FINAL

A - 37 (Middle Park Antelope)
DATA ANALYSIS UNIT PLAN

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Contents

DAU PLAN SUMMARY
Middle Park Pronghorn Antelope

GMUs: 18, 181, 27, 28 and 37 (N ½)

Current Population Estimate: 610 (January 1999)

Proposed New Population Objective: 630

No significant change from current estimate is anticipated.

Current Sex Ratio Objective: Allow the population to reach a "natural ratio" (*i.e.*, not affected by hunting)

Proposed Sex Ratio Objective: 40 bucks:100 does

No change from the 1997 posthunt situation is recommended.

Changes from current objective/management:

This relatively new population has been managed under the research alternative formally adopted in 1990. Under this objective a limited number of hunting licenses were issued, and the population was allowed to expand with little human intervention. The purpose behind this strategy was to take advantage of a unique research opportunity to study how a pioneering pronghorn population reoccupies its former range and examine the dynamics of the population increase. If the new recommended alternative is approved, the population will be stabilized at its December 1997 level, while maintaining the current sex ratio, by increasing the number of licenses issued for both bucks and does.

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

This pronghorn herd is confined mostly to privately owned land and land administered by the Bureau of Land Management, north of the Colorado River. Sixty-two opinion surveys were returned by members of the public (25 landowner respondents). Pronghorn distribution was one of the biggest concerns among people other than landowners attending public meetings. Thirty-six percent of those voting on issues are concerned that during the hunting season a significant portion of the herd is on private property, where access is restricted; 29% also feel habitat is available in the southern portion of the DAU to support a larger herd.

Among other issues relating to private land, "Colorado should reimburse landowners for allowing hunting on their property, like other states do," was an issue statement picked by 20% of the

respondents. The same percentage picked the statement, "Antelope seem to have an undeserved bad reputation in the agricultural community." Landowners on the other hand, have concerns about being forced to support a public resource without any choice or compensation; 18% of all respondents indicated this was an important issue.

Several issues involve the credibility of the Colorado Division of Wildlife (DOW). People have been wondering when we are going to stop studying the herd and start managing it for the public's benefit. There is also a fear held by 18% of the respondents that pronghorn will follow the same pattern of increase seen with elk over the past several decades, and that we won't be able to bring their growth under control.

Overall, a significant portion of respondents (30%) felt an adequate number of pronghorn should be maintained because hunters and wildlife viewers help local business. The two most favored population options did not involve any reduction in pronghorn numbers. Twenty-eight percent of our constituents preferred staying with the population as it existed in December 1997. Thirty percent favored allowing the population to increase another 16% to 750 animals, while retaining the current sex ratio. However, few landowners supported this latter option. Federal land management agencies feel either of these population goals are compatible with their management objectives. The Middle Park Habitat Partnership (HPP) Committee feels 750 animals may be too many, but supports keeping the population at its December 1997 level.

Maintaining the population at its current level will provide ample viewing opportunities for non-consumptive users and also allow between 50 and 80 hunting licenses annually. Hunters are requesting that archery and muzzle-loading seasons be opened in Middle Park, and this can be done on a limited basis. The downside of this alternative is that managing for a posthunt population of 630 animals will not likely address distribution concerns, and it may not provide an answer to the question of whether habitat south of the Colorado River will support more animals. Also, issuing more hunting licenses may ultimately result in a higher portion of the population using private land, and this may require special late seasons and make it necessary for DOW and HPP to gain cooperation for access among those landowners with pronghorn hunting opportunities. A mitigating factor exists, however, in that whenever licenses are totally limited, 15% of the licenses are reserved for landowners prior to the public drawing for licenses; thus, landowners who support pronghorn for at least part of the year have the opportunity to hunt themselves, or consign or sell this license preference on the open market.

Maintaining a posthunt population of 630 animals has a broader base of support among our constituents than permitting the population to grow larger. DOW can gain credibility by managing this herd effectively, and it may be wise to get some experience in managing the herd for a specific level before going to a higher level. People's fears of a runaway population should disappear under management for specific population goals. As people in the agricultural community become better acquainted with pronghorn, their apprehension regarding game damage and competition with livestock may fade.

INTRODUCTION AND PURPOSE

DOW's Management by Objective Process

Historically, big game seasons have been 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 Bureau of Land Management, agricultural producers, guides and outfitters, and other business people all share a stake in the management of Colorado's big game herds. By statute, the Colorado Division of Wildlife (DOW) is accountable to manage all species of wildlife for the benefit of **all** Colorado residents and visitors to the State. To ensure that public needs are met, it is imperative that DOW maintain big game herds at population levels agreed upon in a public review process and approved by the Wildlife Commission.

For convenience, populations of big game ungulates are typically described on the basis of a herd unit occupying a specific geographic area. DOW refers to such an area as a Data Analysis Unit (DAU). Normally each DAU is composed of several game management units (GMUs) that divide the DAU into subunits designed to manage hunter distribution. The boundaries of a given DAU should encompass the area where most of the herd carries out breeding activities, spends the winter, gives birth and raises their young, with minimal ingress of animals from surrounding GMUs, or egress of resident animals.

In recent years, DOW has adopted an objective setting process based on the preparation of a DAU Plan. The DAU plan deals with the primary question of how many animals to maintain in the DAU, and secondarily, the desired sex ratio (number of males per 100 females). These numbers are referred to respectively as the DAU population and composition objectives – typically set for a five year period. Public involvement in determining population goals comes through community meetings sponsored by DOW, along with the opportunity to submit comments directly to the Colorado Wildlife Commission. DOW consults federal land management agencies to help determine the amount of habitat suitable for supporting the big game species covered by the plan and to identify problem areas within the habitat. Local committees of the Habitat Partnership Program (HPP) also play a significant role in the DAU Planning process. This program brings together representatives from the Bureau of Land Management, the USDA Forest Service, DOW, stock growers and hunting interests into working groups. HPP 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, then determine an appropriate balance.

The DAU plan compiles and organizes the most important management data for a particular 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 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 that culminates each year in a hunting season (see diagram below). It is the population objective that 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, the number of licenses will need to be liberalized. The cyclic objective setting approach focuses on the collection and analysis of information, and serves to keep 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 management over a broad area, the DMP focuses on management actions that may reach down to the level of individual ranches. In other words, the DAU plan lays out the overall framework, while the DMP functions as a tactical plan. 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 ensure that big game species are managed properly.

Description of The Data Analysis Unit

Location

The Middle Park Pronghorn DAU (A-37) is located in north-central Colorado and consists of portions of GMUs 18, 181, 27, 28 and 37. It is bounded on the north and east by the Continental Divide, on the south by Interstate 70 east of Silverthorne to the Blue River and Cataract Creek, and on the west by the Gore Range and Eagles Nest Wilderness Divide. (See Figure 2 for details).

Portions of Summit and Grand Counties fall within the DAU. Major towns include Hot Sulphur Springs, Granby, Kremmling and Fraser. U.S. Highway 40 from Berthoud Pass to Rabbit Ears Pass bisects the DAU. The DAU is drained by the upper Colorado River, the Fraser River, the Williams Fork, Troublesome Creek, Muddy Creek, and the Blue River.

DAU Map

Fig. 2. Data Analysis Unit A37

Physiography & Climate

Topography - Middle Park is a large basin surrounded on all sides by high mountain ranges. The Gore Range and Continental Divide both have peaks exceeding 13,000 feet in elevation. Middle Park is unique as an inter-mountain park 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. All the natural surface drainage for this area funnels through Gore Canyon, downstream from Kremmling.

The valley floor at Kremmling is 7,300 feet in elevation. Once snow accumulation forces big game animals down to the valley floor in the winter, they become trapped by Gore Canyon and are unable to migrate out of the valley.

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. When there is no wind during the winter, cold air becomes trapped by the surrounding mountains, causing extreme temperature inversions. During the middle of winter, nighttime low temperatures in the -20º F. range are to be expected, and can drop much further. Kremmling has recorded temperatures down to -64º F.

The 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 90º F. range; however, valleys become significantly cooler than uplands during the night as colder air settles. Fraser has an annual average of only six frost-free days.

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 and Fraser, where prevailing winds push clouds up against the Continental Divide, average precipitation is approximately 20 inches. Areas along the Continental Divide may experience thunderstorms almost daily during the summer.

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. At high elevations, upwards of 20 feet of snow can fall over the course of winter. Big game animals move to lower elevations as snow accumulates, seeking out south facing or wind-blown slopes. In the valleys, sunny winter days and/or windy conditions cause 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. Pronghorn do not generally make use of forest land, wetland/riparian areas or the alpine. They prefer the more open habitats of rangelands and occasionally use croplands. It is in these areas that they can make best use of their keen eyesight and tremendous bursts of speed to avoid danger.

Rangelands consist of Sagebrush Steppe, Mountain Shrub and grassland communities.

These plant communities occur at lower elevations and have been extensively modified by agriculture or are increasingly being disturbed by intensive human use associated with recreational development. The sagebrush type 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 livestock grazing. Bluebunch wheatgrass is prominent in these vegetative types under good range conditions. Native grasslands are found in two different settings. 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 that cannot support sagebrush.

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

Land Status

The total area of the DAU covers roughly 2,000 square miles. However, pronghorn inhabit only about 14% of this area. About 105 square miles of pronghorn habitat is administered by the Bureau of Land Management (BLM) and about 132 square miles is in private ownership. Portions of the Junction Butte and Kemp-Breeze State Wildlife Areas, along with various state school lands, provide about 36 square miles of habitat for pronghorn. Pronghorn only use a tiny portion of USFS lands – 2 square miles. Overall land ownership is categorized in Table 1.

TABLE 1

Land ownership in DAU A-37 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
27	76.3	14.3	66.7	0.0	39.3	0.1	196.7
28	214.4	44.3	392.0	0.0	8.5	1.4	660.6

37	162.0	26.1	333.1	0.0	2.3	2.6	526.1
TOTAL	599.9	216.4	1164.6	151.3	76.1	4.6	2212.9
PERCENT	27.1%	9.8%	52.6%	6.8%	3.4%	0.2%	100.0%

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

Pronghorn have very specific habitat requirements which restrict their overall range mainly to the large, open, rolling hills of sagebrush and native rangelands. Pronghorn in the Middle Park DAU winter in the extreme south end of GMU 181 on BLM land and private lands. During spring and summer animals range widely, moving into GMUs 18, 27 and to some extent 28. GMU 37 remains virtually unused at this time. Some animals are moving as far as Fraser and North Park to spend the summer. Even though they have recently been expanding their range each year, it is unlikely that pronghorn will ever move much south of Green Mountain Reservoir.

Insert Land_A-37 Bitmap 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. Highly developed mountain communities occur in the areas surrounding Winter Park, Granby, and Dillon/Silverthorne. The Kremmling Resource Area of the BLM administers most of the federal lands inhabited by pronghorn within the DAU. Recreation, livestock grazing and wildlife production are the predominant uses of BLM lands, with timber harvest occurring in areas where there are suitable forest products. BLM is also responsible for other activities such as right-of-way administration, mineral production, watershed protection and cultural resource protection.

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. Rafting companies offer trips down the Colorado River, and local rivers also provide opportunities for kayaking. Cross-country skiing and snowmobiling are both popular winitertime activities.

Hunters can take deer, elk, bear, pronghorn, bighorn sheep, mountain goat, mountain lion, blue grouse and sage grouse in Middle Park. Good fishing is provided in several Gold Medal streams, six 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 would have been over $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.

Habitat Condition and Capability

Public Lands

The Bureau of Land Management has 83 allotments in the DAU. These allotments provide 14,800 AUMs of forage for livestock, with use occurring primarily in the spring and fall, although some use occurs in summer and winter. The class of livestock using these allotments is almost exclusively cattle and horses.

Pronghorn seldom use grazing allotments on national forest lands, so these are not included in the analysis.

Wildlife/livestock Conflict Areas - Public Lands

Land use agencies were asked for input on areas where there may be conflicts between livestock and big game. Situations 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 would be examples of conflicts.

Sulphur Ranger District, Parks Ranger District and the Kremmling Resource Area of the BLM have not identified any allotments where pronghorn are causing conflicts with livestock.

Wildlife/livestock Conflict Areas - Private Lands

Current pronghorn conflicts are limited to private lands. One problem arose in the 1980's when pronghorn began congregating on an irrigated alfalfa field where they consumed forage and caused problems during harvest, resulting in liability to DOW under the game damage statute. Damage payments totaled $4,875 in the four years prior to 1998 on this field. Given the potential for these payments to escalate even further with the establishment of an additional field, the decision was made to fence the area with DOW funds to alleviate conflicts and avoid further game damage payments. Complaints about pronghorn use of native hay meadows, clover patches in particular, are also being received by DOW but no damage claims have been submitted. The Middle Park HPP Committee has been involved in helping to solve the one major problem and will likely become involved in the resolution of other significant conflicts if and when they occur.

Pronghorn antelope utilizing forage that could be used by livestock on private rangelands is a concern voiced by some landowners in the DAU. Considering the fact that pronghorn co-evolved with bison on the plains of North America, and bison food habitats are almost identical to cattle, it is unlikely that cattle and pronghorn would be serious competitors for forage. Therefore, DOW views this more as a perceived problem and will continue education efforts in this regard.

Herd Management History

Pronghorn disappeared from Middle Park earlier in this century but have made a reappearance in recent decades. In the late 1800's pronghorn were quite plentiful in the area. Frank B. Mayer, the last of the market hunters, made a successful living supplying meat to the miners in Leadville and Summit County. Mayer's diary reports sightings of 100-200 pronghorn as late as 1880 when pronghorn comprised a moderate portion of his harvest. Pronghorn were still known in Middle Park during in the early part of this century; the town of Kremmling held a barbeque in 1906 to celebrate the arrival of the railroad, and antelope meat was served. By the 1920's pronghorn had been extirpated from Middle Park, and remained totally absent from the area for more than 50 years. By the 1970's pronghorn had started to reappear in the area and were living in the area year-round by the winter of 1983-84. This "pioneering" population probably originated from North Park via the Muddy Pass Divide.

Posthunt Population Size

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Managers in Middle Park are fortunate to have some of the best inventory data on pronghorn in DAU A-37 of any wild ungulate herd in Colorado. DOW initiated a research study on the Middle Park herd in December 1986 that involved ear-tagging and neck-banding animals for identification, along with the installation of nine radio-transmitters to facilitate tracking. New radio transmitters were installed in subsequent years and these, coupled with bi-weekly tracking, have allowed researchers to keep close tabs on animal movements for over ten years. During the winter, when virtually all of the herd forms into large groups within a 25-30 square mile area near Kremmling, radio-collars have helped pinpoint distribution of subherds for managers and allowed teams of observers to go out and conduct a near total count of animals in the open habitat. At times, more than 10% of the population has been "radioed," which has minimized chances of groups escaping detection. These ground counts have then been compared to projected winter population sizes computed from life tables incorporating observed natural mortality rates, recruitment rates and harvest mortality, or to spreadsheet models constructed on personal computers. Figure 4 and Table 1 summarize the results of winter counts with the fall harvest added back into the total.

The Middle Park HPP Committee paid to have 20 solar-powered ear transmitters installed on pronghorn by a helicopter net capture crew in December 1998. These will enable managers to continue mid-winter counts with a high degree of accuracy. However, once transmitters are lost due to mortalities, expired batteries, or for other reasons, it will become much more difficult to conduct accurate counts. More personnel will be needed and "spotter" aircraft may be required. Other census techniques may ultimately prove more useful. Fortunately, some good data on survival rates has been collected on the Middle Park herd which will improve the accuracy of computer models.

The Concept of Carrying Capacity

Decision makers 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 rate and reproductive rate decline as the population approaches carrying capacity, until no further population growth is possible (See Appendix B for more discussion). This occurs because the demands of increased numbers of animals make fewer resources available to individuals in the population.

One of the main objectives of the pronghorn research project in Middle Park was to arrive at an estimate of carrying capacity of the range. By monitoring the declining rate of annual increase of the Middle Park pronghorn herd as the herd increased in size, researcher Tom Pojar has estimated the "K-value," or maximum herd size that the habitat can support (See Figure 5). Since pronghorn evolved on the North American Continent, their ability to remain in balance with the available habitat has likely become "fine-tuned" over millions of years. As this population has grown in size, there has been a dramatic drop in the annual rate of increase. In the late 1980's, the population averaged over 41% annual growth. Since 1993 the growth rate has declined every year, and was below 10% in 1997. With each additional year of data, the estimate of "K-value" has crept upward and it now appears that the herd would level off on its own, without any hunting, somewhere around 800 animals. However, this figure would be for the currently occupied range; if the herd expands its range south of the Colorado River, it is likely this additional habitat would support several hundred more animals.

Comparing population densities between pronghorn in Middle Park and animals in North Park (Jackson County), where pronghorn have done well through the years, also provides insight into the carrying capacity of DAU A-37. Vegetation and climate are very similar between the two areas. Approximately 800 square miles of habitat is available for pronghorn in North Park. Line transect and quadrat estimates indicate the pronghorn population there consists of about 1,900 animals. In Middle Park, there is some 300 square miles of sagebrush habitat north of the Colorado River (GMUs 18, 27 & 181). If we apply the pronghorn density in North Park, which is 2.4 animals per square mile, to Middle Park, we arrive at an estimated 720 animals for a population that would provide good hunting opportunity (*i.e.*, well within carrying capacity). Again, it should be noted that this calculation does not include potential pronghorn habitat south of the Colorado River which is approximately 220 square miles.

A concern raised regarding pronghorn in Middle Park is the effect they may be having on deer populations, due to overlapping ranges during spring, winter and fall. During the winter of 1983-84 deer were artificially fed beginning in January, and they still suffered high mortality. Pronghorn, on the other hand, suffered few, if any, losses during the same period. Obviously, pronghorn have some specialized adaptations allowing them to survive such severe winter

conditions, since it is highly unlikely that a smaller animal is out-competing deer for the same food resource. Even if they were displacing deer, or using up resources that deer could utilize, impacts from the present pronghorn herd of 600-700 pronghorn would be insignificant compared to the problems that elk could be causing for deer during the winter. Elk are larger and more aggressive, and there are many more elk on deer winter range than pronghorn. Consequently, reducing the number of elk on deer winter range is more likely to benefit deer than any reduction in pronghorn numbers. If competition is occurring between pronghorn and deer, it most likely is taking place during a few weeks in spring when green forage is first emerging and animal dispersal has not yet begun.

Hunting Seasons and Harvest

Prior to 1990 there was no hunting of pronghorn in Middle Park. As of the 1998 season, DAU A-37 remained closed to archery and muzzle-loading hunting but there has been a rifle season since 1990. Ten buck permits and five doe permits have been issued annually during this decade. Hunting licenses have been extremely limited under the current management strategy to allow the herd to increase at near maximum rates for research purposes. Licenses for the 1998 season were increased to 20 buck and 40 doe licenses for the First Regular Rifle Season to gain experience in managing hunters and in anticipation of establishing a distinct population objective.

Demand for hunting in Middle Park has been high. Five preference points have typically been needed to draw one of the limited buck licenses.

Prehunt Herd Composition

Age and sex ratio classification surveys have been conducted during the late summer in conjunction with the research project and are summarized in Table 2 and in Figure 6 below. Sample sizes have ranged from 48% to 82% of the estimated population.

Insert graph of A-37 Herd Structure here

Figure 6

TABLE 2

Prehunt Herd Structure of the Middle Park Pronghorn Herd (A-37)

YEAR	POPULATION	BUCKS:100 DOES	FAWNS:100 DOES
1986	80	36	77
1987	122	54	77
1988	160	40	32
1989	223	56	50
1990	261	22	47
1991	308	23	65
1992	347	26	48
1993	425	10	66
1994	466	29	46
1995	535	32	42
1996	594	37	42
1997	637	42	39
1998	657	31	28

Observed sex ratios of the Middle Park pronghorn herd have been extremely variable. This is largely due to sampling error during classification counts in the late summer. Bucks are more widely dispersed at this time of year and harder to observe. During years when few bucks had radio-collars, observed sex ratios tended to be low; during years when more bucks had radio-collars, observed sex ratios were higher.

Age ratios have dropped as the population has come closer to carrying capacity of the habitat. Over the last four years age ratios have averaged 38 fawns:100 does. In the early stages of population expansion, ratios in the 70s were observed.

Current Objective

Until this point DAU A-37 has been managed under the Research Alternative. DOW has never set a definite population or composition goal for this herd. The current objective was formally adopted in 1990 to take advantage of a unique opportunity to study how a pioneering pronghorn herd would reoccupy former range and to determine the capacity of the habitat to support pronghorn. A small number of hunting permits were issued beginning in 1990 to provide some recreational opportunity during the course of the study. A public meeting was held in Hot Sulphur Springs in 1992 to gain consensus from local landowners and hunters to extend the length of the study beyond its initial two years. Another public meeting was held in 1995 to discuss continuation of the project. Valuable data has come out of this research project which will assist in the long-term management of this herd; but the fact that it has been extended so long has left some local people feeling that DOW has taken advantage of the situation to establish a large pronghorn population in Middle Park. Some are of the opinion that the pronghorn population has grown so large that it will be difficult to bring under control. Since most of the research goals have been achieved, the time has come to select a management strategy for this population, or risk hurting DOW credibility even further.

DAU A-37 MANAGEMENT ISSUES

Current Management Problems/Constraints

Problems in DAU A-37 (in no particular order).

1. **Limited Winter Range** - The topography of a closed valley forces both deer and pronghorn onto very restricted and limited winter range. Pronghorn have thus far survived several severe winters, including 1983-84, without significant mortality. (During the winter of 1995-96 the BLM used a snowcat to break trails to help pronghorn that had become trapped by deep snow). Except for the winter of 1985-86, when animals may have been pushed south across the Colorado River by snowmobilers, the entire herd has demonstrated a very strong fidelity to a small area of winter range northeast of Kremmling. During severe winter weather animals are concentrated on only about six square miles. There they appear to be using an "unoccupied niche" in the winter range without serious competition and overlap with deer or elk. Two subdivisions have been platted within the key wintering area for pronghorn; these involve 35-40 acre tracts. Depending on what fencing and habitat alterations are associated with these developments, there could be a significant impact on pronghorn and a shift in winter distribution.

2. **Distribution** - More than half of the pronghorn antelope in Middle Park are found on

private land during the hunting season. This will complicate DOW's ability to properly manage the herd at a desired population level. Landowners generally feel a need to benefit in some fashion from allowing hunting on their property. In some cases, non-resident owners of large tracts of land would rather not be bothered with public hunters. Shifting hunting seasons later in the year, when there are more animals on public land, may help reach desired harvest levels.

3. **Game Damage** - In past years, a segment of the A-37 herd spent a significant portion of late summer and early fall on one of the few irrigated alfalfa fields in the lower Troublesome Creek area. As the herd increased, the number of pronghorn visiting this field also grew. In 1998 this field and another new one were fenced to prevent further damage. To date this problem hasn't shifted to other alfalfa, but the potential for this to occur does exist.

4. **Unoccupied Habitat** - Pronghorn have probably not yet fully recolonized their former range in Middle Park. Habitat south of the Colorado River currently supports less than 5% of the population and animals have only wintered there on one occasion (east of Green Mountain Reservoir). It is unknown whether the southern portion of the habitat is of lower quality, or if animals do not feel as comfortable there. There could be an adaptive advantage for pronghorn to winter in large groups, causing them to remain together. Higher population levels may be needed to trigger a shift of animals to this portion of the range. If range expansion does take place, carrying capacity will increase, which may have a bearing on future management objectives.

5. **Competition Among Pronghorn, Deer and Elk** - It is highly unlikely that elk and antelope are interacting in any way, other than competing spatially. It is unknown whether the pioneering pronghorn herd has had any impact on deer, however. This possibility was discussed under the section dealing with carrying capacity, and under item #1 above.

<u>Potential Problems in DAU A-37</u>

1. **Changes in Animal Behavior** - Increased hunting pressure may lead to behavioral changes in pronghorn in A-37. With more hunting permits and longer seasons, animals will likely become more wary. Animals harassed by vehicles may damage fences as they pass through, especially when displaced into unfamiliar territory. Pronghorn distribution may shift more to private ranches where little or no hunting occurs. If there is a significant differential between private land harvest and public land harvest, the distribution problem described in previous sections could worsen.

Issues and Concerns of Our Constituents

Three meetings were held in Granby, Kremmling and Silverthorne on different evenings to facilitate public involvement 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 the Middle Park pronghorn herd, then were given a survey form on which to identify issues important to them and to select a preferred management strategy. Deer and elk DAUs were also discussed at the same meetings. Fifteen issue statements relating to pronghorn 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 were considered important by DOW. These issues had been discussed with the Middle Park HPP Committee prior to the public meetings, and committee members felt comfortable with what was being presented. People attending the DAU meetings were invited to contribute additional issues, and as new ones arose they were written on a flip chart at the front of the room. Participants added eight more issues during the three meetings. Twenty-two of the issues were picked among the top three concerns of participants, with number of votes ranging from a high of 20 down to a single vote.

Seventy people attended these meetings and forty-nine people voted on the issues. Eight more issue surveys were submitted by landowners and hunters who were later contacted individually by District Wildlife Managers. During the analysis of surveys, an attempt was made to place respondents into one of six constituent groups. Landowners and hunters were about equally represented, making up approximately 84% of the respondents. Guides/outfitters, other business persons and non-consumptive users also attended.

Significant Issues

Those filling out a survey were asked to identify their top three issues for pronghorn. Concerns of the public are extremely varied, but appear to center on the following: animal distribution, private land issues, pronghorn values, hunting opportunity, and DOW credibility. Issues are described below in descending order of importance.

Percentages of respondents picking 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), Recreational (R) or Economic (E), and then ranked in importance within that category.

People are very concerned that . . .

S1 "during the hunting season, a large portion of the herd is on private property and access is restricted." (36%: mainly hunters, guides and outfitters, a merchant and

a few landowners)

E1 "the antelope herd should be maintained at some reasonable level because hunters and wildlife viewers help local business." (30%: all groups)

B1 "habitat south of the Colorado River is lightly used and could likely support more animals." (29%: hunters, guides and outfitters, a few non-consumptive users, and landowners)

Other important social issues included, *a concern that . . .*

S2 "Colorado should reimburse landowners for allowing hunting on their property, like other states do." (20%: hunters, landowners and a guide/outfitter)

S3 "antelope seem to have an undeserved bad reputation in the agricultural community." (20%: hunters, non-consumptive users, and guides and outfitters)

Another top issue included, *a concern that . . .*

R1 "there should be an archery season on antelope." or, "there should be a muzzle-loading season on antelope." (21% and 13% respectively: hunters, and guides and outfitters, and one merchant)

Secondary Issues

People appeared somewhat concerned that . . .

S4 "private landowners are forced to support a public resource without any choice, or compensation." (18%: landowners and one merchant)

S5 "antelope are increasing in numbers and seem destined to follow the same pattern seen with elk." or, "DOW may not be able to hold the antelope population (from increasing)." (18%: landowners and one merchant)

S6 "hunting seasons should be designed to harvest animals causing conflicts." (16%: all groups)

S7 "it is enjoyable to see antelope in the area." (16%: hunters and non-consumptive users)

B2 "antelope may be competing with deer on transition ranges." (11%: landowners, hunters and a non-consumptive user)

S8 "hunters, landowners, and other members of the public do not have enough opportunity to affect antelope management decisions." (9%: hunters, a landowner and a guide/outfitter)

S9 "DOW has not followed through on some or all of their promises with regard to antelope management experiments." (7%: landowners)

Minor Issues

The following issues were selected by three or fewer respondents among their top three issues. *Respondents apparently are less concerned that . . .*

S10 "hunters cause damage to public and private lands and do not respect property rights." (5%: landowner, hunter and a non-consumptive user)

E2 "antelope can interfere with hay production." (4%: landowners)

E3 "wherever antelope concentrate, livestock forage could be reduced." (4%: landowners)

E4 "raising the bottom wire of a 3-strand barbed wire fence to 18" to allow antelope to pass underneath is not a realistic option (to avoid damage)." (4%: landowner and hunter)

E5 "antelope damage fences." (2%: landowner)

S11 "fencing antelope out of one alfalfa field to prevent damage may just shift the problem to someone else." (2%: landowner)

B3 "road kills are becoming more of a problem." (2%: hunter)

S12 "antelope should be eliminated from this area." (a concern expressed during the meetings that did not receive any votes)

Issues and Concerns of Land Management Agencies

A summary of the results of public surveys was mailed to Sulphur Ranger District, Dillon Ranger District and Parks Ranger District of the USFS, along with the Kremmling Resource Area of the BLM. Additional input on pronghorn management issues was solicited from these agencies.

Federal land management agencies did not have any additional concerns. Sulphur Ranger District commented that visitors enjoy viewing the pronghorn in Middle Park and there do not appear to be any habitat conflicts with pronghorn on their district.

Other Issues and Concerns[1]

Blue Valley Ranch, located south of Kremmling, is managed primarily as wildlife habitat. The ranch of more than 12,000 acres was enrolled in the Ranch for Wildlife program through the 1998 hunting season. The owner, Paul Jones, has expressed interest in helping establish a permanent pronghorn population in GMU 37. He has offered to foot the bill for capturing and transporting up to 50 animals that would be temporarily held in one or more large fenced enclosures on his property. He would also bear any feeding costs, outfit animals with radio collars and provide assistance in monitoring animal movements after their release.

This proposal raises several concerns. There would be the appearance of privatization of wildlife. The transplant could also lead to conflicts on neighboring properties. On the other hand, there could be benefits to DOW and the public alike. We would learn something about the quality of the habitat in GMU 37, which up until this point has hardly been used by pronghorn. All of the animals would not be expected to remain on private property, so there would be additional opportunity for wildlife viewing and hunting on adjacent BLM lands if the animals remained in the area of their release. The DOW would gain additional radiocollared animals, at no expense, which would help in monitoring the population over the next several years.

Since this proposal surfaced late in the DAU planning process, it had to be considered within the context of population objectives proposed in the draft plan. Otherwise, additional public meetings would have been needed to discuss the subject, delaying the adoption of new population objectives. DOW continues to evaluate the proposal and negotiate with the landowner. If a formal agreement is reached between DOW and Blue Valley Ranch, allowing animals from outside to be introduced, then additional hunting permits will be issued to reduce the existing herd by a corresponding amount to keep the herd at objective. If transplanted animals move out and join up with “native” animals, then the net effect will be that the hunting public realized additional hunting opportunity during the previous season. If the transplant succeeds in establishing a new subpopulation, then DOW will most likely seek to amend the existing DAU plan with revised objectives at some point in the future, based on the occupation of new habitat.

[1]This section has been added since the Draft A-37 Plan was reviewed 9/98

Issue Resolution

No simple solution can possibly address all the concerns held by our constituents. Many concerns regarding pronghorn are social, rather than biological, in nature. The range of herd management objectives may have little or no effect on some of these. Furthermore, impact on any particular issue may be hard to predict. For example, at a lower population level private land conflicts could still be a factor, especially if most of the harvest occurs on public lands. Issue S1, regarding pronghorn on private property during the hunting season, could be exacerbated since permit numbers will be increased under any of the alternatives. Herd management objectives will have no effect on about seven out of the thirteen significant and secondary public issues (*e.g.*, bad hunter behavior is beyond the scope of this plan). Of the remaining six issues, 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 six management alternatives to the public at DAU meetings held in Grand and Summit Counties. These ranged from 750 pronghorn down to 300 pronghorn in the post-season population, and either 40 bucks:100 does or 30 bucks:100 does (See Appendix C). During the DAU meetings, and on the written surveys handed out to those in attendance, people were given the opportunity to suggest other alternatives. The only other management strategy suggested by a member of the public was to eliminate pronghorn from the area entirely. This was not considered a realistic solution, but was given consideration as an issue; however, no one selected this as one of their top issues. Written comments were also solicited from the USFS and BLM regarding these six alternatives. Land management agencies did not identify any of the alternatives as being unacceptable, but favored alternatives with a higher population.

#1 Maintain the current situation on the ground - *i.e.*, hold the Middle Park pronghorn population at its December 1997 level and sex ratio: 630 pronghorn with 40 bucks per 100 does

Discussion:

Basis for Alternative - This option does not involve any change from the situation following the 1997 hunting season.

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

This option benefits or alleviates the following issues: E1, B1, S7 and S9

This option has no impact on the following issues: S2, S3, R1, S6, B2, S8, S10, E2, E3, E4, E5, S11 and B3

This option exacerbates the following issues: S1, S5 and S4

Advantages of Alternative - This option keeps some older bucks in the population, providing good opportunities for both hunting and wildlife viewing. Some positive economic benefits should result to the local community.

Disadvantages of Alternative - Animals are less likely to expand their range and more fully occupy habitat south of the Colorado River under this option than with a higher population of 750. Curtailing the growth of this population will prevent it from reaching its full recreational potential.

Public Support - This is the second most popular option with our constituents, favored by 28% of those submitting surveys.

#2 Lower the Middle Park pronghorn population by 16% from the December 1997 level while retaining the current sex ratio: 530 pronghorn with 40 bucks per 100 does

Discussion:

Basis for Alternative - The herd was near this level in December 1995, but the sex ratio is higher than what existed then.

Relationship to Public Issues -

Beneficial Impact: S7 and S9

No Impact: E1, B1, S2, S3, R1, S5, S6, B2, S8, S10, E2, E3, E4, E5, S11 and B3

Harmful Impact: S1 and S4

Advantages of Alternative - Chances for game damage problems and private land conflicts would be reduced, provided all the harvest didn't take place on public lands.

Disadvantages of Alternative - Recreational opportunities will be reduced, particularly the chance to hunt and view older bucks. Animals would be less likely to expand their range south of the Colorado River.

Constraints - It would take several years to reach this objective since issuing a large number of licenses in any one year would cause hunter success to drop dramatically.

Support for the Alternative - This was the third most popular alternative among those submitting surveys, favored by 18%.

#3 Lower the Middle Park pronghorn population by 16% and drop the sex ratio by 25% from what existed in December 1997:

530 pronghorn with 30 bucks per 100 does

Discussion:

Basis for Alternative - This was the situation in December 1995.

Relationship to Public Issues -

Beneficial Impact: S9

No Impact: E1, B1, S2, S3, R1, S5, S6, S7, B2, S8, S10, E2, E3, E4, E5, S11 and B3

Harmful Impact: S1 and S4

Advantages of Alternative - Chances for game damage problems and private land conflicts might be reduced, provided all the harvest didn't take place on public lands.

Disadvantages of Alternative - Recreational opportunities will be reduced, particularly the chance to hunt and view older bucks. Animals would be less likely to expand their range south of the Colorado River.

Constraints - It would take several years to reach this objective since issuing a large number of licenses in any one year would cause hunter success to drop dramatically.

Public Support - This alternative was only supported by 8% of those submitting surveys.

#4 Lower the Middle Park pronghorn population by 29% and reduce the buck ratio by 25% from what existed in December 1997:

445 pronghorn with 30 bucks per 100 does

Discussion:

Basis for Alternative - This was the situation in December 1994.

Relationship to Public Issues -

Beneficial Impact: S5, S9 and B3

No Impact: S2, S3, R1, S6, B2, S8, S10, E2, E3, E4, E5 and S11

Harmful Impact: S1, E1, B1, S4 and S7

Advantages of Alternative - Chances for game damage problems and private land conflicts might be reduced, provided all the harvest didn't take place on public lands.

Disadvantages of Alternative - This alternative affords still fewer opportunities for the public to view pronghorn and fewer mature bucks for hunters than the previous objective. Animals would be much less likely to expand their range south of the Colorado River. It may be difficult for hunters to find enough animals on public lands at this population level, causing hunter success to fall off.

Constraints - It would take considerable time or special seasons to reduce the population to this level.

Public Support - This option was supported by only 7% of those submitting surveys, making it the least popular alternative.

#5 Reduce the size of the Middle Park pronghorn population by 52% and the sex ratio by 25% from what existed in December 1997.

300 pronghorn with 30 bucks per 100 does

Discussion:

Basis for Alternative - This population size was given consideration in the 1990 DAU Plan, and some landowners seem to be under the impression that DOW guaranteed that the herd would never exceed this level. In 1992 the herd surpassed this level but the sex ratio was lower at that time.

Relationship to Public Issues -

Beneficial Impact: S4, S5, B2, S9 and B3

No Impact: S2, S3, R1, S6, S8, S10, E2, E3, E4, E5 and S11

Harmful Impact: S1, E1, B1 and S7

Advantages of Alternative - Conflicts with landowners and the possibility of game damage occurring should be minimized under this alternative, providing hunting pressure is directed at the animals causing the conflicts.

Disadvantages of Alternative - This alternative would result in the least viewing opportunities and chances to harvest older bucks. Economic benefits to the local community from the pronghorn herd would decline. Animals would be much less likely to expand their range south of the Colorado River. It may be difficult for hunters to find enough animals on public lands at this population level, causing hunter success to fall off.

Constraints - It would take some type of special season to lower the population this much within several years. Landowners who have antelope on their property would need to allow some hunter access to their property to avoid over-harvesting animals on public lands.

Public Support - This alternative was only supported by 10% of those submitting surveys.

#6 Allow the Middle Park pronghorn population to increase by 19% while keeping the sex ratio that existed in December 1997. 750 pronghorn with 40 bucks per 100 does

Discussion:

Basis for Alternative - The population has not been at this level for perhaps 100 years or more. Experience during recent years has demonstrated there is enough habitat to support this large of a population.

Relationship to Public Issues -

Beneficial Impact: E1, B1 and S7

No Impact: S2, S3, R1, S6, S8, S10 and E4

Harmful Impact: S1, S4, S5, B2, S9, E2, E3, E5, S11 and B3

Advantages of Alternative - The highest quality bucks should be produced under this alternative and Option#1. There may be some positive benefits to the local economy with a larger herd. This option provides the best opportunity to find out if animals are going to expand their range and more fully occupy habitat south of the Colorado River.

Disadvantages of Alternative - Fawn production would probably fall off at this level and the annual surplus available for hunters may not be any larger than with Option #1. Game damage problems might increase.

Public Support - Except among landowners, this option had the greatest support (30%) among those submitting surveys.

Alternative Selection

Seventy-six percent of the people completing a DAU survey preferred a population level between 530 and 750 antelope, with 40 bucks:100 does (*i.e.*, Options 1, 2 & 6). The population should perform well under any of these three alternatives. Option #6, with a posthunt population of 750 animals, had the greatest support of any alternative and presents the best opportunity to see if pronghorn will expand their winter range south of Kremmling. The disadvantage is that it might possibly lead to more private land conflicts (Issues E2, E3, E4, and E5) and would put another 120 animals in habitat used by deer (Issue B2).

There is little support among landowners for allowing the population to increase to 750 animals posthunt in any event. A portion of landowners feel DOW has not been forthright with them regarding intentions for increasing size of the herd (Issue S9). People wonder when DOW is going to stop studying the herd and start managing it. A significant number of landowners also feel they are being taken advantage of by having to support increasing numbers of pronghorn on their land (Issue S4) and feel they are reliving the same situation that occurred with elk over the past several decades (Issue S5).

Support for Option #1, the current situation, is close to being evenly split between landowners and hunters. Sulphur Ranger District prefers either Option #1 or Option #6, as does the Kremmling Resource Area of the BLM. Parks Ranger District prefers Option #1, and Dillon Ranger District did not express a preference. The Middle Park HPP Committee is not in favor of any further increase in pronghorn, but does support Option #1. It would seem prudent to obtain experience managing the population at one of the lower levels to determine what, if any, problems might occur before allowing a further increase in population. Option #1, with 40 bucks:100 does as an objective, will maintain a more natural sex ratio (of an unhunted herd), which should provide good viewing opportunities and good prospects for hunters interested in harvesting a trophy. This may also prove to be a benefit to landowners interested in charging for access.

The draft plan was reviewed by members of the Middle Park Habitat Partnership Committee and staff of the Kremmling Resource Area, BLM. Copies of the Executive Summary were mailed to members of the public who attended the DAU meetings and requested that they be kept informed of the outcome of the planning process. No negative comments on the draft plan were received at the Hot Sulphur Springs Service Center. Therefore, Option #1 is recommended for final adoption by the Wildlife Commission.

(A final version of the plan was presented to the Wildlife Commission at their March 12, 1999 meeting in Westminster, where it received unanimous approval.)

Implementation

1. Limited muzzle-loading and archery seasons have been established for the 1999 season.

2. A significant portion of the herd is staying on private property during regular antelope seasons. No matter which alternative is selected, a lack of hunter access onto private land will shift most of the harvest onto BLM lands, doing little to resolve landowner conflicts. The possibility of holding special late seasons (in November?) may need to be explored to help achieve desired harvest levels. DOW, along with the Middle Park HPP Committee, will do whatever they can to encourage landowners with pronghorn to allow some hunting on their property.

APPENDIX A
A-37 Population Model

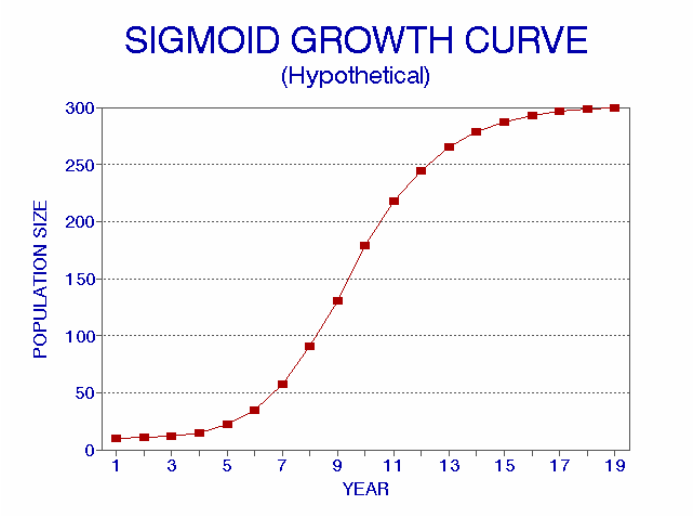
Middle Park Pronghorn Spread Sheet Population Model - 9-8-98 T.M. Pojar

	Early Winter Population						survival - fawns		survival - adults		% fems = 0.5 pre-fawning pop		
							fem	male	fem	male			
Year	bucks	does	fawns	total	b:d	f:d	0.935	0.935	0.950	0.700	bucks	does	total
1986-87	14	38	29	81	37	76	1.000	1.000	1.000	1.000	29	53	81
1987-88	29	53	40	121	54	77	0.935	0.935	0.950	0.800	42	69	110
1988-89	42	69	53	163	61	77	0.935	0.935	0.950	0.950	64	90	154
1989-90	64	90	68	222	71	75	0.935	0.935	0.950	0.700	77	117	194
1990-91	67	112	59	237	59	52	0.935	0.935	0.950	0.700	74	134	208
1991-92	64	129	63	256	50	49	0.935	0.935	0.950	0.700	74	152	226
1992-93	64	147	99	310	44	67	0.935	0.935	0.950	0.700	91	186	277
1993-94	81	181	89	351	45	49	0.935	0.935	0.950	0.700	98	213	312
1994-95	88	208	141	438	42	68	0.935	0.935	0.950	0.700	128	264	392
1995-96	118	259	121	498	46	47	0.935	0.935	0.950	0.700	139	303	442
1996-97	129	298	127	554	43	43	0.935	0.935	0.950	0.700	150	342	492
1997-98	140	337	144	621	41	43	0.935	0.935	0.950	0.700	165	388	553
1998-99	145	353	104	602	41	30	0.935	0.935	0.950	0.700	150	384	534
1999-00	130	349	148	627	37	42	0.935	0.935	0.950	0.700	160	400	561
2000-01	140	365	155	661	38	42	0.935	0.935	0.950	0.700	171	420	590

Observed values		Late summer pop				Harvest				Projected early winter pop				
obs f:d	obs b:d	bucks	does	fawns	total	bucks	does	fawns	total	bucks	does	fawns	total	obs pop size
77	36	29	53	40	121	0	0	0	0	29	53	40	121	122
77	54	42	69	53	163	0	0	0	0	42	69	53	163	160
75	40	64	90	68	222	0	0	0	0	64	90	68	222	223
50	56	77	117	59	252	10	5	0	15	67	112	59	237	246
47	22	74	134	63	271	10	5	0	15	64	129	63	256	292
65	23	74	152	99	325	10	5	0	15	64	147	99	310	332
48	26	91	186	89	366	10	5	0	15	81	181	89	351	410
66	10	98	213	141	453	10	5	0	15	88	208	141	438	453
46	29	128	264	121	513	10	5	0	15	118	259	121	498	520
42	32	139	303	127	569	10	5	0	15	129	298	127	554	579
42	37	150	342	144	636	10	5	0	15	140	337	144	621	626
28	31	165	388	109	661	20	35	5	60	145	353	104	601	613
40		150	384	153	687	20	35	5	60	130	349	148	627	
40		160	400	160	721	20	35	5	60	140	365	155	661	
40		171	420	168	758	20	35	5	60	151	385	163	698	

APPENDIX B
Population Dynamics

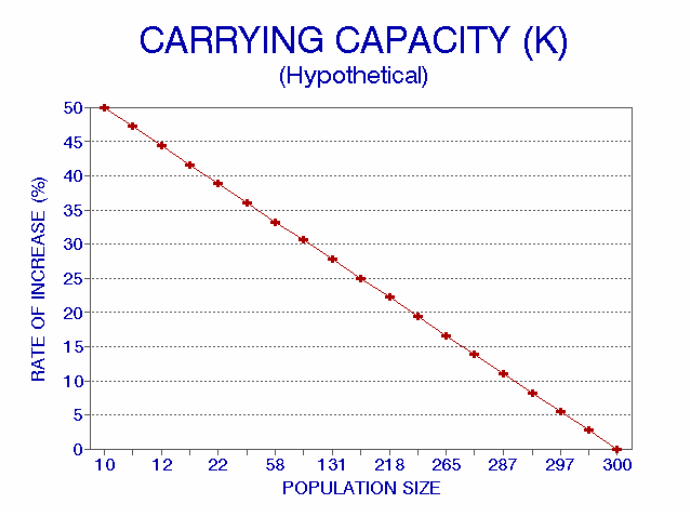
The sigmoid curve can be used to describe various phenomena in nature, including the typical growth pattern for animal populations. Three phases of this population growth curve are readily apparent:



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).

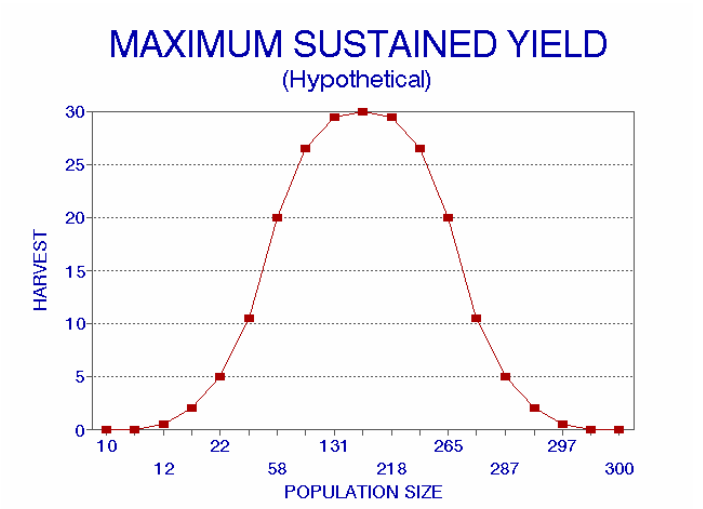
Prosperity Phase (years 6-15 on the graph): food, cover, water and living space are still abundant. Survival rates are at their highest. Although rate of increase is declining, the population begins to build "momentum" because of the increasing size of the core population; this results in larger increases 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.

Equilibrium Phase (Years 16-19 on the graph): the population continues to grow until it reaches the maximum carrying capacity of the habitat (the K value). Animals become crowded into available habitat, bringing them into direct competition with each other. Environmental resistance develops due to the scarcity of some resources. Game damage problems tend to be the worst under these circumstances. Momentum developed in the prosperity phase begins to dissipate as the rate of increase approaches zero. Overall condition of animals declines and mortality is high, especially among young and those under stress. 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 rate varies 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 Middle Park Pronghorn Herd (A-37)

APPENDIX D
Written Comments Regarding Management of the MP Pronghorn Herd (A-37)

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