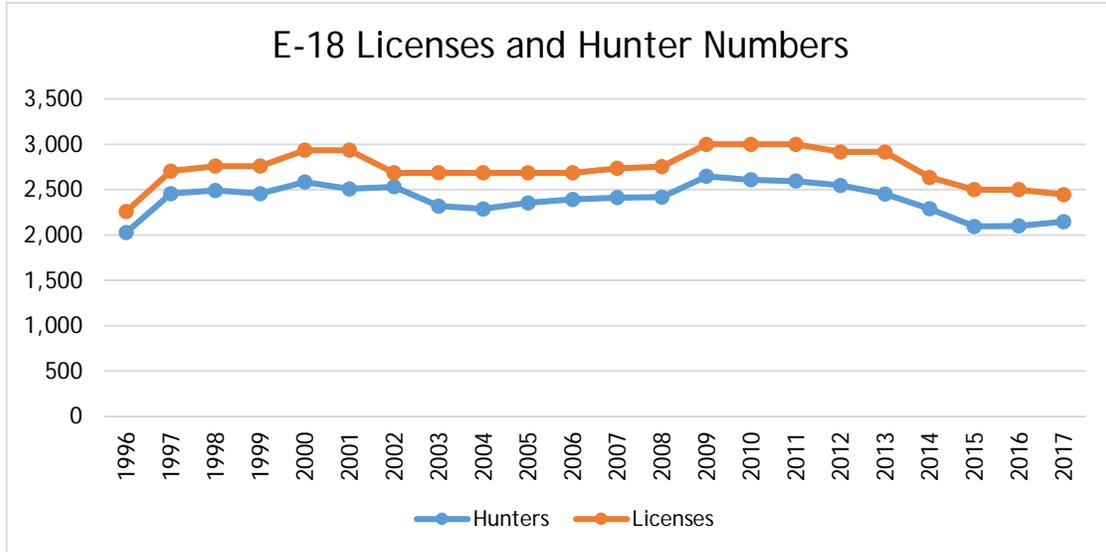


Figure 13: Elk license and hunter numbers for the Kenosha Pass elk herd Data Analysis Unit (DAU) E-18, composed of Game Management Units (GMU) 50, 500, and 501 from 1996-2017.

Elk license numbers and elk hunter numbers are higher in both GMUs 50 and 500 compared to GMU 501. As a result, harvest is higher in both these GMUs compared to GMU 501 (Figure 14).

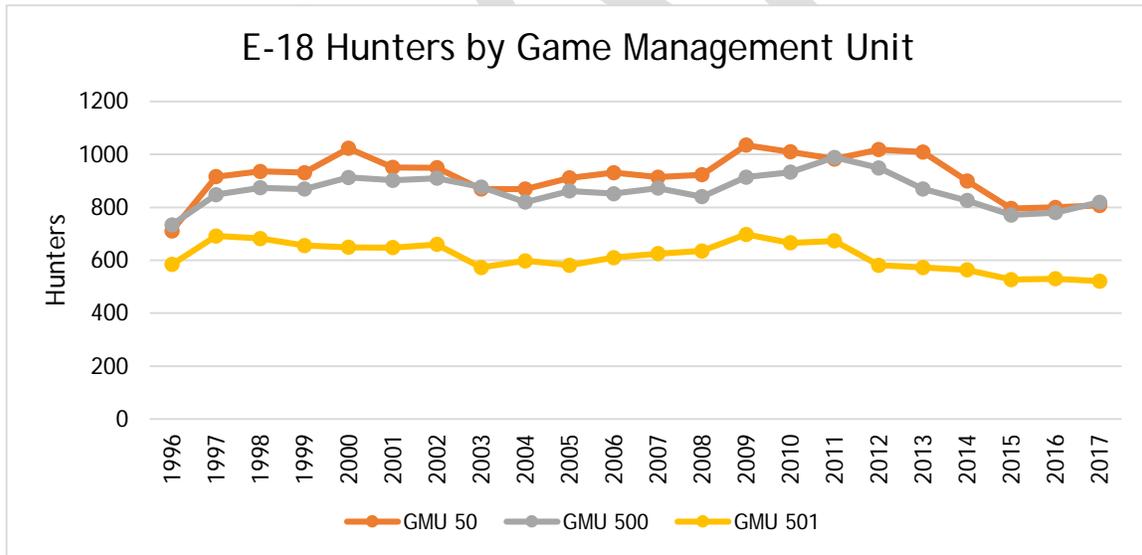


Figure 14: Total number of hunters in Game Management Units (GMU) 50, 500, and 501 for the Kenosha Pass elk herd Data Analysis Unit (DAU) E-18 from 1996-2017.

Success Rates

Success rates in E-18 vary annually and are calculated here as total harvest divided by the total number of hunters afield. The average annual success rate for the last 20 years is 20%, with a high of 29% in 1997 and a low of 12% in 2003 (Figure 15). The PLO antlerless seasons have higher success rates than the regular rifle antlerless, late antlerless, archery, and antlerless muzzleloader seasons. In GMU

50, the first and second antlered rifle seasons have higher success rates than the other antlered rifle, muzzleloader, and archery seasons. In GMU 500 and 501, the first antlered rifle season has higher success rates than all other seasons. Success rates in E-18 have an inverse relationship with the number of licenses available. As the number of available licenses increases, success rates decline and when licenses decrease, success increases (Figure 16). The only exception is in 2003 when success dropped but licenses remained the same.

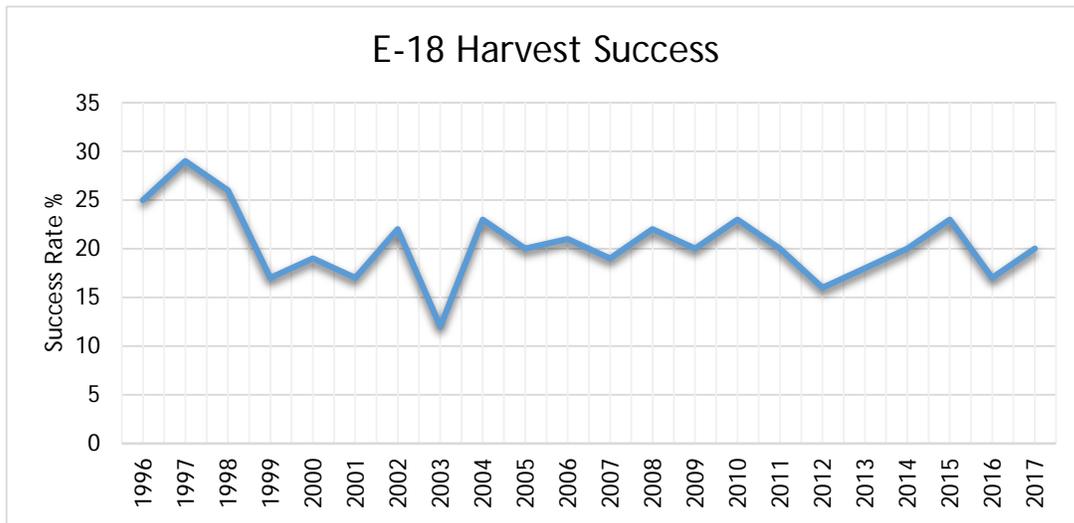


Figure 15: Harvest success of the Kenosha Pass elk herd Data Analysis Unit (DAU) E-18, composed of Game Management Units (GMU) 50, 500, and 501 from 1996-2017.

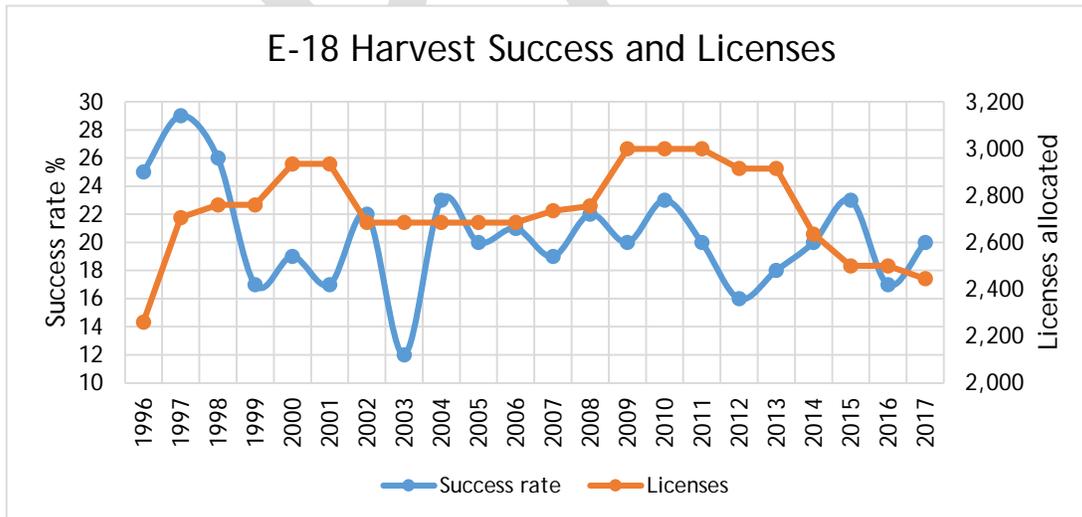


Figure 16: Harvest success and licenses allocated in the Kenosha Pass elk herd Data Analysis Unit (DAU) E-18, composed of Game Management Units (GMU) 50, 500, and 501 from 1996-2017.

Economic Impact

Hunting and fishing activities are an important part of the Colorado tourism economy and provide economic impacts in all counties. Elk hunters in E-18 provide monies to local economies in Park and Jefferson Counties through the use of lodging services and the purchase of goods and services (Table 3).

Table 3. Estimated Hunting and Fishing Economic Impacts by E-18 counties compared the sum of all counties statewide in Colorado. These figures include trip and equipment expenditures supporting these activities (Colorado Parks and Wildlife, 2008)

	Direct Expenditures (\$)	Total Impact (\$)	Job Creation
Jefferson County	67,110	116,340	1,420
Park County	10,450	17,790	207
Total	77,560	134,130	1,627
Statewide	1,076,300	1,843,300	21,350

CURRENT HERD MANAGEMENT

Population and Herd Composition Ranges

Current Post-hunt Objectives
 Population Size - 1,800-2,200
 Sex Ratio - 35-40 bulls: 100 cows

Current Post-hunt Population Estimates (2017)
 Population Size (Modeled) - 2,100
 Sex Ratio (Modeled) - 39 bulls: 100 cows

Proposed Objectives
 Population Size Range - 2,000-2,400
 Sex Ratio Range - 35-40 bulls: 100 cows

Current Management Issues and Strategies

Land use changes have resulted in elk habitat loss. However, the Kenosha Pass elk herd area contains adequate habitat to support the current elk population. Much of the conversion from agricultural to residential use has occurred in winter and transitional ranges which are critical habitats. Impacts from development include direct loss of habitat as well as the loss of public hunting access. Restrictions on hunting access create elk refuges, which create challenges for managing elk populations.

Over the last century, wild fire control on public lands has led to landscape scale conversion of meadow and grasslands, as well as open forests, to denser forests thereby reducing the amount of palatable forage for elk. In general, fire suppression in this DAU has led to habitat reaching late-seral growth stages that are not particularly productive for elk. Elk use patterns have responded with an increasing use of the open areas, including South Park basin grasslands. Habitat succession coupled with land use conversion, has reduced the distribution of elk on public lands compared to historical use. Forage on public and private lands with livestock grazing can attract elk use which results in conflicts with elk. In contrast, large scale wildfires in GMU 501 in the last 20 years, including the Hayman, Buffalo Creek and Meadow Creek fires, have improved forage conditions and increased elk utilization.

The South Park HPP committee has joined with the CPW and USFS to improve elk habitat, provide fencing materials, and conduct range management seminars for landowners. Habitat improvement projects have been focused on winter range conditions in an effort to attract wintering elk to public lands rather than adjacent private lands. The HPP committee has also collaborated with land trusts and other organizations to assist landowners with conservation easements to protect the long-term habitat values of their lands.

There has been very little game damage conflict due to loss of agriculture products. Most complaints involve competition for forage and fence damage. While there is adequate forage to support a larger elk population, the concentration of elk on private lands has been a management concern. Private land only antlerless hunting, late antlerless elk seasons, and distribution management elk licenses have been made available to redistribute elk and reduce conflicts. These license types have been successful in reducing human-elk conflicts.

PUBLIC INVOLVEMENT

Public input into the management of the Kenosha Pass elk herd was solicited through one open house, a survey, and draft comment period. The open house was announced by CPW through various local media outlets and posted in public information offices. The open house was held in Fairplay, August 11, 2017. The open house was not attended by anyone from the public.

A postcard soliciting participation in the survey was mailed to 1,500 elk hunters (Appendix B). Elk hunters were randomly selected from a list of hunters that had applied for a license in the Kenosha Pass herd the three previous years. The postcards also notified recipients that they could contact the wildlife biologist to have paper surveys and information packets mailed to them. In total, 240 respondents completed the survey.

The survey was available to the public on the CPW website for 30 days starting July 5, 2018. The survey's availability and background information on the herd was announced with on CPW's website. No additional public comments were received.

Public input from the survey was then incorporated into a draft management plan that was posted on the CPW website and also sent to local governments and land management agencies for review. Individuals, land management agencies, HPP, and local governments were then invited to submit comments on the draft herd management plan during a 30-day comment period which was held from July 5-August 5, 2018. HPP provided a letter of support for the preferred management alternatives (Appendix C).

Summary of Public Input

Survey Results

The public survey and survey results are located in Appendix B. Most survey respondents live in Colorado (89%) and nearly the same percentage (87%) live in the E-18. The majority of respondents have hunted in E-18 (94%). The majority of respondents feel spending time in nature, spending time hunting with family or friends, and obtaining wild game are very important to the reasons they hunt in E-18.

Over half of the respondents (56%) stated they are either somewhat satisfied or very satisfied with their elk hunting experience in E-18. Half responded they feel hunting is more crowded than it used to be and one third responded that the quality of bulls had decreased and also the number of cows had decreased.

When asked how respondents would like to see the population managed, 43% said increase the population, 40% said keep the population the same, and 17% said decrease the population (Appendix B, Question 11). The majority of respondents would like to see the bull: cow ratio and bull hunting opportunity remain the same (Appendix B, Question 12).

Issue Identification

Several common issues emerged from general comments in the survey. Common themes were:

- Road closures on Forest Service lands restrict access and harvest
- There are crowding issues from too many hunters and non-hunters on public lands
- Motorized use has increased and negatively impacted hunting
- Elk stay on private land during the hunting seasons and are not available to public hunters
- Keep things the same as they have been last 10 years

MANAGEMENT ALTERNATIVES AND SELECTED OBJECTIVE

Population Objective Alternatives

The current population objective is 1,800-2,200 elk. Precisely estimating and managing populations is complex and there is variation in carrying capacity due to changes in climate, land management, and habitat (e.g., fires, winter weather events, drought, forest management, and land use changes). Managing for a population range allows for flexibility on managing the annual variability in ecological conditions. For the past decade, hunting license allocation and harvest management have reduced the population towards the population objective. More recently, the population has been estimated within the objective range and license availability has declined. All three alternatives listed below are within the biological and social carrying capacity of the herd.

Alternative 1: 1,600 - 2,000 elk post hunt

This alternative range is approximately 10% lower than the current population objective. This alternative would result in more licenses available in the short term, but fewer licenses available in the long term. Fewer licenses available may cause an increase in the number of preference points needed to draw an elk license. Of the three alternatives, elk harvest, elk hunting opportunities, and elk viewing opportunities would decline the most. Hunter dissatisfaction may increase with hunters having less opportunity to see and harvest elk. An increase in late cow, PLO cow, and distribution management licenses may be needed to achieve this objective without increasing conflicts with elk.

Alternative 2: 2,000 - 2,400 elk post hunt

This alternative range represents an approximately 10% increase from the current population objective. The number of preference points needed to draw an elk license should remain similar to what hunters have experienced with the current population objective. This alternative will result in license allocation and harvest similar to what has been done the last several years. Elk conflicts are not expected to increase with this alternative as long as allocation of late antlerless, PLO antlerless, and distribution management license continues.

Alternative 3: 2,400 - 2,800 elk post hunt

This alternative range is approximately 30% higher than the current population objective. This alternative would result in fewer licenses available in the short term, but more licenses available in the long term. This alternative would provide the greatest elk harvest and elk hunting opportunity in the future. However, this alternative would likely result in an increase in the number of elk related conflicts. An increase in the population at this level may require 5 or more years to achieve.

Herd Composition (Sex Ratio) Objective Alternatives

The current sex ratio is 35-40 bulls: 100 cows. Sex ratio alternatives considered the tradeoffs between hunting opportunity (the ability to draw a license) and the ability to harvest an older, larger antlered bull. Sex ratios are managed in ranges

to allow flexibility on managing the annual variability in ecological conditions such as fires, winter weather events, drought, forest management, and land use changes.

Alternative 1: 30 - 35 Bulls: 100 Cows

This alternative range is approximately a 10% reduction from the current objective. For a given population size, this alternative would result in the most bull hunting opportunity with an increase in bull license allocation. This alternative will result in the greatest decrease in number of bulls on the landscape and the fewest mature bulls. Hunters would experience more hunters afield, see fewer bulls, and harvest younger and smaller bulls compared to Alternatives 2 and 3.

Alternative 2: 35 - 40 bulls: 100 cows

This alternative range is status quo of the current objective. Compared to the other alternatives, this alternative will result in license allocation and harvest most similar to what has been done. The number of mature bulls in the population is expected to be similar to current numbers. Hunters could expect similar numbers of hunters afield to what they have experienced the last several years.

Alternative 3: 40 - 45 bulls: 100 cows

This alternative range is approximately a 10% increase from the current objective. The number of mature bulls in the herd area will increase, if the population objective remains near the previous objective. However, of the three alternatives, this alternative most limits the opportunity to draw a bull license and will decrease the number of bull hunters in the field. It would take longer to draw a bull license, but hunters could expect to see more bulls and fewer hunters afield compared to the previous two alternatives.

Preferred Alternative Objectives

The following alternative objectives were developed through consideration of habitat, potential for elk-human conflicts, and results from the public input process. The public input process indicated that the public would like more elk and to maintain current bull hunting opportunities.

Population Alternative: 2,000-2,400 Post-Hunt

This alternative was selected because it is within biological carrying capacity and is supportive by the public findings. This objective is about a 10% increase from the current population objective.

Herd Composition Alternative: 35-40 bulls: 100 cows

This alternative is status quo of the current management objective and will provide similar levels of hunting opportunity and older age class males in the population. This ratio provides a balance between bull hunting opportunity and larger antlered bulls in the population. The public expressed a desire to see management continue as seen the previous 10 years.

Strategies for Achieving Objectives

Population- To maintain the population within objective, antlerless harvest will be adjusted as needed. This will be accomplished through allocations of antlerless elk licenses, primarily during the general elk rifle seasons.

*Herd composition-*E-18 license quotas have generally kept bull:cow ratios within the objective range of 35-40 bulls per 100 cows, and antlered licenses will continue to be allocated accordingly to keep the sex ratio within objective.

Strategies to Address Management Concerns

*Elk distribution and conflicts-*Management tools such as PLO and late antlerless licenses, distribution management hunts, and HPP's game damage program will be utilized to address elk distribution and conflicts on agriculture lands.

DRAFT

Literature Cited

Anderson, E. W. and R. J. Scherzinger. 1975. Improving Quality of Winter Forage for Elk by Cattle Grazing. *Journal of Range Management* 28(2): 120-125.

Colorado Parks and Wildlife. 2008. Final Report. The Economic Impacts of Hunting, Fishing and Wildlife Watching in Colorado. Prepared by BBC Research and Consulting.

Frisina, M.R. and F. G. Morin. 1991. Grazing Private and Public Land to Improve the Fleecer Elk Winter Range. *Rangelands* 13(6): 291-294.

Frisina, M.R. 1992. Elk Habitat Use Within a Rest-Rotation Grazing System. *Rangelands* 14(2): 93-96.

Grover, K. E. and M. J. Thompson. 1986. Factors Influencing Spring Feeding Site Selection by Elk in the Eikhorn Mountains, Montana. *Journal of Wildlife Management* 50(3): 466-470.

Heitschmidt, R. K. 1990. The Role of Livestock and Other Herbivores in Improving Rangeland Vegetation. *Rangelands* 12(2): 112-115.

Savory, Allen. 1988. *Holistic Resource Management*. Island Press. Washington D.C.

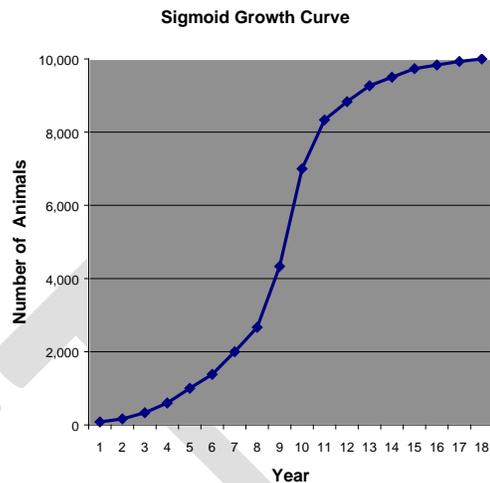
Severson, K. E. and Philip J. Urness. 1994. Livestock grazing: a tool to improve wildlife habitat. pp. 232-249 In: M. Vavra, W. A. Laycock and R. D. Pieper (eds.). *Ecological Implications of Livestock Herbivory in the West*. Soc. Range Management. Denver, CO.

Stoddard, L. A. and A. D. Smith. 1955. *Range Management*. McGraw-Hill Book Co., New York, NY.

White, G.C. and B.L. Lubow. 2002. Fitting population models to multiple sources of observed data. *Journal of Wildlife Management* 66:300-309.

APPENDIX A: Population Dynamics, Maximum Sustained Yield, and Density Dependence

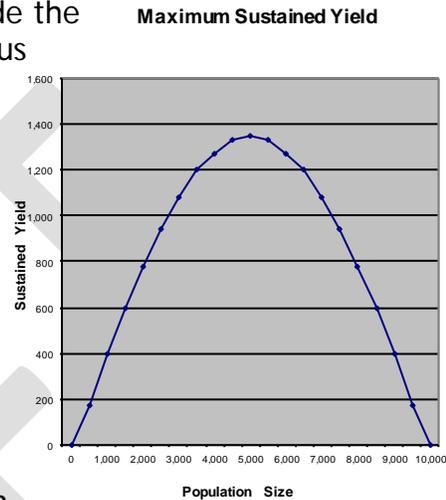
Numerous studies of animal populations, including such species as bacteria, mice, rabbits, and white-tailed deer have shown that the populations grow in a mathematical relationship referred to as the "sigmoid growth curve" (right). There are three distinct phases to this cycle. The first phase occurs while the population level is still very low and is characterized by a slow growth rate and a high mortality rate. This occurs because the populations may have too few animals and the loss of even a few to predation or accidents can significantly affect population growth.



The second phase occurs when the population number is at a moderate level. This phase is characterized by high reproductive and survival rates. During this phase, food, cover, water and space are not a limiting factor. During this phase animals such as white-tailed deer have been known to successfully breed at six months of age and produce a live fawn on their first birthday and older does have been known to produce 3-4 fawns that are very robust and healthy. Survival rates of all sex and age classes are also at maximum rates during this phase.

The final or third phase occurs when the habitat becomes too crowded or habitat conditions become less favorable. During this phase the quantity and quality of food, water, cover and space become scarce due to the competition with other members of the population. These types of factors that increasingly limit productivity and survival at higher population densities are known as density-dependent effects. During this phase, for example, white-tailed deer fawns can no longer find enough food to grow to achieve a critical minimum weight that allows them to reproduce; adult does will usually only produce 1-3 fawns; and survival of all deer (bucks, does and fawns) will decrease. During severe winters, large die-offs can occur due to the crowding and lack of food. The first to die during these situations are fawns, then bucks, followed by adult does. Severe winters affect future buck:doe ratios by favoring more does and fewer bucks in the population. Also, because the quality of a buck's antlers is somewhat dependent upon the quantity and quality of his diet, antlers development is diminished. If the population continues to grow it will eventually reach a point called "K" or the maximum carrying capacity. At this point, the population reaches an "equilibrium" with the habitat. The number of births each year equals the number of deaths, therefore, to maintain the population at this level would not allow for any "hunnable surplus." The animals in the population would be in relatively poor body condition, habitat condition would be degraded from over-use, and when a severe winter or other catastrophic event occurs, a large die-off is inevitable.

What does all this mean to the management of Colorado's big game herds? It means that if we attempt to manage for healthy big game herds that are being limited by density-dependent effects, we should attempt to hold the populations more towards the middle of the "sigmoid growth curve." Biologists call this point of inflection of the sigmoid growth curve the point of "MSY" or "maximum sustained yield." In the example below, MSY, which is approximately half the maximum population size or "K", would be 5,000 animals. At this level, the population should provide the maximum production, survival, and available surplus animals for hunter harvest. Also, at this level, range habitat condition should be good to excellent and range trend should be stable to improving. Game damage problems should be lower and economic return to the local and state economy should be higher. This population level should produce a "win - win" situation to balance sportsmen and private landowner concerns.



A graph of a hypothetical deer population showing sustained yield (harvest) potential vs. population size is shown (right). Notice that as the population increases from 0 to 5,000 deer, the harvest also increases. However, when the population reaches 5,000 or "MSY", food, water and cover becomes scarce and the harvest potential decreases. Finally, when the population reaches the maximum carrying capacity or "K" (10,000 deer in this example), the harvest potential will be reduced to zero. Also, notice that it is possible to harvest exactly the same number of deer each year with 3,000 or 7,000 deer in the population. This phenomenon occurs because the population of 3,000 deer has a much higher survival and reproductive rate compared to the population of 7,000 deer. However, at the 3,000 deer level, there will be less game damage and resource degradation but lower watchable wildlife values.

Actually managing deer and elk populations for MSY on a DAU basis is difficult if not impossible due to the amount of detailed biological information about habitat and population size required. Additionally, carrying capacity is not static, the complex and dynamic nature of the environment cause carrying capacity to vary seasonally, annually, and trend over time. In most cases we would not desire true MSY management even if possible because of the potential for overharvest and the number of mature of bulls and bucks are minimized because harvest reduces recruitment to older age classes. However, the concept of MSY is useful for understanding how reducing densities and pushing asymptotic populations towards the inflection point can stimulate productivity and increase harvest yields. Knowing the exact point of MSY is not necessary if the goal is to conservatively reduce population size to increase yield. Long-term harvest data can be used to gauge the effectiveness of reduced population size on harvest yield.

Research in several studies in Colorado has shown that density-dependent winter fawn survival is the mechanism that limits mule deer population size because winter forage is limiting (Bartmann et al. 1992, Bishop et al. 2009). Adult doe survival and reproduction remain high but winter fawn survival is lower at higher population sizes relative to what the winter habitat can support. The intuition to restrict, or even eliminate, female harvest in populations where productivity is low and when populations are below DAU plan objectives is counterproductive and creates a management paradox. In that, for populations limited by density dependent processes, this “hands-off” type of management simply exacerbates and perpetuates the problem of the population being resource limited, and countermands the goals and objectives of the DAU plan. As Bartmann et al. (1992) suggest, because of density-dependent processes, it would be counterproductive to reduce female harvest when juvenile survival is low and increase harvest when survival is high. Instead, a moderate level of female harvest helps to maintain the population below habitat carrying capacity and should result in improved survival and recruitment of fawns. Increased fawn recruitment allows for more buck hunting opportunity and a more resilient population. Thus, the key for DAU planning and management by objective is to set population objectives in line with what the limiting habitat attributes can support. A population objective range aptly set must be below carrying capacity.

Literature Cited

- Bartmann, R.M., G.C. White, L.H. Carpenter. 1992. Compensatory mortality in a Colorado mule deer population. *Wildlife Monographs* No. 121. 39 pp.
- Bishop, C.J., G.C. White, D.J. Freddy, B.E. Watkins, and T.R. Stephenson. 2009. Effect of enhanced nutrition on mule deer population rate of change. *Wildlife Monographs* No. 172. 28 pp.

APPENDIX B: Public Survey and Survey Results

SOLICITATION FOR COMMENT ON ELK MANAGEMENT

The Kenosha Pass Elk Herd (E18) (Game Management Units 50, 500, and 501)

In Colorado, big game species are managed at the herd level. The management of each herd is guided by a herd management plan, which describes the population and management histories of the herd as well as the population objectives, and management strategies for a minimum of 10 years. The herd management planning process is a way to incorporate the interests, concerns, and desires of the public within the biological capabilities of specific big game herds.

Colorado Parks and Wildlife (CPW) wildlife managers have begun the process of updating the herd management plan for the Kenosha Pass Elk Herd (GMUs 50, 500, and 501). The Kenosha Pass elk herd is located in central Colorado, beginning 12 miles southwest of Chatfield Dam in southwestern Denver, and 30 miles west of Colorado Springs.

CPW is seeking **your input** on the future management of this herd. The information you provide will help CPW develop objectives and management strategies for the herd.



Shannon Schaller, Wildlife Biologist
Colorado Parks and Wildlife
6060 Broadway
Denver, CO 80216

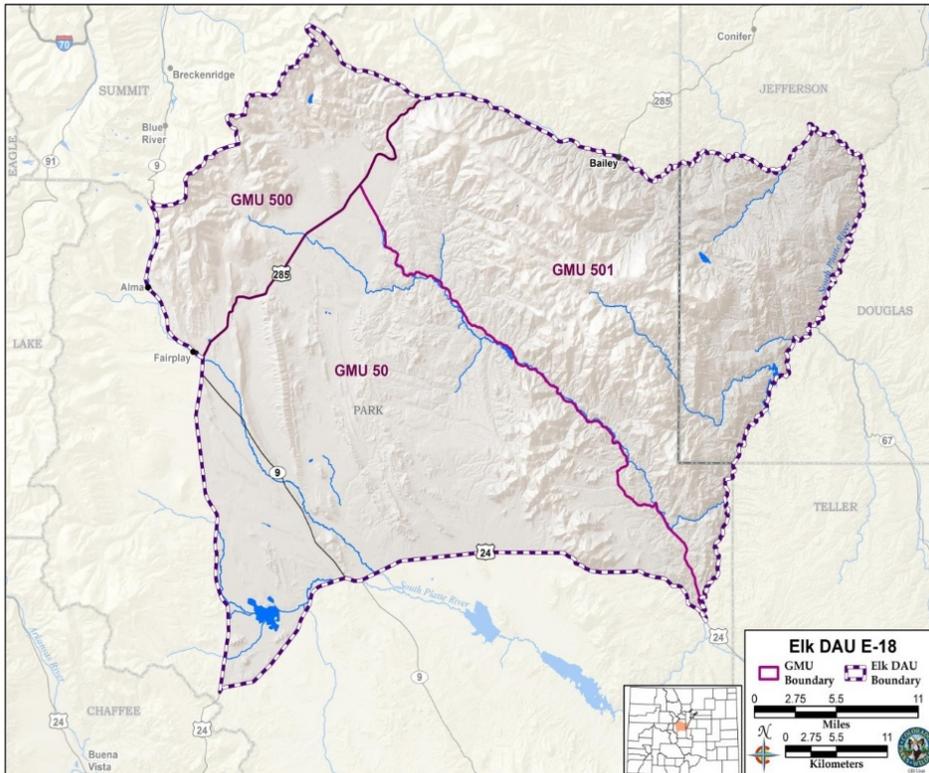
Background

1. Are you a resident of Colorado? *(Please check one.)*

- Yes (89% responded YES)
- No (11% responded NO)

2. Do you currently own any land in GMU 50, 500, or 501? *(Please see map below and check one.)*

- Yes (87% responded YES)
- No (13% responded NO)



3. Do you ranch or farm on the property you own or lease in GMU 50, 500, or 501? *(Please check one.)*

- Yes (87% responded YES)
- No (13% responded NO)

4. Are you currently enrolled in, or have you received landowner vouchers from, the Priority Landowner Preference Program? *(Please check one.)*

- Yes **(7% responded YES)**
- No **(89% responded NO)**
- I am not sure **(4% responded I AM NOT SURE)**

Elk Management

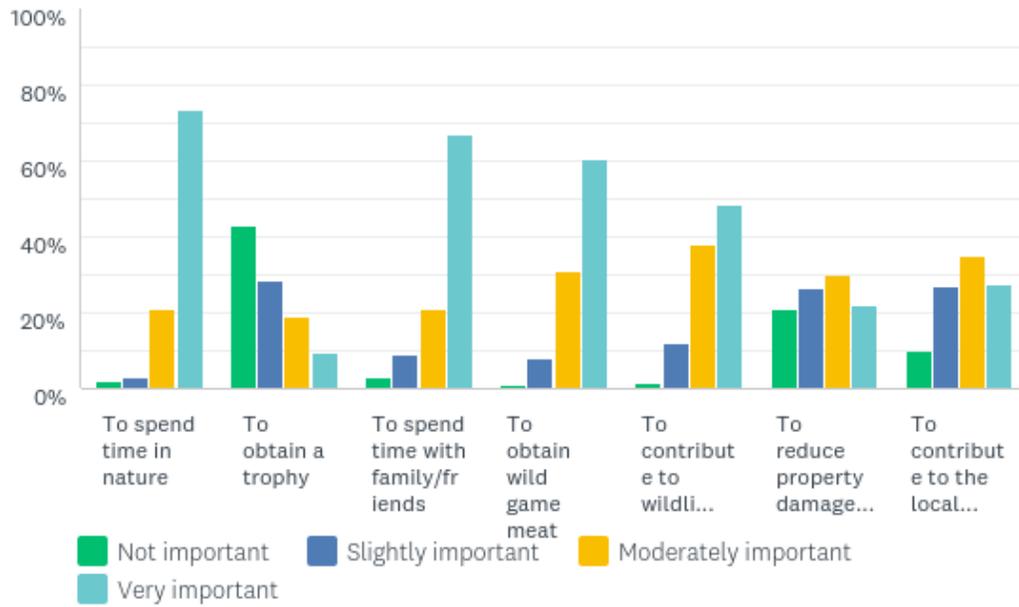
5. Have you ever hunted elk in GMUs 50, 500, or 501? *(Please check one.)*

- Yes **(94% responded YES)**
- No **(6% responded NO)**

6. How important to you is each of the following reasons to hunt elk in GMUs 50, 500, or 501? *(Please check only one response for each statement.)*

<i>Reasons to hunt</i>	Not important	Slightly important	Moderately important	Very important
To spend time in nature	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To spend time with family/friends	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To obtain wild game meat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To contribute to wildlife management	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To reduce property damage caused by wildlife	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To contribute to the local community (e.g., financial benefits from hunters)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
To obtain a trophy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other (please specify):	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

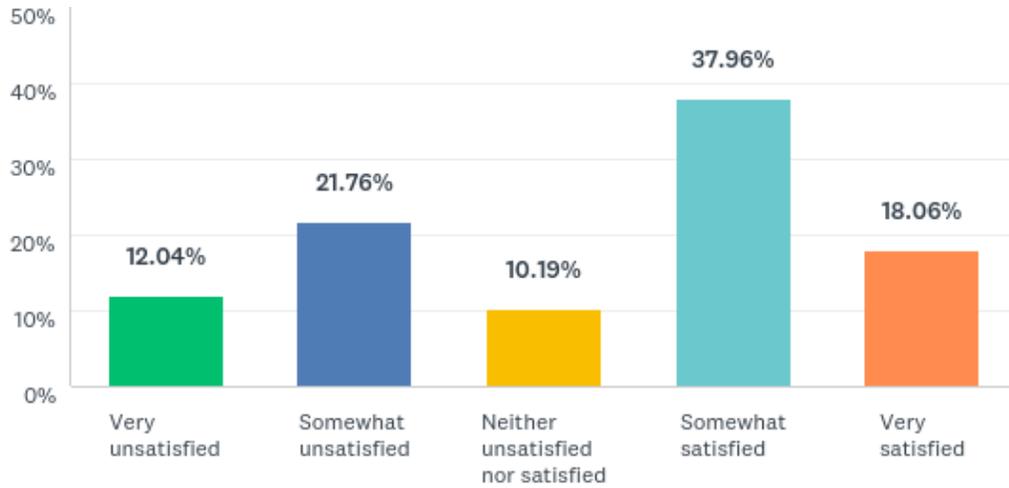
Responses



7. Overall, how satisfied were you with your elk hunting experience in GMUs 50, 500, or 501? (Please check one.)

- Very unsatisfied
- Somewhat unsatisfied
- Neither unsatisfied nor unsatisfied
- Somewhat satisfied
- Very satisfied

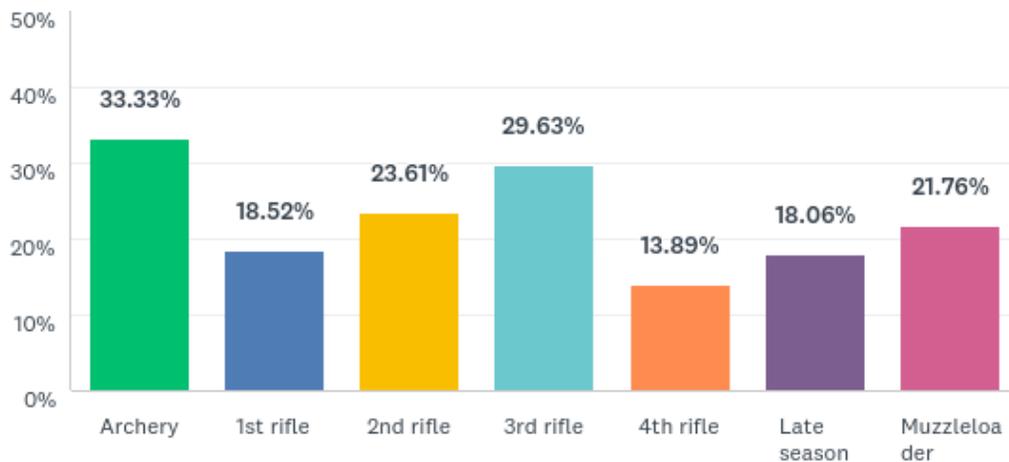
Responses



8. During which season do you prefer to hunt elk in GMU 50, 500, or 501?
 (Please check all that apply.)

- Archery
- 1st rifle
- 2nd rifle
- 3rd rifle
- 4th rifle
- Late season
- Muzzleloader

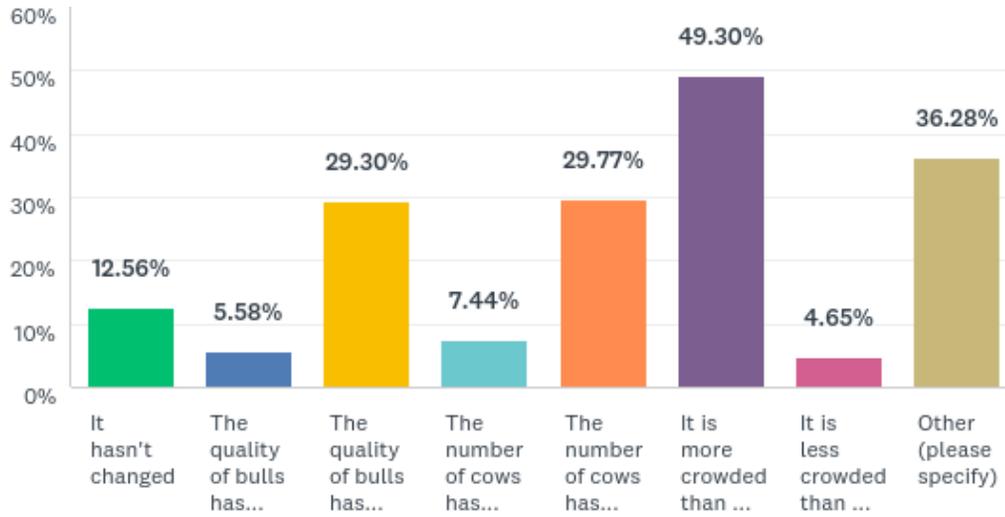
Responses



9. Overall, how has hunting in GMU 50, 500, or 501 changed in the last ten years? *(Please check all that apply.)*

- It hasn't change
- The quality of bulls has increased
- The quality of bulls has decreased
- The number of cows has increased
- The number of cows has decreased
- It is more crowded than it used to be
- It is less crowded than it used to be
- Others *(see summary of comments)*

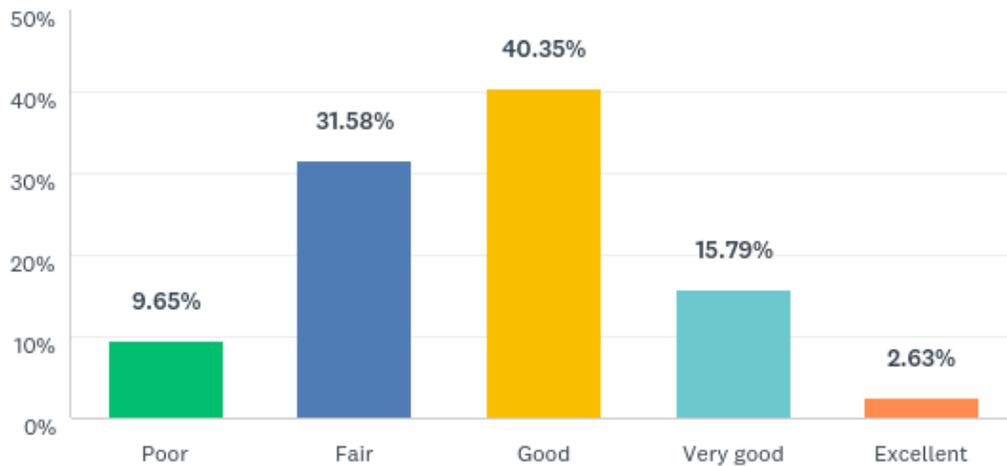
Responses



10. How would you rate CPW's management of elk in GMUs 50, 500, or 501? *(Please check one.)*

- Poor
- Fair
- Good
- Excellent

Responses



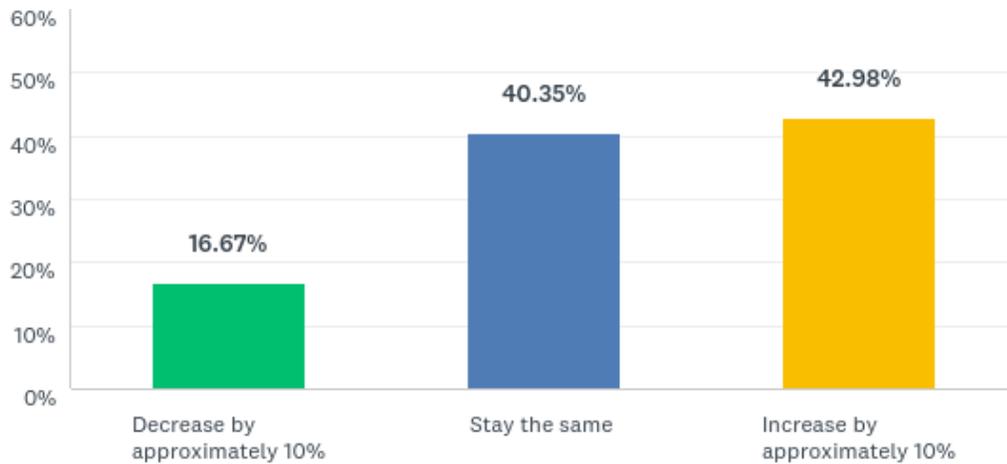
Please read the following brief description about managing elk herds before answering question 6 (below).

- To **increase** populations of elk, CPW would likely reduce the number of licenses in the short-term, allowing the population to grow. As the number of elk increase, CPW may choose to **increase** licenses to maintain population objectives in the long-term.
- Maintaining the status quo for populations of elk would mean similar license allocation to what has been done the last several years. The current population objective is 1,800-2,200 elk.
- To **decrease** populations of elk, CPW would increase the number of licenses in the short term. As the population declines, CPW may choose to decrease the number of licenses to sustain the population (within objectives), in the long-term

11. Please indicate which option best represents how you would like to see the elk herd in GMUs 50, 500, and 501 managed in the next 10 years. (*Please check one.*)

- Decrease by approximately 10%
- Stay the same
- Increase by approximately 10%

Responses



Please read the following brief description about bull-to-cow elk ratios before answering question 7 (below).

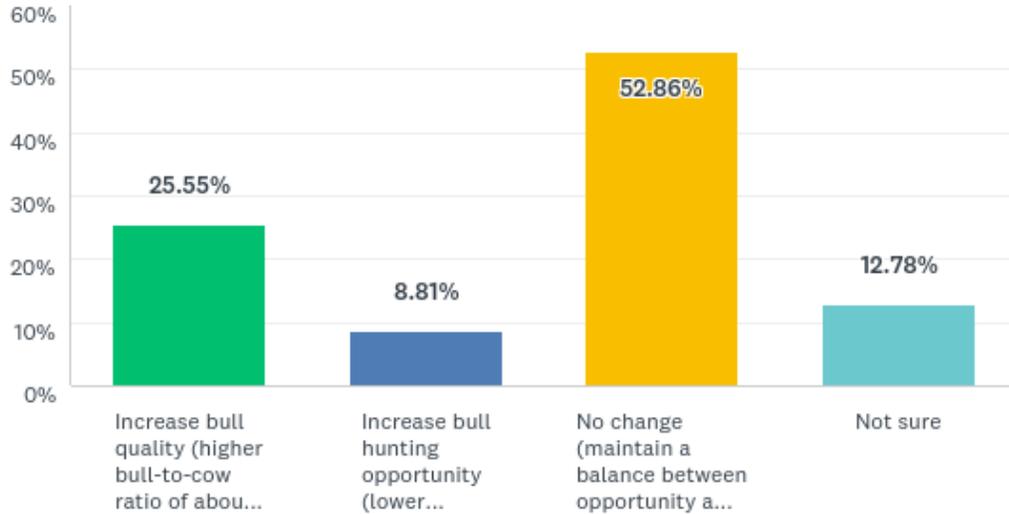
There is often a trade-off between managing for larger antlered bulls and the number of bull licenses issued. Currently, the elk herd in GMUs 50, 500, and 501 is managed to balance bull opportunity with bull quality at ratio of 35-40 bulls:100 cows.

- If elk herds are managed to **increase hunting opportunity**, more bull-elk hunting licenses are made available which increases the number of hunters in the field. This also results in fewer total bulls in the herd (lower bull-to-cow ratio) and fewer large or mature bull-elk.
- If a herd is managed to **increase mature, larger-antlered bull-elk**, fewer bull licenses are issued which increases the number of bull in the population (higher bull-to-cow ratio). This results in larger bull being harvested and fewer hunters in the field.

12. How do you believe the elk herd should be managed in terms of bull opportunity and quality? *(Please check one.)*

- Increase bull **quality** (*higher bull-to-cow ratio of about 40-to-45 bull/cow*)
- Increase bull hunting **opportunity** (*lower bull-to-cow ratio of about 30-35 bull/cow*)
- No change (*maintain a balance between opportunity and quality; about 35-40 bull/cow*)
- Not sure

Responses



13. Please use the space below to share any additional comments you may have about the Kenosha Pass area elk herd in GMUs 50, 500, and 501.

Responses

Several common issues emerged from general comments in the public survey. Common themes were:

- There are too many campers and hikers on public lands degrading the hunting experience
- There are too many road closures on Forest Service lands which restrict access and harvest
- There are too many hunters and there are crowding issues
- Motorized use has increased and negatively impacted hunting
- Elk stay on private land during the hunting seasons and are not available to public hunters
- Keep things the same as they have been last 10 years

Thank You for your time!

APPENDIX C: Letter from South Park Habitat Partnership Program



July 26, 2018

Shannon Schaller
Colorado Parks and Wildlife
6060 Broadway
Denver, CO 80216

RE: South Park Habitat Partnership Program Comments - Elk DAU El 8

Dear Shannon:

One of the initial reasons for creating the Habitat Partnership Program was to provide local landowners and other interests an opportunity to provide input into big game management in their areas. The diverse makeup of local HPP committees (3 livestock growers, Forest Service, BLM, CPW and sportsmen representatives) provide a good cross section of local interests to review DAU proposals and respond accordingly for CPW consideration.

The South Park HPP committee has discussed your presentation and reviewed the draft alternatives for this DAU plan update. The South Park HPP committee is in agreement with the following comments pertaining to proposals for the population range and sex ratio objectives for the above DAU plan.

The SPHPP committee supports the draft alternative to increase the number of animals within this DAU and within our committee area. The SPHPP committee does not believe this increase would create more conflicts and we also believe we have the resources necessary to address conflicts should they occur. Increasing the population objective will ultimately lead to more hunting licenses and sportsmen opportunities.

The SPHPP committee also discussed the proposed sex ratio alternative. We believe the current sex ratio is a good balance and provides ample hunting opportunity while also providing for a reasonable number of mature animals for those hunters who want to take a larger bull/buck.

Thank you for the presentation and the opportunity to provide these comments.

Sincerely,



John Woodward, Chair
South Park HPP Committee