

FINAL

**E - 8 (Troublesome Elk)
DATA ANALYSIS UNIT PLAN**

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DAU PLAN SUMMARY
Troublesome Elk

GMUs: 18 and 181

Current Population Estimate: 4,300 (posthunt 1997)

Proposed New Population Objective: 2,700 No change recommended

Percent Change: 37% reduction from the 1997 estimated posthunt population.

Current Sex Ratio Objective: 24 bulls:100 cows

Proposed Sex Ratio Objective: 24/100 No change recommended.

Percent Change: 14% drop from 1998 posthunt, no change from posthunt 1997

Changes from current objective/management:

If the proposed alternative is approved there will be no change from the current objectives. However, the herd will likely need to be reduced by 37% from the estimated 1997 posthunt population. This will be done by offering antlerless licenses that are additional, private land only licenses, and possibly by resuming the experimental either-sex season of 1998.

Description of significant issues raised during public involvement sessions and how the plan addresses those issues:

The current objectives for this DAU were set in 1990, and it now appears that the population size was underestimated by 22% at that time. Large numbers of antlerless permits have been issued this decade – more than 2,000 in 1993 & 94. This DAU contains steep terrain and heavy cover, with parts accessible only by foot or horseback; it is a hard area to hunt. Consequently, hunter success remains low, averaging only 19% during the period when permits have exceeded 1,450. The DAU also takes in Rocky Mountain National Park where no hunting is allowed. The population objective has not been met and the present herd size could still be above the 1990 level. Unlimited either-sex licenses and antlerless permits considered additional, previously unavailable, were implemented for the 1998 season. Hopefully, these new tools will improve harvests to the point where the population can be brought under control over time; at the same time, more cow harvest will need to take place on privately owned lands if conflicts are to be reduced.

Issues regarding elk management in this area are diverse. Forty-three DAU surveys were returned by members of the public. Fifty-two percent of those surveyed are very concerned that refuge areas, where there is little or no hunting, along with changing land use patterns, are making it nearly impossible to manage elk. Refuge areas include Rocky Mountain National Park and private ranch land that is leased out just for hunting trophy bulls, or ranches where hunting is not acceptable. Subdivision of the land brings multiple ownership and a diversity of viewpoints that makes it difficult to gain consensus for any management. Additionally, hunters, guides and outfitters tend to feel that some of the landowners complaining about too many elk are the same ones who restrict access for cow hunting during the season (an issue picked by 40% of survey respondents).

Non-consumptive users, guides and outfitters, and merchants are concerned that elk habitat is shrinking due to human activities. Another big concern is that summer recreational pressure at higher elevations may keep elk from using traditional habitats on national forest, shifting additional use onto transitional range. Major concerns in the agricultural community include: (1) large herds could be causing damage to forage resources on public and private lands; (2) DOW has failed to reduce the two major elk herds in Middle Park enough to bring them anywhere close to the objective agreed upon in 1990; and (3) private landowners are forced to support a public resource without being given any choice, or compensation. Landowners, along with hunters, also feel that not enough cows are killed during the regular season. Guides and outfitters, merchants and some landowners and hunters feel there may be too many elk for optimal herd health, and that high numbers adversely affect other wildlife species such as deer.

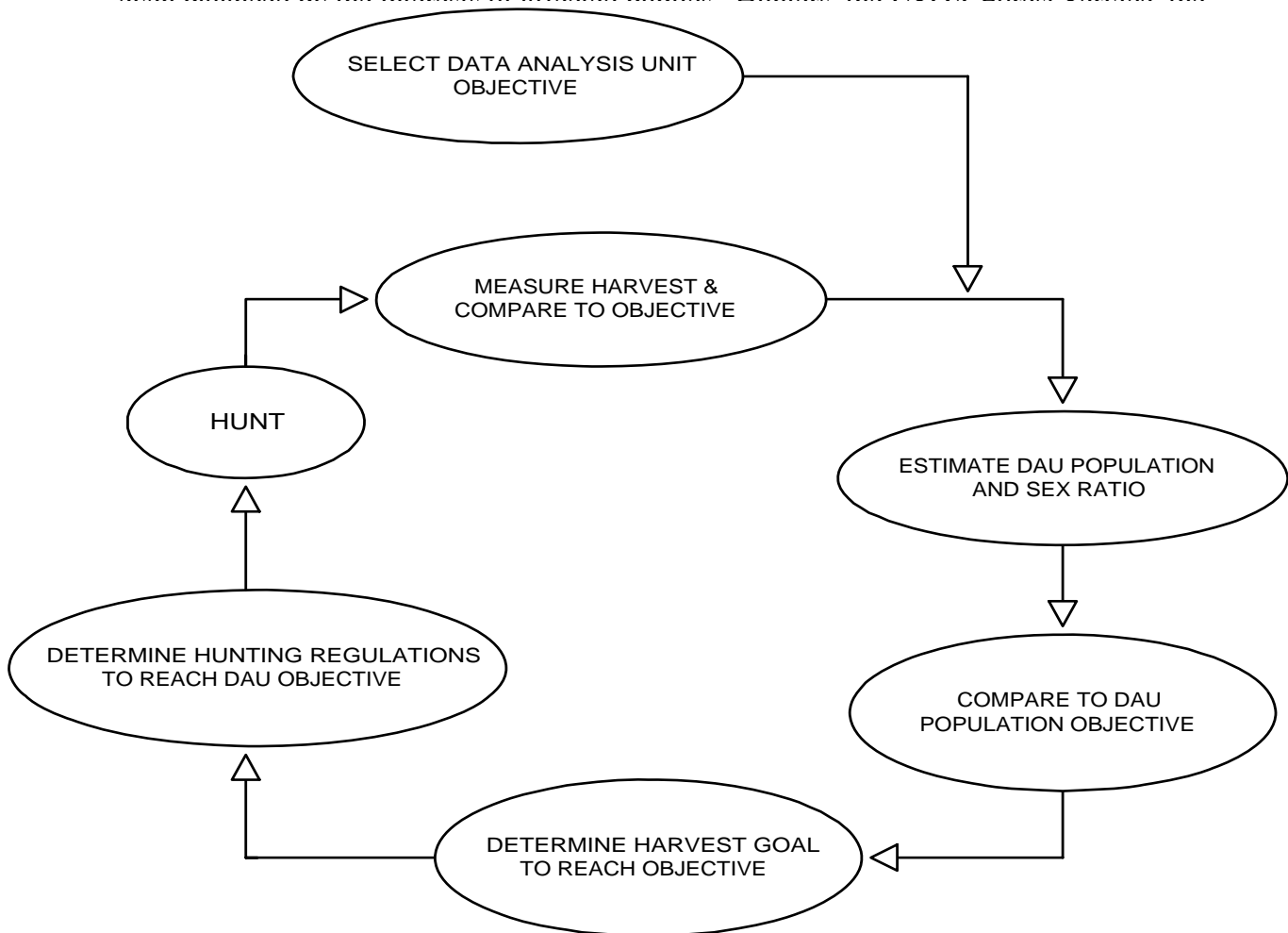
Major concerns of the DOW include inadequate census information, the difficulties in managing elk due to land use changes, lack of adequate harvests, and distribution problems with elk. This latter category includes a possible shift of elk use from public lands to private lands, along with the problem of elk wintering in the valley bottoms where they create conflicts and damage private property, and where they also may be competing with deer on winter ranges. In addition, considerable immigration and emigration may be occurring in this DAU, which complicates management.

Forty-eight percent of people submitting surveys preferred a posthunt population of 2,700 elk with a sex ratio of 24 bulls:100 cows. This was by far the most popular alternative, with the next most popular option only gaining 20% of the vote. The preferred alternative was favored by sportsmen, landowners, guides and outfitters, the Kremmling Resource Area of the Bureau of Land Management and the Sulphur Ranger District of the USDA Forest Service. It is also the option supported by the Middle Park HPP Committee and is the recommendation of local DOW personnel. This option will address many of the issues that concern landowners, and will bring about a better balance between herbivores and their habitat. A smaller elk herd should prove beneficial to the deer herd. However, this population objective has been difficult to achieve in the past and may continue to prove elusive. DOW credibility stands to be hurt further if we fail to lower this herd to objective. Landowners with the ability to provide opportunity for cow harvest also risk the loss of public sympathy for their damage problems if they fail to actively participate in the herd reduction.

INTRODUCTION AND PURPOSE

DOW's Management by Objective Process

Big game seasons were historically set on the basis of tradition or by the vagaries of politics. Often, the seasons that resulted were not related to herd levels, status of the habitat or even balanced by the interests of affected publics. Hunters, the USDA Forest Service, the



growers and hunting interests into working groups. Full participation in DAU planning ensures that private land habitat issues are considered in setting the DAU objectives, that conflict areas are identified and solution strategies are appropriate. The whole DAU planning process is designed to examine the public desires and biological herd capabilities, and determine an appropriate balance. Once set, the herd objectives typically remain in effect over a five-year period.

herd into one utilitarian planning document, compiles DAU issues identified through a public scoping process, examines alternative solutions to the issues and problems that have come to light during scoping, and finally recommends an alternative. After the Colorado Wildlife Commission reviews and approves a DAU plan, the population and composition objectives become management targets that drive the annual permit setting process.

Management by objective is a process based on an annual cycle of information collection, analysis, and decision-making culminating each year in the hunting season (see diagram below). The population objective drives the most important decision in the annual big game season setting process – how many animals need to be harvested to meet the population objective. If, for example, the herd is under objective, this will call for relatively few, if any, antlerless licenses. On the other hand, if the herd is over objective, number of licenses will need to be liberalized. The cyclic objective setting approach focuses on the collection and analysis of information, keeping decision makers working toward a specific goal.

In instances where significant conflicts occur with agricultural interests in the management of a particular species, local HPP committees attempt to address these problems. Individual HPP Committees are responsible for developing a Distribution Management Plan (DMP), which sets a framework for alleviating big game conflicts on public and private lands through habitat enhancements and direct distribution techniques, such as specialized hunts. Whereas the DAU plan addresses the overriding management strategy, the DMP focuses on management actions that may reach down to the level of individual ranches. To accomplish objectives outlined in the DMP, committees are allocated money at a rate of 5% of the annual three-year average license revenues for deer, elk and antelope licenses in their locality. HPP is also authorized to compensate landowners for actual damage to fence and forage caused by big game.

Tradition and politics still play a role in the season setting process. But hopefully this new approach does a much better job of analyzing the desires of various publics and then setting objectives, helping to insure that big game species are managed properly.

Description of The Data Analysis Unit

Location

The Troublesome Elk DAU (E-8) is located in north-central Colorado and consists of GMUs 18 and 181. It is bounded on the north and east by the Continental Divide, on the south by Arapaho Creek, Lake Granby and the Colorado River, and on the west by US Highway 40.

1. DOW's Annual Management Cycle

The DAU occupies the northeast portion of Middle Park and takes in slightly less than half of Grand County. It includes the headwaters of the Colorado River and all of the Troublesome, Antelope, Corral and Willow Creek drainages. Major towns include Kremmling and Grand Lake; Hot Sulphur Springs and Granby lie just outside the boundary. A map of the Troublesome Creek Elk DAU E-8 follows.

DAU Map

Fig. 2. Data Analysis Unit E-8

Physiography & Climate

Topography - Middle Park is a large basin surrounded by high mountain ranges. As an inter-mountain park it is unique in two respects. It does not have the level interior characteristic of other large mountain parks in Colorado, such as North Park and South Park, and it lies west of the Continental Divide. The Troublesome Creek DAU has numerous peaks along the Continental Divide reaching altitudes above 13,000 feet. The highest of these is North Arapaho Peak at 13,502 feet in the southeast corner of the DAU. All the natural surface drainage for this area funnels through Gore Canyon, downstream from Kremmling.

Once snow accumulation forces big game down to the valley floor in the winter, the animals become trapped in the park by Gore Canyon and are unable to migrate out of the valley. The valley floor at Kremmling is 7,300 feet in elevation, making it one of the higher elk winter ranges in Colorado.

Climate - Weather in Middle Park varies greatly depending on location and altitude. In general, the climate is cold and the majority of annual precipitation falls as snow. Drought years occur with some regularity. During winter when there is no wind, cold air becomes trapped by the surrounding mountains, causing extreme temperature inversions. During the middle of winter, nighttime low temperatures in the minus 20-degree Fahrenheit range are to be expected, and can drop much further. Temperatures down to minus 64-degrees F. have been recorded in Kremmling.

The summer growing season is extremely short and variable. Snow showers may even strike in the summer at higher elevations. Lower elevations may have daytime temperatures reaching into the 90-degree F. range; however, valleys become significantly cooler than uplands during the night as colder air settles.

Local topography also affects the amount and type of moisture. Kremmling lies in the "rain shadow" of the Gore Range and only averages about 11 inches of moisture per year; whereas at Grand Lake, where prevailing winds push clouds up against the Continental Divide, average precipitation is approximately 20 inches. Thunderstorms occur almost daily during the summer along the Continental Divide.

Most of the moisture that falls in the area comes during the period of October to late April. Snow blankets the area during the winter and accumulations of 30" are typical at the 9,000-10,000 foot level. Deer and elk move to lower elevations as snow accumulates, seeking out south-facing or wind-blown slopes. At high elevations, upwards of 20 feet of snow can fall over the course of winter. In the valleys, sunny winter days and/or windy conditions causes snow to disappear on some slopes.

Vegetation

Vegetation in Middle Park can be categorized into five broad types – cropland, wetland/riparian, rangeland, forestland and alpine. The variety of vegetation types scattered throughout Middle Park creates a highly desirable mosaic very beneficial to wildlife. However, plant communities at lower elevations are becoming increasingly disturbed by intensive human use.

Croplands consist of irrigated hay meadows and terraces that have been re-seeded to desirable forage plants. Most hay ground is "native hay," consisting of Timothy and Smooth Broome, with sedges and some rushes. A few hay meadows have been seeded to alfalfa. Truck crops such as broccoli, spinach, lettuce, peas and asparagus are grown just north of Granby.

Wetlands and Transition Riparian occur along the river bottoms and irrigated meadows. The most extensive riparian habitat lies along the Colorado River between the towns of Granby and Kremmling. This area is dominated by narrowleaf cottonwood and willow. The riparian habitat is one of the least represented vegetative types in Middle Park but is extremely valuable as wildlife habitat. It supports the greatest abundance and diversity of wildlife.

Rangelands consist of Sagebrush Steppe, Mountain Shrub and grassland communities. The sagebrush community is by far the most common rangeland in Middle Park at elevations up to 9,000 feet. It is found on drier non-agricultural areas on the valley floors and the lower hills. Mountain Shrub, consisting of big sagebrush mixed with serviceberry, chokecherry and antelope bitterbrush, is found on better soils at lower elevations. This plant community is not widely represented in Middle Park but provides important wildlife food and cover. Both Sagebrush Steppe and Mountain Shrub have grass and forb understories, making them suitable for rangeland. Bluebunch wheatgrass is prominent in these vegetative types under good range conditions. Native grasslands are found in two different sites. Mountain meadows, consisting of grasses, forbs and some shrubs, occur at higher elevations in association with lodgepole, aspen and spruce-fir forest types. Low elevation grasslands occur on windswept sites with poorly developed soils incapable of supporting sagebrush.

Forestlands in Middle Park can be subdivided into four major types: piñon-juniper, lodgepole pine, aspen and spruce-fir. Piñon-juniper woodlands are found on some of the lower slopes. "P-J" can provide cover during the winter, along with low quality forage. Lodgepole pine is the most widely distributed forest type. This species typically occurs in even-aged stands at elevations between 7,500 feet and 10,500 feet. Due to the dense overstory, this habitat type typically provides little forage for elk but is important from the standpoint of cover. At higher elevations, Engelmann spruce and subalpine fir regularly occur in uneven-aged stands. This habitat provides excellent summer cover for deer and elk. Aspen stands usually are found in areas with better soil moisture, or in areas of less severe exposure at elevations up to 10,500 feet. The understory in aspen typically consists of vigorous herbaceous growth, shrubbery and emerging conifers. This forest type is attractive to a variety of wildlife and provides important cover and forage for big game animals. On some sites aspen is the climax species; on other sites it is a transitional species that occurs for only a relatively short period of time after a disturbance, such as fire. Douglas-fir, ponderosa pine and limber pine forest types also occur in Middle Park, but to a lesser extent.

As temperature and winds become more extreme with increasing altitude, Engelmann spruce and subalpine fir become stunted, eventually giving way to forbs, grasses and sedges.

Low growing plants are typically nestled among lichen-covered rocks. This is the Alpine community, or tundra, which usually occurs above 11,000 feet in elevation. In those protected areas blanketed by snow during the winter, and kept moist by melting snow banks during the summer, thickets of bog birch and willows can exist. Alpine sites can provide high quality elk forage from July through early September.

Land Status

The DAU covers a total of 830 square miles. Seventy-nine percent of this landscape is administered by the federal government, either the USDA Forest Service (USFS), Bureau of Land Management (BLM) or the National Park Service (NPS). Eighteen percent of the DAU is in private ownership. The State of Colorado (State Land Board and DOW) administers slightly more than 3% of the land area. DOW's portion of this consists of approximately 400 acres on the west side of Byers Canyon. Land ownership is categorized in Table 1 and Figure 3.

TABLE 1

Land ownership in DAU E-8 by GMU shown in square miles.

GMU	PRIVATE	BLM	USFS	NPS*	SLB*	DNR*	TOTAL
18	82.9	68.2	341.4	151.3	4.3	0.5	648.6
181	64.3	63.5	31.4	0.0	21.7	0.0	180.9
TOTAL	147.2	131.7	372.8	151.3	26	0.5	829.5
PERCENT	17.7%	15.9%	44.9%	18.2%	3.1%	0.1%	100.0%

*NPS = National Park Service SLB = State Land Board DNR = Dept. Nat. Resources (State Wildlife Areas)

The DAU contains approximately 234 square miles of elk winter range, 79 square miles of severe winter range and 66 square miles of elk winter concentration areas. Severe winter range is defined as the area of winter range where 90% of the elk will be confined during the worst two winters out of ten when the snow pack is at the maximum. Winter concentration areas are defined as areas of the winter range having a density of at least 200% more elk than surrounding areas during the normal five out of ten winters. The bulk of the winter range occurs on BLM land (approximately 54%), followed by private land (approximately 30%), SLB lands (approximately 8%), USFS lands (approximately 5%), NPS lands (approximately 3%) and DOW lands (less than 1%).

Insert Land_E-8 Bitmap Image Here

FIGURE 3

Land Use

The main industries in this part of the state are recreation, mining and ranching (in descending economic importance). Some commercial logging also takes place. Expansive mountain communities occur in the areas surrounding Granby and Grand Lake. The Sulphur Ranger District of the Arapaho/Roosevelt National Forest, the Parks Ranger District of the Medicine Bow/Routt National Forest, the Kremmling Resource Area of the BLM and Rocky Mountain National Park administer federal lands within the DAU. Recreation, livestock grazing and wildlife production are predominant uses of USFS and BLM lands, with timber harvest occurring in areas where there are suitable forest products; other activities such as right-of-way administration, mineral production, watershed protection and cultural resource protection are common to the two agencies. The mission of the NPS is to preserve ecosystems and scenery, along with natural and historic objects for future generations.

Grand County is a popular destination for summer recreationists, with numerous campgrounds, dude ranches and other resorts. The west side of Rocky Mountain National Park receives more than 400,000 visitors annually. Reservoirs built to divert water to East Slope metropolitan areas provide good fishing, along with opportunities for recreational boating. The USFS administers the Arapaho National Recreation Area which takes in Lake Granby and

Shadow Mountain Reservoir and associated developed recreation sites. The Colorado River Water Conservation District administers Wolford Mountain Reservoir and associated developed recreation sites. Rafting companies offer trips down the Colorado River, and local rivers also provide opportunities for kayaking. All, or portions, of Indian Peaks and Never Summer Wilderness Areas are located within the DAU. The Bowen Gulch Protection Area, administered by the USFS, is also within the DAU. Cross-country skiing and snowmobiling are both popular wintertime activities. The Town of Grand Lake strives to maintain a reputation of being the snowmobile capital of Colorado.

Hunters can take deer, elk, black bear, pronghorn antelope, bighorn sheep, mountain goat, mountain lion, blue grouse and sage grouse in Middle Park. Good fishing is provided by several Gold Medal streams, four large reservoirs and numerous high lakes. Hunters and anglers make substantial contributions to local economies. DOW figures show that for the year 1996, the total annual impact of all hunting and fishing in Grand County was more than \$52 million (factoring in both direct expenditures and the multiplier effect of dollars recirculating in the economy). People who take trips to observe and photograph wildlife also buy gas, groceries and other supplies, substantially impacting both destination areas and retailers along travel routes.

Besides providing recreational opportunity, undeveloped lands in the DAU are also used to raise livestock. Most livestock operations are cow-calf enterprises. Most livestock are pastured on USFS or BLM allotments during summer months. Private lands are used for hay production and winter/spring pasture.

Commercial logging has been curtailed somewhat by recent closures of processing plants at Kremmling and Walden, but with wood prices rising the industry remains economically viable. In the past, lodgepole, spruce and fir accounted for nearly all the saw and pole timber produced in the area, with aspen being harvested for pulpwood.

Habitat Condition and Capability

Public Lands

USFS -

The USFS manages 13 grazing allotments occurring totally or partially in DAU E-8. Three of these have been vacated and are not being used by domestic livestock at this time. All together, the 13 allotments provide 6,083 AUMs of forage for livestock on an annual basis. The period of utilization is variable, but primarily occurs from late June through September. Classes of livestock using these allotments are cattle and horses.

Standing forage, security cover, road access and the mix of these largely determine the quality of elk habitat. Habitat conditions on USFS lands are believed adequate to meet the needs of the current population in the DAU. Habitat diversity is high throughout the area, providing a good forage:cover ratio. Additional logging is not generally needed for elk or other wildlife species in the DAU in the near future except where aspen stands are being invaded and crowded out by conifers. Livestock graze over most of this DAU and forage condition is fair to good overall. Competition between cattle and elk does not appear to be a significant problem, based

on the fact that adjustments in allotment management plans have not occurred because of wildlife impacts. In the southern and eastern portion of the DAU, high concentrations of roads decrease habitat effectiveness. The USFS has developed travel management plans that should improve these conditions, so long as road closures are enforced. In the unroaded central portion of the DAU it is unlikely that management activities requiring new roads will occur in the near future.

Only a small percentage (5%) of winter range in this DAU is on USFS lands. Mature bulls may be found wintering in these areas, sometimes with other elk in mild winters. Conditions on these ranges are fair to good. Some small scale burning projects may be considered to increase the amount of forage.

BLM -

The Bureau of Land Management has 35 allotments in the DAU. These provide 9,416 AUMs of forage for livestock, with use occurring primarily in the spring and fall, although some use occurs in summer and winter. Classes of livestock using these allotments are almost exclusively cattle and horses.

The Kremmling Resource Management Plan emphasizes the management, production and use of renewable resources on the public lands in the Troublesome DAU. Sustained yield and multiple use are primary tenets of this management philosophy. Range forage has been allocated to optimize both livestock production and big game populations wherever feasible. In grazing allotments where optimizing for both was not possible, livestock production was favored while providing sufficient forage to support 1980 big game levels.

BLM lands provide more than half the winter range for elk in this DAU. Large herds may form up in these areas during severe conditions, such as January 1997, when nearly 1,900 elk were located within five miles of Kremmling in GMU 181.

Wildlife/livestock Conflict Areas - Public Lands

Federal land management agencies were asked to provide information on areas where conflicts may occur between livestock and big game – for example, where wildlife had forced a change or delay in period of use on an allotment, or where forage utilization by wildlife had caused a reduction in AUMs of forage available for livestock. No conflict areas were identified by the Sulphur Ranger District or the Kremmling Resource Area of the BLM. Parks Ranger District felt conflicts between cattle and elk had existed in the past in the Chimney Rock area (GMUs 17 & 181) and the East Fork of Troublesome Creek (GMU 18), and that these might be potential areas for renewed conflicts.

Over the past seven years, the Middle Park HPP Committee has contributed to the salary of a temporary range technician over the summer season. This person has concentrated on determining the degree of use, and timing of use, by large herbivores on critical rangelands. Range utilization cages constructed of wire mesh are placed in key areas on private meadows, state lands, BLM, USFS and NPS lands to be monitored throughout the growing season. A primary focus of this work in the initial years was to determine the degree to which elk might be damaging spring pastures. Damage does not appear to be a problem, but elk use can force a

delay in livestock being put out to pasture, increasing the time they must be fed. The summary report for the 1997 summer season did not identify any particular problem areas, although it was noted that above average rainfall in early and late summer had benefitted rangeland vegetation. Most of the hardest hit areas observed were at lower elevations on BLM where elk gathered in the winter and early spring, with cattle coming in right behind in late spring and early summer. Not much has changed during the 1998 season, although the early part of July was very dry. Competition for summer forage between elk and livestock does not appear to be of any concern, other than the effect it may be having on elk distribution – this could be occurring to some degree on USFS allotments in the East Fork of the Troublesome and Chimney Rock area.

Wildlife/livestock Conflict Areas - Private Lands

Elk damage crops and fences, raid and destroy haystacks, compete with livestock for spring forage, damage aspen trees, and have other impacts on privately owned habitat in parts of DAU E-8. Wintertime concentrations lead to conflicts with some regularity, particularly in regard to cattle feeding operations. Most hay storage areas have had to be permanently fenced to keep elk out. DOW provides materials for these stackyards and ranchers erect them. During the summer, private hay fields adjacent to Rocky Mountain National Park receive heavy use by elk, reducing their yields.

During the winter of 1996-97, about 400 elk became trapped just north of Granby by deep snows. These animals raided haystacks which had not been bothered for more than fifteen years and were not protected by fencing. These elk had to be baited away from areas where ranchers were feeding livestock. The following spring as animals dispersed, they damaged spinach fields and nursery plants on Granby Mesa. Ultimately, the damage caused by these elk, along with the labor and hay for the baiting operation, ended up costing DOW \$120,000. DOW paid to permanently protect the spinach field with 8-foot high-tensile fencing following this incident.

Whenever damage to livestock fencing or forage occurs, or that potential exists, the Middle Park HPP Committee has typically become involved in the resolution of these conflicts. Aerial fertilization of elk habitat on public lands has been used with some success to attract animals away from private rangelands. In addition, HPP funds have been used to construct a high-tensile livestock fence in an area where perennial fence damage was occurring, and also to provide materials for “Middle Park Gates.” Landowners are encouraged to install these metal gates in existing travel corridors of elk. These can then be left open during times when cattle are not being pastured, and elk seem willing to go out of their way to use these gates when they aren’t hurried. HPP has also paid to build several high-tensile division fences to improve grazing management of BLM allotments, and has been involved in improving grazing practices in other ways, such as water development. Distribution management hunts, where landowners are allowed to bring in hunters of their own choosing when elk are causing conflicts during the period from Aug. 15-Jan 30 (excluding regular hunting seasons), have also proven useful in reducing damage. An average of 40 licenses for distribution management hunts have been issued annually since 1990 for ranches in E-8. In situations where elk take spring forage intended for cattle use because snow prevents them from moving onto the national forest, HPP can make lease payments for pasture if there is nowhere else for the elk to be at that time of year.

Grazing practices on some private lands may be having an effect on where elk are summering and wintering. Coal Mountain may be an area that no longer provides much winter and transition range for elk, at least during some years.

Herd Management History

Elk were plentiful in Middle Park in pre-settlement times, but were soon exploited when Europeans began arriving on the scene. Market hunters supplied mining camps near Leadville and in Clear Creek and Summit Counties with wild game meat. Later, thousands of elk were shot throughout Colorado for just their teeth. The disappearance of elk brought about closed seasons from 1902-1928. In 1913, it is estimated that only 50 head remained in the entire upper Colorado River Basin (500-1000 in all of Colorado). Between 1912 & 1928 there were 14 reintroductions in Colorado totaling 350 animals. (The Elks Lodge was instrumental in getting these done). One such transplant occurred at Estes Park in 1913, with 36 elk from Yellowstone; another release occurred near Steamboat Springs. During the late teens and twenties the entire Williams Fork drainage in Middle Park (in the adjoining DAU) was maintained as an elk refuge, along with an area centering on Corral Creek. Due to these protections afforded elk, numbers in the Troublesome Creek DAU have been gradually increasing since the turn of the century, and elk are now a prominent feature of the local fauna.

Posthunt Population Size

No practical census technique has ever been developed for elk in Colorado. Consequently, DOW uses computer population models as their primary method for estimating population size and for setting permit numbers. Prior to 1998, a software program called POP-II was used on personal computers to help determine what is occurring in big game populations. A new spreadsheet model is currently being evaluated as a replacement for the POP-II program. Both programs are similar in that harvest figures are entered into the computer along with estimates of mortality, initial population size, sex ratio at birth and wounding loss. Numerous simulations are run with the model until the outputs reasonably align with age and sex ratio data collected following the hunting season at least every other year in the Troublesome DAU. Accuracy of the new spreadsheet model is estimated to be within 20%, but there is no way to verifying this. Results of the computer generated population estimates are summarized in Appendix A.

The Troublesome Creek elk herd has been steadily increasing in the last half of this century, except for a few setbacks such as the winter of 1983-84. The highest posthunt population estimate from computer modeling was during 1995-96 when the DAU may have had more than 5,000 elk (see Figure 4).

The lowest population estimate was 800 elk in 1953.

The closest thing to an elk census occurred during

Figure 4.
Insert E-8_pop.bmp here

the winter of 1995-96 when the Middle Park HPP Committee contributed money for additional helicopter flights. Near ideal counting conditions were present during February of that year after a heavy snowfall with very little wind and no drifting. Elk began to move to lower elevations and into habitat with less tree cover, and congregated in groups that averaged slightly more than 21 elk in size. The solid snow cover greatly increased visibility of animals and made tracking from the air possible. A total of 31 hours of flight time were spent counting and classifying elk in Middle Park. Photographs were taken of some of the larger groups to ascertain the degree to which undercounting was occurring. The total number of elk accounted for in E-8, after adjusting for sightability and counting error in large groups, was 3,158. However this figure does not reflect elk that had migrated out of the DAU for the winter, such as to Estes Park, or those elk that may have been in areas that were not surveyed.

Disclaimer

Estimating population numbers of wild animals over large geographic areas is an inexact science. Whenever attempts have been made to account for a known number of animals in large fenced enclosures, investigators have consistently failed to see every animal. In some cases, less than 50% of the animals can be observed and counted. “High-tech” methods using remote sensing have also met with very limited success. Most population estimates derived from computer model simulations involve estimations of sex ratio at birth, survival rates, wounding loss and annual production. Such simulations are aligned on measured posthunt age and sex ratio classification counts, taking into account any information available on minimum population size or population trend. DOW recognizes population estimation as a serious limitation in our management efforts and attempts to minimize this problem by using the latest technology and inventory methodology available. Major revisions of POP-II elk models were made in 1992 (15 age classes), 1996 (20 age classes) and 1998 (higher survival rates), and all these changes resulted in higher population estimates. As better information has been obtained on survival rates, wounding loss, fetal sex ratios and density estimates, and whenever new modeling techniques and programs have emerged, these have been assimilated into the process for population estimates. These changes may result in significant differences in population estimates, calling for new management strategies. It is recommended that the population estimates presented in this document not be viewed as an exact representation of the number of animals in the DAU; rather, their utility is as an **index** to evaluate population trends over time.

In 1990, when the last population objective was set, DOW significantly underestimated the size of the elk population in Middle Park. At the time, it was felt that reducing the population by 18% would bring the population in DAU E-8 down to the objective of 2,700 animals. We now know that this assumption was incorrect, and that a much larger reduction (37%?) in the population was needed to achieve the objective. This example only points out the folly of trying to deal in terms of exact numbers of wildlife, especially with a species as elusive as elk.

The Concept of Carrying Capacity

Decision makers must take carrying capacity into account when determining optimum size

at which to maintain a herd. As any population of animals expands in a finite habitat, it eventually reaches a maximum sustainable level. That level for ungulates is usually governed by availability of food resources. Typically, survival and reproductive rates decline as the population approaches carrying capacity, until no further population growth is possible (see Appendix B for more discussion). Fewer resources are available to individuals in the population at this point due to the demands of increased numbers of animals. In most situations carrying capacity is not static, however, but fluctuates from year to year based on factors such as forage production, forage availability, and competition with other species.

Wildlife managers recognize that it is often possible to increase harvest over the long term and reduce the possibility of large die-offs due to severe winters by managing a population at some level well below carrying capacity of the habitat. The increased production that results from individuals being on a higher plane of nutrition more than compensates for the reduced population size. Individual animals are usually more healthy and robust. Other species may also benefit from increased availability of forage and cover.

The question often asked in relation to the DAU plan is, "How can you set a population objective without knowing a number that the area can support?" However, arriving at a definitive estimate of biological carrying capacity is not any easier than estimating population size. One must first know animal requirements and how they use their environment, then resources must be inventoried across a wide geographic area, and yearly variability must be taken into account. The cost of conducting such investigations is usually prohibitively expensive.

The posthunt population in DAU E-8 has probably been above 5,000 animals on several occasions, most recently in 1996. Based on the large harvests (approaching 1,000 on average) consistently occurring in this DAU, it is safe to assume that this level is well within carrying capacity of the habitat. Does this indicate that 5,000 elk is the right number to have in the posthunt population? Lacking definitive data on the vegetation, we cannot say. Ultimately, the decision on biological carrying capacity must come down to a consensus of interested parties as to what demands wildlife and livestock are presently making on the forage, and what that "feels" like in terms of general range condition. This is the utility of a DAU Planning process.

Posthunt Herd Composition

The first documented age and sex ratio surveys of the Troublesome Creek elk herd were conducted in 1972. Since then, DOW has conducted a total of 18 posthunt age (calf to cow ratio) and sex (bull to cow ratio) classifications. Sex ratios have averaged 24 bulls:100 cows, with a range of 10 to 42. During this decade DOW has conducted five classification surveys in E-8 which averaged 25 bulls:100 cows, with a range

Insert Graph of Troublesome Sex Ratios Here
Figure 5

of 22 to 30 (sex ratios are shown in Figure 5).

Sex ratios in this herd have consistently been in the range of 20-30 bulls, even without any restriction on hunter numbers or season-long antler point restrictions. This is because the lack of access, both legal and physical, in the Troublesome DAU, along with the proximity of Rocky Mountain National Park. The ratio did dip in the mid-80s, probably as a result of very heavy elk hunting pressure on bulls during the early 1980's. Since 1986, DOW has been using the four-point antler restriction to protect a portion of the bulls during 1st and 2nd combined rifle seasons. (Spikes were protected all three seasons during the experimental unlimited either-sex season in 1998). There have also been a large number of cow permits in this unit this decade. The combination of these factors has maintained the bull ratio at higher levels.

Posthunt age ratios are measured at the same time as sex ratios – early in the winter. These give some indication of reproductive success but, depending on severity of the winter, may not accurately reflect recruitment into the population (*i.e.*, those animals surviving to one year of age). Significant mortality of young can occur between the time of the counts and May.

Posthunt age ratios have been more variable than sex ratios. Over the last 25 years the average age ratio has been 58 calves:100 cows (range: 39 to 77). This decade DOW has conducted five surveys; two of these age ratios were quite high (one was the second highest on record), while two were all-time lows. The reasons for these wide swings are unknown but could be weather related (growing season or winter severity), could reflect undue stress during the fall or winter, or possibly be related to higher densities of elk. Age ratios are shown in Figure 6.

Other Management Activities in DAU E-8

Hunters in the 1989 game damage season and subsequent distribution management hunts have been required to submit the lower jaw and uterus from harvested cows. DOW has maintained records of pregnancy rates, fetal sex ratios and age structure of the harvest from these

Insert Graph of Troublesome Age Ratios Here
Figure 6

biological samples, and has also estimated dates of conception and parturition from measurements of the fetuses. Through the years, 941 jaws have been aged and 815 uteri have been examined. Pregnancy rates in Middle Park elk have averaged 90% for animals 2½ years of age and older and 31% for yearlings. Two to 3 percent of the cows harvested appear to have been 15 years of age or older, and one of these animals had twin fetuses (the only incidence of twinning detected).

Harvest History

Both bull harvest and antlerless (cow and calf) harvest have steadily increased since the 1950s in the Troublesome Creek DAU. In the 1950's the harvest averaged 64 elk per year; this rose to 224 in the 1960's, 352 in the 1970's, 617 in the 1980's and 932 in the 1990's. Antlerless harvest has increased dramatically from a low of seven in 1958 to 614 in 1997. The maximum number of elk harvested in any one year was 1,142 in 1996, and the lowest number was 41 in 1953 (see Figure 7 for a graph of the harvest data). Note: harvest figures are estimated from random surveys of hunters and may be subject to error.

Antlerless harvest is a function of antlerless licenses issued, but there does seem to be a point of diminishing returns over a certain level. Since 1983, DOW has authorized anywhere from 800 to 2,080 antlerless licenses in the DAU (see Table 2). During the last several years, somewhat fewer antlerless licenses have been issued – not because the population is nearing objective, but because experience has shown there is a diminishing point of return beyond which declining success rates prevent any further increases in harvest. Anywhere from 1,236 to 1,472 antlerless licenses were issued during the application process from 1994-97. Permit numbers over and above this level end up being sold at DOW offices to walk-in customers.

TABLE 2

Limited Licenses in DAU E-8

YEAR	POSTHUNT OBJECTIVE	TOTAL LICENSES	LICENSE TYPE	HARVEST	PERCENT SUCCESS
1983	2,200 elk	850	Antlerless	141	17%
1984	2,500 elk	1,160	Antlerless	287	25%
1985	2,540 elk	980	Antlerless	234	24%
1986	2,540 elk	1380	Antlerless	355	26%
1987	2,540 elk	800	Antlerless	182	23%
1988	3,300 elk	800	Antlerless	222	28%
1989	3,300 elk	860	Antlerless	272	32%
1990	2,700 elk	1,190	Antlerless	435	37%
1991	2,700 elk	1,150	Antlerless	267	23%
1992	2,700 elk	1,500	Antlerless	289	19%
1993	2,700 elk	2,000	Antlerless	435	22%
1994	2,700 elk	2,080	Antlerless	367	18%
1995	2,700 elk	1,775	Antlerless	289	16%
1996	2,700 elk	1,920	Antlerless	424	22%
1997	2,700 elk	1,880	Antlerless	255	14%
1998	2,700 elk	1,880	Antlerless	NA	NA

Hunting Pressure

Hunting pressure in the Troublesome DAU has increased along with the elk population. The lowest number of elk hunters was 222 in 1954 and the highest was 6,939 in 1997. During the period 1993-97 hunter numbers have averaged 5,577.

As would be expected, overall hunter success in E-8 has varied significantly over the last fifty years. During the 1950's, percent success averaged 21%; it climbed to 23% in the 1960's, then dropped to 15% in the 1970's, crept back upward to 16% in the 1980's and was 18% in the 1990's. During the past five years, overall hunter success has been declining (see Figures 7 & 8 for a summary of hunting pressure and percent success). The same decline is seen among hunters holding antlerless permits for the last five years.

Insert Graph of E-8 Harvest History Here Figure 7	Insert Graph of E-8 Hunter Success Here FIGURE 8
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Season Structure

Hunters have been able to buy a general license to hunt bulls in DAU E-8 since 1947 or before (unlimited either sex seasons were held from 1948-51). Starting in 1953, limited antlerless licenses have been available by drawing in the DAU, except for 1961, 1971 and 1972. Managers experimented with an either-sex season in 1970 in GMU 18, east of State Highway 125. Again in 1998, hunters could purchase unlimited either-sex elk licenses for the 2nd and 3rd Combined Seasons in many parts of western Colorado, including E-8.

An elk season separate from that of deer was initiated in 1971, and Colorado went to two separate and one combined seasons in 1976. Another major overhaul of the season structure occurred in 1986 when the three combined season structure made its appearance.

Antler point restrictions have been used at times to improve the number of bulls 2½ years and older in the population. Branch antlered only hunting was first tried throughout the state in 1972. The “4-point” antler restriction has been in effect for the 1st and 2nd Combined Seasons in E-8 since 1986.

Besides either-sex licenses, DOW has tried various methods of increasing cow harvest in Middle Park. In 1990 and 1991 late private land only (PLO) seasons were held. These proved unpopular with landowners and there were problems with hunters pushing elk off public lands, so these hunts were discontinued. DOW started issuing limited antlerless licenses in 1st Combined Season beginning in 1992. A nine-day late season was held three weeks after the close of 3rd Combined in 1997, with 1,000 antlerless licenses for all of Middle Park south of I-70. Licenses for this late season were sold first come first served and demand for these far outstripped availability; hunters succeeded in harvesting about 350 cows in Middle Park, but the season was not without its problems (agents and offices were swamped, and there were safety concerns, poor sportsmanship and illegal bull harvest). PLO antlerless licenses were instituted on a trial basis for the 1996 regular season and are being retained – these are considered additional. For the 1999 season, all antlerless licenses for the rifle seasons will also be additional.

Damage hunts and distribution management hunts have been used to alleviate elk conflicts. Hunters are restricted to harvesting an antlerless animal during these hunts. Damage seasons were held during the winter of 1989-90. With the formation of the prototype HPP Committee in Middle Park in 1990, distribution management hunts were instituted. These have been

somewhat successful in easing conflicts.

Current Objective

Prior to 1979, DOW's intent was to increase elk in DAU E-8. Following the severe winter of 1978-79 the objective was to stabilize the population. In 1988 the population objective was raised from 2,540 to 3,300 elk, and this was retained for 1989.

The first DAU planning process was completed in 1990, which resulted in the lower objective of 2,700 elk in the post-season population, along with a sex ratio objective of 24 bulls:100 cows. The objective of 2,700 elk was intended to give landowners some relief from game damage problems, as well as to bring about a better balance between elk and their winter range. The plan was to lower the population incrementally over three years until the objective was reached. This reduction was never achieved and our constituent groups have never had the benefit of seeing what this herd level looks like on the ground. The sex ratio objective of 24 bulls:100 cows has been successfully maintained, however.

DAU E-8 MANAGEMENT ISSUES

Current Management Problems/Constraints

Major Problems in DAU E-8 (in no particular order).

1. **Limited Winter Range** - Only a limited amount of habitat is available in Middle Park to support deer, elk and pronghorn antelope during the winter. Habitat continues to be converted to housing and associated development every year, and there may not be enough winter range remaining in the eastern part of the E-8 to sustain present elk numbers during the severest of winters. Wintering herds also have to coexist with an increasing number of recreational users. When recreation occurs on winter range, animals often seek refuge on private lands, aggravating existing conflicts. The larger elk herds of the last two decades have also encroached on winter range needed by deer.
2. **Inadequate Census Information** - As noted in the Disclaimer Section, the size of the elk population in DAU E-8 was significantly underestimated when the existing DAU plan was written. The last DAU planning process was contentious and the various constituencies were likely misled by this inaccurate information. Inadequate census information has made accurate computer modeling much more difficult because there is no benchmark on which to align the model. Underestimates of population size resulted in too few antlerless licenses being issued, allowing the population to grow. When a large cow harvest occurred in 1986 and the model at that time indicated the population objective had been reached, antlerless permits were cut by 42% in 1987.
3. **Problems with the Model** - Because of inadequate census information, models tended to

be conservative. Early models used unrealistic survival rates – no one realized natural mortality of elk was so low and that significant numbers of cow elk were living (and breeding) past 12 years of age. We now know from survival studies that elk herds have the potential to increase 18% annually discounting any hunting, and this was not reflected in models until just recently. There also has been a general reluctance among DOW field personnel to believe higher population estimates from the model, another reason models tend to be conservative. When harvest figures were inputted in these conservative models every March, and modeled sex ratios fell short of sex ratios observed the previous January, the model was adjusted to reflect more animals. Through the latter part of the 1980's this annual adjustment amounted to just 100-200 additional animals, but by 1993 larger adjustments became necessary. This retroactive adjustment left managers one step behind the population increase, and once it became obvious there was a serious problem with the population estimate, the “damage” had already occurred, *i.e.*, DOW has been left with populations that have proven difficult to control.

4. **Inability to Harvest Animals** - Even if DOW could precisely measure the size of elk populations and know exactly how many animals needed to be harvested to stabilize the herd, there could be difficulties in achieving this harvest. A statewide season structure does not always present the ideal situation to facilitate harvest in certain localities. Many factors, such as hunting conditions (*i.e.*, weather), access (particularly to private property), the commitment of hunters to success and their hunting ability are beyond the control of DOW. In 1997, 1,880 regular antlerless elk licenses were issued for this DAU, compared to a total of 1,150 licenses in 1991. Although there were 63% more licenses issued in 1997 than 1991, there was actually 4% less antlerless harvest during the 1997 regular season. Too often, people looking for simplistic solutions believe the overpopulation problem could be solved with more licenses.
5. **Competition with Deer** - While deer numbers were in general decline over the past 15-20 years in Middle Park, elk numbers were building. During this period of increase elk have expanded their historic winter ranges into lower elevations, setting up the possibility of competition with deer. Elk are stronger and more aggressive than deer, and have more diverse food habits. Questions linger as to whether elk displacement of deer on winter feeding grounds may have contributed to the decrease in deer numbers and made them more susceptible to die-offs. Deer may also be impacted at other times of the year on transition ranges.
6. **Refuge Areas and Changes in Land Use** - Many traditional ranches around Granby and Grand Lake are being subdivided. As patchwork ownership develops, it becomes virtually impossible to reach consensus on wildlife management decisions due to the diversity of viewpoints. Safety issues also come into play with regard to hunting with high-powered rifles. In those situations where a family continues to control a large area, owners are tending to become very conservative in the amount of hunting they allow. Some ranches are charging large sums of money for bull hunting and are not interested in letting cow hunters in during the regular season. Hunters sometimes become upset about the lack of animals on public lands and complain that landowners are holding elk on

private lands for their own paying hunters. On the other hand, large numbers of hunters on public land often create a formidable barrier, unwittingly pushing elk back onto private lands as soon as animals try to cross over onto public ground. A sizable elk herd resides in Rocky Mountain National Park and the Park Service has gone out of their way to provide hunter access to adjoining USFS lands; however, their no-hunt policy impacts a large land area (23% of GMU 18).

7. **Game Damage** - High elk numbers in this area over the past 25 years have periodically resulted in damage problems – a major concern of DOW and landowners in the Troublesome Creek DAU. Growing crops (primarily hay meadows), livestock forage and fences have been affected. Damage was especially bad during the severe winters of 1978-79 and 1983-84. DOW has attempted to mitigate these problems by providing temporary and permanent fencing, hazing elk and paying game damage claims. Payments on game damage claims in E-8 have averaged \$15,007 annually over the past five years. Game damage hunts and distribution management hunts designed to selectively harvest animals causing damage on private land have been implemented. HPP becomes involved where there is damage to fence or forage. In situations where elk take spring forage intended for cattle use, HPP can make lease payments for pasture when there is no where else for elk to go until melting snow allows them to move to calving areas. By allowing the animals to remain on these sites, damage to other private lands is averted. This last spring, HPP paid its first claim for loss of spring forage. HPP payments for fence and forage in E-8 have totaled \$5,145 over the last two years. Despite all efforts, game damage seems to be continually taking on new dimensions.
8. **Changes in Recreational Use** - Mountain bikes, all-terrain vehicles, snowmobiles and sport utility vehicles have all come into existence within the last 20-30 years. Recent technological advances have made these more efficient, with increased comfort and reliability. Bikes and ATVs allow humans to visit areas that were once the domain of the dedicated hiker or those on horseback. Extensive road and trail networks have been developed since these inventions came onto the scene. During winter flights conducted by DOW in helicopter and fixed-wing plane in Middle Park, snowmobile tracks are observed throughout most parts of the winter range. Changes in demographics and culture have increased the portion of the city-dwelling population that “heads for the hills” during time off. The population residing in Grand County has also increased, and these newcomers often go biking, driving, hiking or jogging before or after work. Ownership of large dogs has increased over the years and people frequently bring their pets with them to the mountains. All of this adds up to a tremendous increase in the presence of humans and pets in important parts of elk habitat. It would not be surprising if this has caused elk to spend more time on large tracts of privately owned lands, where there is less disturbance. Such displacement could be increasing use on transitional ranges which deer and elk typically occupy during the spring and early winter. These areas are important to animals needing to build fat reserves for the winter, and rebounding from the rigors of winter in preparation for lactation.
9. **Habitat Changes due to Logging** - The ratio of hiding cover to foraging areas on USFS

lands has changed due to harvest of aspen and lodgepole pine over the last several decades. Construction of logging roads coupled with the loss of escape cover may be forcing elk to leave public lands and seek refuge on less accessible private lands. Such movement could be accentuating distribution problems, increasing game damage, as well as lowering hunter success rates.

10. **Elk Ingress from Adjacent Areas** - DAUs are delineated on the assumption that there is very limited interchange with adjoining areas. Elk numbers may be fluctuating in this DAU due to migrations of elk back and forth to adjacent areas such as Gore Pass, North Park and Rocky Mountain National Park. A major influx or departure of animals greatly increases the difficulty of maintaining the elk population at the predetermined number. DOW has considered readjusting boundaries of this particular DAU to include GMU 27 to the west and GMUs 17 & 171 in the southern part of North Park, but making this change would likely create other problems. Further movement studies may be needed to best determine how to realign DAU boundaries. In the meantime, DOW will continue to experiment with computer models that incorporate surrounding GMUs.
11. **Low Hunter Success** - Hunter success has tended to be low in this DAU since the early seventies and it has become increasingly difficult to harvest enough cow elk in recent years. Over the past four years antlerless harvest success has only averaged 18%. There appears to be a diminishing return when increasing the number of cow licenses issued – more hunters result in lower success with no increase, or only slight increases, in harvest. This problem appears to be a result of limited access, both physical and legal, to key elk hunting areas in the DAU, such as the East Fork of Troublesome Creek. It is also related to hunter overcrowding problems and the fact that there is a limited pool of dedicated elk hunters on which to draw.
12. **Herd Vigor and Habitat Concerns** - As herd size increases, particularly where it begins to tax available forage in critical areas, vigor of the herd and ability to grow large bulls diminishes. Age ratios may also decline. Particularly on limited range (*e.g.*, winter range or spring pastures), elk can create localized problems and impact the productivity of such areas for a period of time. Deteriorating range condition impacts other wildlife species and livestock operations dependent on the same resource.
13. **Distribution Problems** - Frequently it is not the total number of elk in a DAU that creates problems, but rather animals congregating in critical areas, such as winter range or security areas, particularly at times when resources are most limited. Elk also create conflicts in agricultural areas. Distribution problems are at times compounded by recreational use on public lands, excessive hunting pressure, and by inappropriate hazing of animals from one piece of deeded land to another. Studies in the White River National Forest suggest that animals are quite attuned to the hunting seasons, and do indeed seek out refuges away from hunting pressure. Often these are the privately owned lands.

Other Problems or Potential Problems in DAU E-8

1. **Extended Hunting Seasons** - Distribution management hunts can begin in mid-August and extend until the end of January (except during the regular hunting season). Game damage hunts can occur as late as February. Applying hunting pressure for up to a half year increases stress on animals. Sometimes the harassment that accompanies late seasons increases energy consumption of the animals, in turn raising forage demands, and further intensifying conflicts with livestock operations.
2. **Leftover Licenses** - Over 1,400 limited antlerless licenses have been offered annually during the period 1992-98. A sizable portion of this license allotment is not claimed during the drawing. Over the last four years an average of 29% of the antlerless allotment has had to be issued as left-overs. Flooding the market with licenses often means the people picking up the remaining licenses are not familiar with the area they will be hunting or are not that serious about harvesting an elk. Consequently, the more licenses left over after the drawing, the harder it becomes to meet harvest objectives.
3. **Hunter Overcrowding** - There are several areas in the DAU where hunters tend to over-concentrate. These tend to be in areas with extensive road networks or backcountry accessible to ATVs. This problem is also affected to some extent by the number of antlerless permits issued. At one point during 3rd Combined Season in 1997, more than 150 vehicles parked along the first four miles of Chimney Rock Road (FSR 103) where it hits the State Land Board lease in GMU 181. When hunters dispersed from their vehicles and campsites they formed a wall that turned back animals trying to move through the area. These situations are counterproductive to achieving harvest goals and heighten chances of an accident occurring. The quality of the hunt is obviously affected, and hunters of better ability typically avoid such areas.

Issues and Concerns of Our Constituents

Three meetings were held in Granby, Kremmling and Silverthorne on different evenings to involve the public in the DAU planning process. Notices for these meetings were placed in local newspapers, and about 450 personal invitations were mailed to potentially affected parties. People attending the meetings received 15-20 minutes of background information on local elk herds, then were given a survey form on which to identify elk issues important to them, and to select a preferred management strategy. Deer and antelope DAUs were also discussed at the same meetings. Thirty issue statements relating to elk were presented at the first public meeting: these were issues and concerns that had surfaced at previous public meetings and/or had been identified through mail surveys in past years, or that DOW felt were important. These issues had been discussed with the Middle Park Habitat Partnership Committee meeting prior to the public meetings, and committee members felt all the main issues were covered. People attending the DAU meetings were invited to contribute additional issues, and as new ones came up they were written on a flip chart at the front of the room. Participants added seven more issues during the three meetings. Twenty-nine of the issues were picked among the top four concerns of the participants, with votes ranging from a high of 17 down to a single vote.

Seventy people attended these meetings and 36 people voted on the issues in DAU E-8. An additional seven surveys were hand-delivered by local District Wildlife Managers to landowners and sportsmen who were not at the DAU meetings. When surveys were analyzed, an attempt was made to place respondents into one of six constituent groups. Landowners and hunters were about equally represented and made up approximately 75% of the respondents. Guides/outfitters, other business persons and non-consumptive users also submitted surveys.

Significant Issues

Those filling out a survey were asked to identify their top four issues for elk. Fifty-two percent of those surveyed are very concerned that refuge areas, where there is little or no hunting, along with changing land use patterns are making it nearly impossible to manage elk. People also had major concerns about various aspects of the hunting seasons. Issues are described below in descending order of importance.

Percentages of respondents selecting the particular issue are listed in parentheses, along with the group(s) most closely identified with the issue. Issues are categorized as Biological (B), Social (S), Economic (E), Recreation (R), or a Combination (C) of several issues, and then ranked in importance within that category.

People are very concerned that . . .

S1 “landowners are quick to complain about too many elk, but are reluctant to grant permission to hunt their property unless you are willing to pay high dollars.” (40%: hunters, guides and outfitters, and merchants)

C1 “subdivision of the land, diversification of uses and conflicting interests are making it nearly impossible to manage elk.” . . . or . . . “land use problems are starting to interfere with our ability to hunt elk.” (29%: all groups)

B1 “large areas are closed to hunting, or have limited access; these areas of protection are making it extremely difficult to reduce the size of the herd.” (26%: mainly hunters)

Other important biological issues included, a concern that . . .

B2 “elk habitat is shrinking due to human activities.” (24%: guides and outfitters, non-consumptive users, merchants, hunters and one landowner)

C2 “elk don’t move to the high country during the summer; they now spend most of the year on private property because there is too much human activity on the national forest” . . . or . . . “summer recreational pressure at higher elevations may keep elk from using traditional habitats on national forest, shifting additional use

onto transitional range.” (21%: landowners, non-consumptive users, hunters, and guides and outfitters)

B3 “large herds could be causing damage to forage resources on public and/or private lands.” (19%: mainly landowners)

B4 “there may be too many elk for optimal herd health, and that high numbers adversely affect other wildlife species such as deer.” (17%: mainly merchants, guides and outfitters)

B5 “not enough cows are killed during the regular season.” (17%: landowners, hunters and merchants)

Important social issues included, *a concern that . . .*

S2 “DOW has failed to reduce the two major elk herds in Middle Park enough to bring them anywhere close to the objective agreed upon in 1990.” (17%: landowners and one merchant)

S3 “private landowners are forced to support a public resource without being given any choice, or compensation.” (17%: landowners)

Secondary Issues

People are also concerned that . . .

B6 “hunting seasons extend over 5 months, which is too long a period to be stressing animals.” (14%: guides and outfitters, non-consumptive users and landowners)

R1 “hunter overcrowding is a serious problem in some areas.” (14%: hunters and one non-consumptive user, landowner, and a guide/outfitter)

R2 “too many landowners are trying to hold elk on their land during hunting seasons for their clients.” (14%: hunters and a landowner and guide/outfitter)

R3 “hunting pressure on public lands pushes animals onto private property during the seasons.” (14%: hunters and merchants)

E1 “elk cause conflicts by using forage that could go to livestock, they damage fences and interfere with winter feeding operations.” (12%: landowners and one hunter)

E2 “elk use seems to get priority over livestock on federal grazing allotments.” (12%:

landowners and hunters)

- R4 “there aren’t enough big bulls in the population.” (10%: landowners)
- R5 “more hunting pressure is needed on private property early in the season, to keep elk from moving off the national forest too soon.” (10%: landowners and a hunter)
- B7 “there aren’t enough serious hunters in the field to achieve an adequate harvest.” (10%: landowner, hunter, guide/outfitter, and a non-consumptive user)
- E3 “landowners who support elk during the winter may not be the ones to benefit from the hunting season.” (7%: landowners and a guide/outfitter)
- E4 “elk should not be wintering in the valley bottoms.” (7%: landowners)
- B8 “census information is inadequate for effective management to take place.” (7%: guides and outfitters)
- R6 “high fees charged for hunting private property keep the average hunter from having access to good elk hunting.” (7%: hunters)

Minor Issues

Respondents apparently are less concerned that . . .

- S4 “hunters, landowners, and other members of the public do not have enough opportunity to affect elk management decisions.” (5%: guide/outfitter and unknown)
- S5 “trophy hunting should be discouraged because it sends the wrong message to hunters and non-hunters alike, and encourages exploitation.” (2%: non-consumptive user)
- S6 “hunters cause damage to public and private lands and do not respect property rights.” (2%: hunter)
- B9 “elk are killing out aspens or damaging them” . . . or . . . “high elk populations may interfere with aspen regeneration.” (2%: non-consumptive user)
- R7 “hunting seasons should be designed to harvest animals causing conflicts.” (2%: landowner)

- R8 “we should have more elk than we have now.” (2%: hunter)
- S7 “wherever livestock overuse occurs on federal grazing allotments, elk move elsewhere.” (2%: outfitter)

The following issues were not among anyone’s top four issues.

“unrealistic management objectives produce undesirable and unexpected effects (e.g., hunter overcrowding, unacceptably low hunter success, and a need for late seasons).”

“National Forests could be better managed for elk.”

“HPP should enhance habitat (fertilize) in more areas on federal lands and then make an effort to move elk to those areas.”

“archers keep getting restricted more and more.”

“there are too many road closures now and these keep hunters from accessing areas.”

“increased pressure to harvest more elk may ultimately result in the elimination of individual sub-herds.”

“too many bulls are accidentally killed during late seasons.”

Issues and Concerns of Land Management Agencies

A summary of the results from public surveys was mailed to Sulphur Ranger District and Parks Ranger District of the USDA Forest Service, and the Kremmling Resource Area of the Bureau of Land Management. Additional input on elk management issues was solicited from these agencies.

Kremmling Resource Area of the BLM echoed concerns expressed by members of the public and the Middle Park HPP Committee regarding the potential conflict between deer and elk, particularly for winter habitat. Expanding elk herds are occupying winter ranges which have historically been important deer winter ranges. They recommended that DOW consider some type of evaluation of this potential problem in Middle Park.

Parks Ranger District commented that problems with fall elk distribution could be related to habituation to the pattern of hunting seasons. They suggested investigating a rotation of hunting methods and seasons both temporally and spatially, as practiced by Arizona, to reduce chances of developing ingrained behavioral responses. They also prefer a population with a higher bull ratio than currently exists. Implementing these practices would likely require all licenses to be

limited, but the positive side of this would be the increased chance of success and improvement in the quality of hunting experiences. The reduction of hunter pressure by itself might also alleviate some of the problems with fall elk distribution. Parks Ranger District also is experimenting with temporary road closures in Jackson County in an attempt to hold elk in areas with better hunting potential.

Issue Resolution

Obviously, no simple solution can possibly address all the concerns of our constituents. Herd management objectives will have no effect on more than half of the twenty-one significant and secondary public issues. Issues such as changing land use patterns and bad hunter behavior are among those beyond the scope of this plan. Of the remaining ten issues that can be impacted, each individual alternative under consideration may have some positive impact on the issue, or it may make matters worse. These impacts are summarized in the following section under each individual option.

ALTERNATIVE DEVELOPMENT

Alternative Management Strategies

DOW presented seven alternatives to the public at DAU meetings held in Grand and Summit Counties. During the DAU meetings, and on the written surveys handed out to those in attendance, people were given the opportunity to suggest other alternatives. People presumably felt comfortable with this range of alternatives, since no other suggestions have been submitted.

Written comments were also solicited from the USFS and BLM regarding these seven alternatives. Land management agencies did not indicate that any of these alternatives were not feasible.

#1 Hold the E-8 elk population at the December 1997 level and sex ratio using the current season structure:

4,300 elk with 24 bulls per 100 cows

Discussion:

Basis for Alternative - This was the situation as it existed in the 1997 posthunt population. This alternative has proven achievable under the current season structure.

Relationship to Public Issues (stronger impacts are designated by underlining) -

This option helps address the following issues: none

This option has no impact on the following issues: S1, B1, C1, C2, B3, B4, B5, S3, B6, R1, E1, R2, R3, E2, R4, R5, E3, B7, E4, B8, R6, S4, S5, S6, B9, R7 and S7

This option exacerbates the following issues: B2, S2, and R8

Advantages of Alternative - Produces the largest total annual harvest of any option and provides the most hunting opportunity. Has a positive economic impact on businesses and license income for DOW.

Disadvantages of Alternative - There may be some habitat impacts associated with this large of an elk population, and the deer population may be negatively affected. This alternative requires the most antlerless permits and carries a risk of the herd getting out of control following several years of poor hunting. Experience has shown that large numbers of leftover antlerless licenses typically occur with the herd at this level.

Public Support - Only 4% of the people submitting surveys supported this alternative.

#2 Hold the E-8 elk population at the December 1997 level, but take the necessary steps to increase the present post-season bull ratio by about 25% from what it was at that time:

4,300 elk with 30 bulls per 100 cows

Discussion:

Basis for Alternative - This was the estimated 1997 posthunt herd size; at times the bull ratio has approached this level. Since sex ratios tend to be high even with unlimited antlered licenses, 30 bulls per 100 cows is not an unrealistic goal with antler point restrictions in all seasons.

Relationship to Public Issues -

Beneficial Impact: R4

No Impact: S1, B1, C1, C2, B3, B4, B5, S3, B6, R1, E1, R2, R3, E2, R5, E3, B7, E4, B8, R6, S4, S5, S6, B9, R7 and S7

Harmful Impact: B2, S2, and R8

Advantages of Alternative - Produces the second largest total annual harvest of any option, along with the largest preseason bull population. Hunters would have the best opportunity of harvesting a mature bull under either this scenario or Option #7.

Disadvantages of Alternative - There may be habitat impacts associated with this high of an elk population, and the deer population may be negatively affected. Under this alternative the herd has a lower growth potential than with Option #1, so it should be easier to keep under control. Large numbers of leftover licenses are also likely under this scenario.

Constraints - Spike bulls would likely need total protection during the hunting season to achieve this higher sex ratio, or else bull licenses would need to be limited by drawing.

Public Support - This alternative was supported by only 6% of the survey respondents.

#3 Reduce the elk population in DAU E-8 by approximately 19% from the December 1997 posthunt size, while maintaining the sex ratio at that time:

3,500 elk with 24 bulls per 100 cows

Discussion:

Basis for Alternative - The population was probably last near this level during the mid-1980's. On average, the bull ratio has been slightly above this level over the past 10 years.

Relationship to Public Issues -

Beneficial Impact: B2, B3, B4, E1 and B9

No Impact: S1, B1, C1, C2, B5, S2, S3, B6, R1, R3, E2, R5, E3, B7, E4, B8, S4, S5, S6, R7 and S7

Harmful Impact: R2, R4, R6, and R8

Advantages of Alternative - This option probably benefits the deer herd more than the current situation, and the potential for habitat damage is less. A reduction in game damage problems could be expected.

Disadvantages of Alternative - There will be some loss of income to local merchants and DOW once the herd is reduced to this level. At this level and sex ratio the herd still has considerable growth potential and several poor hunting seasons could create difficulties.

Constraints - Reducing the herd to this level will likely require the continuation of unlimited either-sex licenses or additional antlerless licenses.

Public Support - Only 2% of those completing surveys at the DAU meetings supported this alternative.

#4 Reduce the elk population in DAU E-8 by approximately 19% from the December 1997 posthunt size and increase the postseason bull ratio by about 25% from what it was at that time:

3,500 elk with 30 bulls per 100 cows

Discussion:

Basis for Alternative - The population was probably last near this level during the mid-1980's. At times the bull ratio has approached this level and it is not an unrealistic goal, with antler point restrictions in all seasons.

Relationship to Public Issues -

Beneficial Impact: B2, B3, B4, E1 and B9

No Impact: S1, B1, C1, C2, B5, S2, S3, B6, R1, R3, E2, R4, R5, B7, E3, E4, B8, S4, S5, S6, R7 and S7

Harmful Impact: R2, R6 and R8

Advantages of Alternative - This alternative is probably better for the habitat and deer herd than the current situation. Fewer game damage problems and other conflicts would be expected. Once the herd has been reduced to this level, it should be easier to maintain due to the smaller female component. Fewer leftover antlerless licenses will likely remain after the initial drawing than with any of the previous three alternatives.

Disadvantages of Alternative - There will be some loss of income to local merchants and DOW once the herd is reduced to this level.

Constraints - Reducing the herd to this level will likely require the continuation of unlimited either-sex licenses or additional antlerless licenses. Spike bulls would likely need total protection during the hunting season to achieve this higher sex ratio, or else bull licenses would need to be limited by drawing.

Public Support - Twenty percent of the people responding to the survey favored this alternative, making it the second most popular alternative.

#5 Current Objective - Reduce the size of the E-8 elk population by approximately 37% from the December 1997 level, while maintaining the sex ratio as it existed then:

2,700 elk with 24 bulls per 100 cows

Discussion:

Basis for Alternative - This alternative calls for no change from the current objective for population size and sex ratio. The population was probably last at this level prior to, and following, the bad winter of 1978-79.

Relationship to Public Issues -

Beneficial Impact: B2, B3, B4, S2, R1, E1, E2 and B9

No Impact: S1, B1, C1, C2, B5, S3, B6, R3, E3, B7, E4, B8, S4, S5, S6, R7 and S7

Harmful Impact: R2, R4, R5, R6, and R8

Advantages of Alternative - This population level would be easier on the habitat and deer herd than the current situation. It should also minimize game damage problems.

Disadvantages of Alternative - To reach this population level, cow harvest on private land would need to increase substantially (improvement in Issues S1, B1, R2, R5 and R6). Once the population has been lowered to this level there could be a negative fiscal impact on the DOW and local merchants, due to reduced annual harvests.

Constraints - It will take at least several years to reach this population level.

Support for the Alternative - Forty-eight percent of people submitting surveys preferred this option, making it by far the most popular; there also seems to be a broad basis of support across all interest groups. Sulphur Ranger District of the USDA Forest Service and the Kremmling Resource Area of the BLM also prefer this option.

#6 Reduce the size of the E-8 elk population by approximately 37% from the December 1997 posthunt level, while raising the sex ratio 25% above what it was at that time:

2,700 elk with 30 bulls per 100 cows

Discussion:

Basis for Alternative - This alternative is the current population objective with a sex ratio objective of 30 bulls:100 cows, rather than 24 bulls:100 cows.

Relationship to Public Issues -

Beneficial Impact: B2, B3, B4, S2, R1, R4, E1, E2, E4 and B9

No Impact: S1, B1, C1, C2, B5, S3, B6, R3, E3, B7, B8, S4, S5, S6, R7 and S7

Harmful Impact: R2, R5, R6 and R8

Advantages of Alternative - This population level would be easier on the habitat and deer herd than any of the first four options. It should also minimize game damage problems. Once the population objective is achieved, the smaller female component

would lessen the potential for growth, making it easier to keep the herd under control.

Disadvantages of Alternative - Once the herd is at objective, there would be a negative fiscal impact on DOW and license agents due to limited licenses and reduced annual harvests. The smaller cow component would produce a slower recovery from a severe winter or over-harvest.

Constraints - To reach this population level, cow harvest on private land would need to increase substantially (improvement in Issues S1, B1, R2, R5 and R6). Spike bulls would likely need total protection during the hunting season to achieve this higher sex ratio, or else bull licenses would need to be limited by drawing. It will take several years, at minimum, to reach this population level.

Public Support - Roughly 12% of the people submitting surveys preferred this option.

#7 Reduce the size of the E-8 elk population by approximately 37% from the December 1997 level, while raising the sex ratio 46% above the level at that time:

2,700 elk with 35 bulls per 100 cows

Discussion:

Basis for Alternative - This alternative is the current population objective with a much higher sex ratio. There hasn't been this many bulls in DAU E-8 since 1973, but the goal should be feasible under the proper season framework.

Relationship to Public Issues -

Beneficial Impact: B2, B3, B4, S2, R1, R4, E1, E2, E4 and B9

No Impact: S1, B1, C1, C2, B5, S3, B6, R3, E3, B7, B8, S4, S5, S6, R7 and S7

Harmful Impact: R2, R5, R6 and R8

Advantages of Alternative - This population level would be easier on the habitat and deer herd than any of the first four options. It also minimizes game damage problems. The small female component would lessen the herd's potential for growth,

making it easier to keep the herd under control, once the population objective is achieved. The smallest percentage of bulls would be harvested under this alternative, and when coupled with gains in habitat condition, affords the best chance of producing quality bulls.

Disadvantages of Alternative - There could be a negative fiscal impact on the DOW and license agents due to reduced annual harvests, once the population has been lowered to this level. With this herd composition, the population would be slow to recover from a severe winter.

Constraints - To reach this population level, cow harvest on private land would need to increase substantially (improvement in Issues S1, B1, R2, R5 and R6). To achieve this objective, licenses for all seasons and both sexes would likely need to be limited. Whenever licenses are totally limited, DOW is required to reserve 15% of the licenses for private landowners. It will also take several years, at minimum, to reach this population level.

Public Support - Roughly 8% of the people submitting surveys preferred this option. This option is preferred by the Parks Ranger District.

Alternative Selection

Option #5, with 2,700 elk and 24 bulls per 100 cows, is the recommended alternative. This option has support from local hunters (over 44% of survey respondents), landowners (more than 50% of survey respondents), guides and outfitters (over 75% of survey respondents), BLM and Sulphur Ranger District, Middle Park HPP Committee and the local DOW. However, this reduction of approximately 37% in herd size must occur fairly uniformly across the DAU. If herds on public land incur most of the thinning, the broad base of support for this alternative will likely evaporate. Animals that are inaccessible for harvest are already a major problem (Issues S1, B1, R2, R5, and R6)

This option addresses habitat concerns (Issues B2, B3 and B4) and should give landowners with damage problems some relief. If DOW can achieve this reduction, it should help their credibility (Issue S2). Reducing the herd to 2,700 animals in the posthunt population should take some of the pressure off the winter range and transition range – improving habitat condition and herd vigor. The deer population will also probably benefit from a reduction in the elk population.

However, this is not a population objective that will be achieved in one or two years; rather, it is likely to take three to five years to achieve this reduction. If significant winter mortality occurs in the next several years, this will shorten the time table. If poor hunting conditions occur one or more years, it could take longer to reach objective.

Implementation

This population goal has proven elusive over the past eight years. Additional tools, such as antlerless licenses that are additional and the experimental unlimited either-sex licenses, are now available to enhance harvest. However, for this alternative to be successful antlerless harvest on private land will need to increase substantially, or else elk in refuge areas will need to be pressured to move onto public land when hunting seasons are underway. Preferably, this additional harvest needs to come at some point during the regular season. Hunters and the non-hunting public are unlikely to support a major herd reduction during January and February, and conditions conducive to achieving a good harvest in late November and December are too undependable.

Possibilities for improving harvest on private land include:

1. **Hunter Referral System or Hunter Registry** - Landowners willing to accept cow hunters on their land, and hunters looking for a place to hunt could be brought into contact with each other under this system. Some screening would be necessary to insure hunters were responsible. Hunters receiving any type of complaint could be permanently dropped from the system. A nominal trespass fee could be incorporated into the system.
2. **Hunt Coordinators** - These persons would be employed by the Middle Park HPP Committee and supervised by the local District Wildlife Manager to oversee public hunting on participating ranches. Coordinators schedule hunts and act as intermediaries between landowners and hunters, directing people to specific hunting areas and advising them of ranch boundaries and rules. This relieves the landowner of the day-to-day chore of dealing with hunters. Landowners' friends and relatives who hunt can still receive priority; however, in order for the hunt coordinator program to be workable, these people need to plan ahead and give the hunt coordinator ample notice of their intentions, to prevent breakdowns in scheduling.
3. **Early Private Land Only Seasons** - Landowners who do not sell hunting rights may be willing to allow cow hunters on their property between primitive weapons season and 1st Combined Season. Hunting pressure applied at this time of year may succeed in pushing animals onto public lands, making them available to the general public.
4. **Landowner Incentives** - Landowners selling bull hunts may need encouragement to allow cow harvest to take place toward the end of the regular season. There are several possibilities that can be considered here, most of which would require legislation or the approval by the Wildlife Commission. These could be considered under the new 5-year season structure for 2000-05.
5. **Private Land Either-Sex Licenses** - These are being used in other parts of the state to encourage cow harvest on private land. It would be easy to implement these in Middle

Park at such time as the unlimited either-sex license experiment is ended. These would create additional incentive to hunt private property.

6. **Late Hunts, Damage Hunts and Distribution Hunts** - These special hunts make it possible to thin down groups of elk that otherwise may be unavailable for harvest, or that may be causing perennial problems. However, they should not be viewed as the answer to major herd reduction. Distribution hunts are widely viewed as “the rancher season,” allowing landowners’ friends and relatives to get an elk; the general public perceives this as special treatment and feels excluded. Attempts to expand this program could result in loss of this tool altogether. On the other hand, damage hunts require hunter selection by lottery, so participating landowners have no say over who hunts their property. Late hunts run the risk of developing into situations that appear as wholesale slaughter to many. They can also increase the energy requirements of animals by shuttling elk between neighboring ranches.

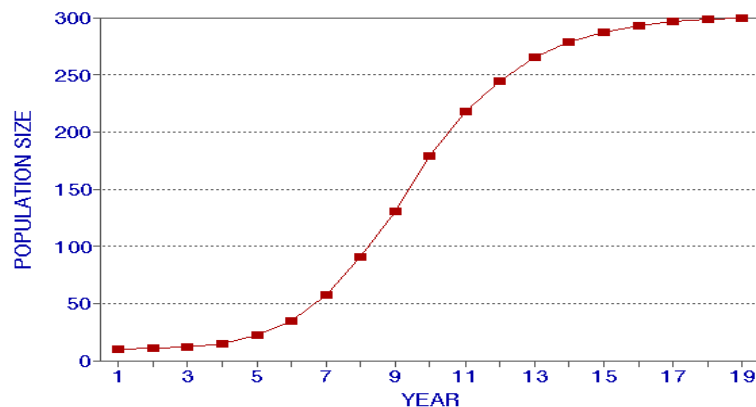
APPENDIX A
E-8 Population Model

APPENDIX B Population Dynamics

The sigmoid curve can be used to describe various phenomena in nature, including the typical growth pattern for animal populations. Three phases of this population growth curve are readily apparent:

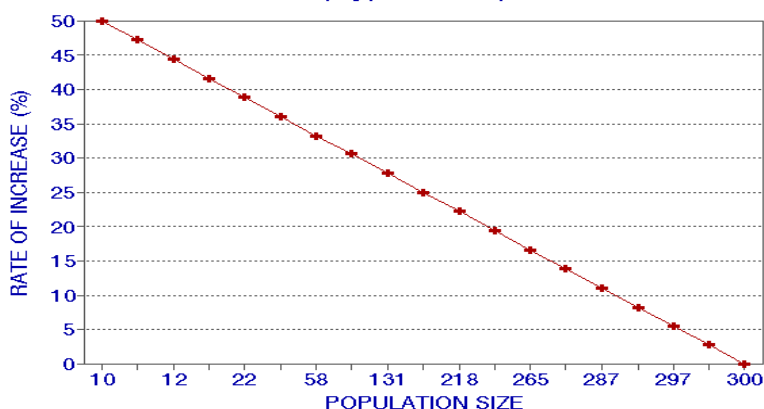
Establishment phase (years 1-5 on the graph): here the population is gaining a foothold; numbers are low, and the population will be significantly affected by mortality and recruitment (recruitment being animals added to the breeding component of the population). In this situation the rate of increase may be high, but due to the small core population, the increase in actual numbers is small (*e.g.*, a 50% increase in ten animals is only five individuals).

SIGMOID GROWTH CURVE
(Hypothetical)



Prosperity Phase (years 6-15 on the graph): food, cover, water and living space are still abundant. Survival rates are at their highest. Although the rate of increase is declining, the population begins to build "momentum" because of the increasing size of the core population; this results in larger increases in actual numbers (*e.g.*, a 30% increase in a population of 100 animals results in 30 additional animals). Since the population is experiencing its greatest recruitment in this range, the largest surplus would be available for hunting (see the concept of MSY on the following page). The situation at this point tends to be ideal from several management aspects – range condition and trend are optimal, economic return to state wildlife agencies is the greatest, while game damage problems are still minimal. These circumstances represent a win-win situation for both sportsmen and landowners.

CARRYING CAPACITY (K)
(Hypothetical)



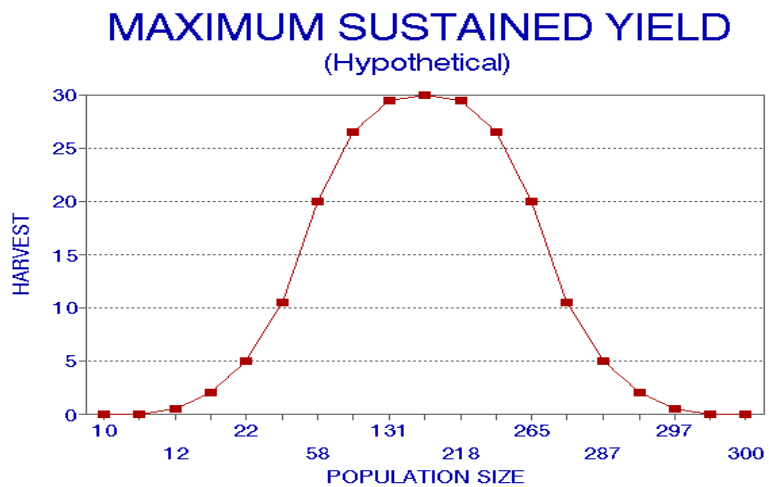
continues to grow until it reaches animals become crowded into each other. Environmental game damage problems tend to be the prosperity phase begins to decline of animals declines and so. Only the fittest animals breed

successfully. Animals recruited into the population will equal those dying. If condition of the habitat deteriorates further, then deaths begin to exceed recruitment.

The straight-line regression graph shown above illustrates how growth rates vary at different population levels.

Maximum sustained yield (MSY) theoretically occurs at half the population that would be present at maximum carrying capacity. At this point, the greatest harvest of animals can be sustained over the long term, providing animals are removed randomly (without regard to age or sex). Hunting doesn't normally occur in this manner; however, the concept can still be viewed as a general guideline for purposes of discussion. In the MSY curve

shown at the right, it is noteworthy that at points equidistant above and below MSY the same surplus of animals will likely be available in any given population. Maintaining a population at a point to the left of MSY is an exacting business, however. Population size must be accurately measured, along with recruitment and mortality. Any over-harvest or under-harvest will require dramatic adjustments in future harvests, creating a boom-or-bust management scenario. On the other hand, managing at a point to the right of MSY tends to be very forgiving, since population dynamics naturally compensate for any management "mistakes."



APPENDIX C
Management Options for the Troublesome Elk Herd (E-8)

APPENDIX D

Written Comments Regarding Management of the Troublesome Elk Herd (E-8)

Comments received from the Middle Park HPP Committee, Kremmling Resource Area of the BLM, Sulphur Ranger District and Parks Ranger District follow on the next nine pages.