

**MOOSE
DATA ANALYSIS UNIT PLAN
M-4
Southwest Colorado**

2005

**GAME MANAGEMENT UNITS
66, 67, 68, 74, 75, 751, 76, 77, 78, 79, 80 AND 81**

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DATA ANALYSIS UNIT PLAN FOR M-4
EXECUTIVE SUMMARY

Data Analysis Unit (DAU): M-4 (Southwest Colorado Moose)

Game Management Units (GMUs): 66, 67, 68, 74, 75, 751, 76, 77, 78, 79, 80 and 81.
(Underlined GMUs are core units which currently have a hunting season. Other GMUs have the potential for future hunting seasons, particularly 67, 77 & 751.)

Current Population Estimate: between 350 and 450 animals in the Upper Rio Grande (GMU 76) and Gunnison Units (GMUs 66/67); 20-100 in other areas of the San Juans west of the Continental Divide; and 15-50 in other parts of the San Luis Valley.

Population Objectives: (1) Keep the population small enough to avoid excessive damage to willow stands; (2) maximize hunting opportunity for cows and mature bulls by maintaining high productivity in the herd; and (3) provide adequate opportunities for viewing. Maintaining between 350-500 animals (post-hunt) in GMUs 66 and 76 should allow us to achieve these multiple objectives. As permits are added for other GMUs, the overall population objective will be raised by the number determined suitable for the new GMU(s).

Sex Ratio Objective: Insure sufficient bulls for successful early breeding in order to minimize cows being bred during their 2nd or 3rd estrus, and to provide for quality hunting. Ideally, we desire a post-season ratio of between 55 and 65 bulls:100 cows. Maintain an average antler spread of more than 40 inches in harvested bulls to maintain hunter satisfaction and also provide viewing opportunities for mature bulls.

Changes from recent management: Moose in southwest Colorado have been allowed to increase following a series of transplants in the early 1990s, with very limited hunting first allowed in 1999. A USDA Forest Service Environmental Assessment (Appendix A) established an initial population goal of 350 moose in the Upper Rio Grande Basin. We don't know if that level has been reached, and CDOW will work with the USDA Forest Service to determine what, if any, changes need to be made in the current population level. Moose have been allowed to increase on the Lake Fork of the Gunnison River in GMU 66 and that population level will be reassessed. Moose numbers will be allowed to increase in other parts of the DAU for a period of time.

Significant issues raised during the public involvement sessions: Most members of the public surveyed are happy to have moose in the area, and would like to see more animals. This, of course, is dependent on the habitat capability. Business owners feel that viewing opportunities for moose attract people to the area. Federal land management agencies are generally supportive of having a moose population, but are wary about impacts to the riparian system from too many animals. There are also concerns about DOW's ability to accurately assess the population size and regulate numbers in problem areas.

SOUTHWEST COLORADO MOOSE HERD
DATA ANALYSIS UNIT (DAU) M-4
FOR
GAME MANAGEMENT UNITS
66, 67, 68, 74, 75, 751, 76, 77, 78, 79, 80 and 81

INTRODUCTION

The purpose of a Data Analysis Unit (DAU) plan is to give the Colorado Division of Wildlife (CDOW) direction in managing a species in a given geographical area. It identifies suitable habitat, gives the herd history and current status, and identifies issues and problems. Key features of a DAU plan are the herd size and herd composition objectives, which are developed after considering input from all interested entities. CDOW intends to update these plans as new information and data become available, at least once every ten years.

1. DAU PLANS AND WILDLIFE MANAGEMENT BY OBJECTIVES

Growing demands on finite wildlife resources dictates wise management of Colorado's resources. CDOW's Long Range Plan provides direction and broad objectives to achieve legislative and Wildlife Commission mandates. Within these confines, CDOW employs a management by objectives approach to manage individual big game populations.

Data Analysis Units provide the framework to manage individual herds of big game animals. DAUs are geographical areas that encompass relatively discrete big game herds. The DAU plan process is designed to balance public demands, habitat capabilities and herd capabilities into a management scheme for the individual herd. The public, sportsmen, federal land use agencies, landowners and agricultural interests are involved in the determination of the plan objectives through input given during public meetings, the opportunity to comment on draft plans, and during final review by the Colorado Wildlife Commission.

The objectives defined in the plan guide a long-term cycle of information collection, information analysis and decision making. The end product of this process is a recommendation for numbers of hunting permits for the herd (Fig. 1).

Individual DAUs are managed with the goal of meeting herd objectives. Herd data, which is typically collected annually, is entered into a computerized population model to get a population projection. The parameters that go into the model include harvest data tabulated from hunter surveys, sex and age composition of the herd gathered by field surveys, and mortality factors such as wounding loss and winter severity, generally acquired from field observations. The resultant computer population projection is then compared to the herd objective, and a harvest calculated to align the population with the herd objective.

COLORADO'S BIG GAME MANAGEMENT BY OBJECTIVE PROCESS

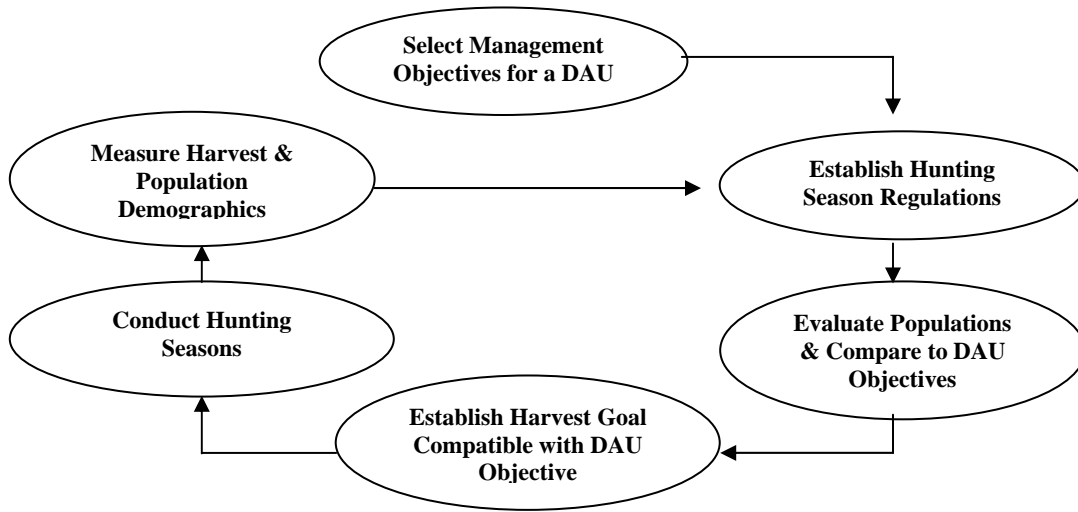


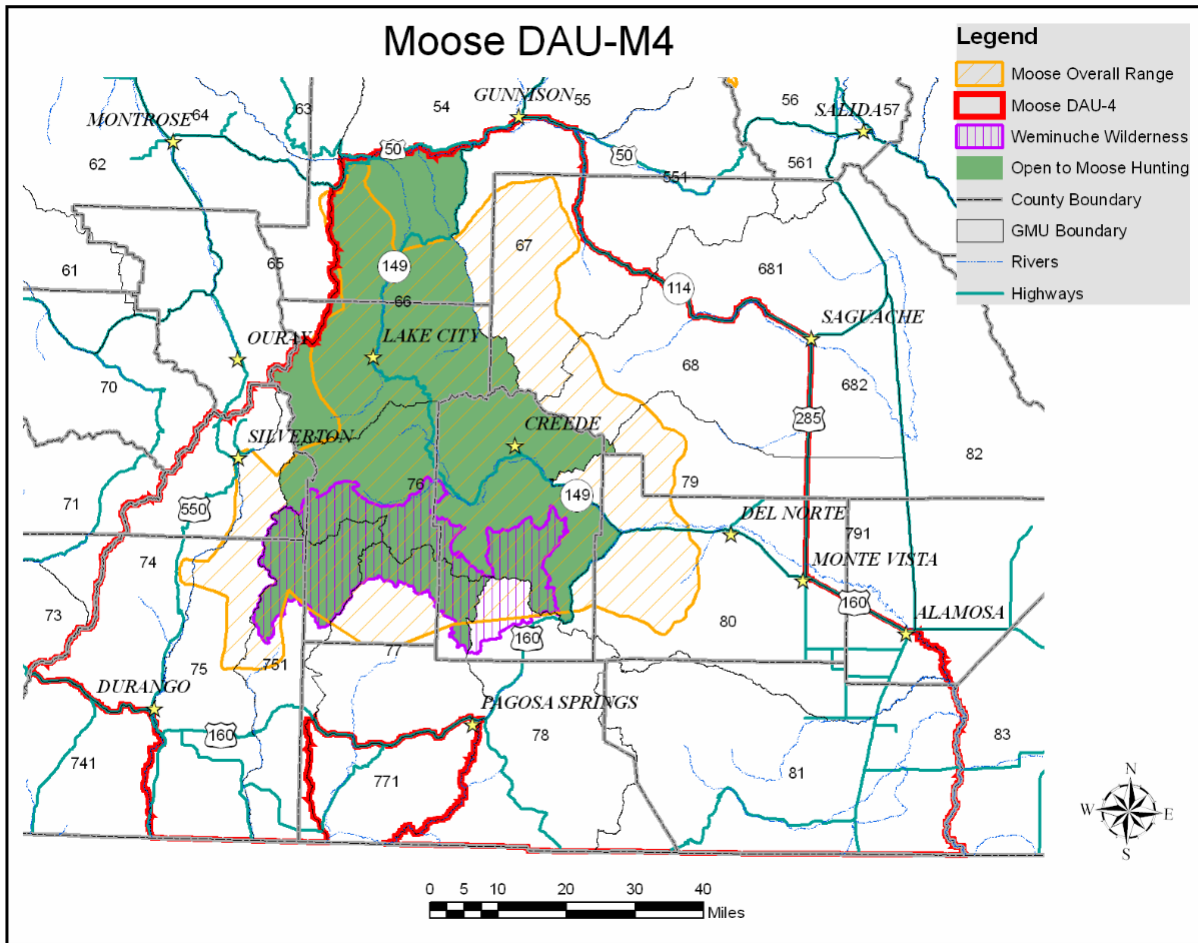
Figure 1. Management by objectives process used by the CDOW to manage big game populations on a DAU basis.

2. DESCRIPTION OF DATA ANALYSIS UNIT

This Data Analysis Unit (DAU) includes twelve Game Management Units (GMUs): 66, 67, 68, 74, 75, 751, 76, 77, 78, 79, 80 and 81. Two of these GMUs and the Weminuche Wilderness Area in GMUs 76, 77 and 751, currently have hunting permits. The rest are not currently open to hunting, but provide habitat for part of the herd. This area encompasses a large portion of south-central Colorado on both sides of the Continental Divide. Basically it runs from Alamosa west to Durango, then north to Silverton and northeast to Blue Mesa Reservoir, east to Gunnison then back south to Alamosa. (Map 1). It encompasses 8,815 square miles, affording roughly 3,000 square miles of suitable moose habitat. It takes in portions of the Gunnison, Rio Grande, San Juan and Animas River drainages. The DAU encompasses three national forests, including the Rio Grande, San Juan and Gunnison.

Land ownership composition in the entire DAU is 24.6% private, 56.1% U.S. Forest Service, 14.5% BLM, 2.0% Native American Land, 2.2% Colorado State Lands, 0.3% National Park Service (National Recreation Area) and 0.3% U.S. Fish & Wildlife Service. Land ownership and composition in occupied habitat is 317 mis² private (10.1%), 2,435 mis² U.S. Forest Service (77.4%), 381 mis² BLM (12.1%) and 12 mis² Colorado State lands (0.4%).

Map 1



The main geographic feature in the DAU is the San Juan Mountain range, which runs north-south along the Continental Divide and rises to more than 14,300 feet in elevation west of Lake City. Elevation in the DAU drops to about 7,700 feet along the Gunnison River in the north, to 8,200 feet on the southeastern end near South Fork and 6,500 feet in the Durango area.

The climate is highland or montane with cool summers and cold winters, combined with heavy snows. Higher elevations of the San Juan Mountains receive 50 inches of precipitation yearly, while the foothills receive 12 to 16 inches, and the Gunnison Valley about 11 inches. At higher elevations about 75% of the precipitation comes in the form of snow, with as much as 250 to 300 inches of accumulation, while at lower elevations the percentage of precipitation in the form of snow drops to 30%.

Lower elevations are grassland/shrub with some agricultural lands along the valley bottoms. As elevation and precipitation increase, the vegetation shifts from pinion-juniper, to ponderosa pine, then to Douglas fir and white fir combined with extensive stands of aspen. Between 9,500 and 12,500 feet in elevation, stands of Engelmann spruce and subalpine fir predominant. Riparian areas which occupy less than 1% of the landscape provide the most important habitat for moose. Eight species of willow are found in these riparian areas and make up a major component of the

moose diet. Moose also frequent small ponds within the forest. Coniferous forest is important thermal cover for moose, providing shade in the summer and protection from the wind during the winter. Large areas of alpine occur above 12,000 feet and moose in this DAU sometimes utilize low stands of willow near tree line.

The area where hunting is now allowed consists mainly of GMUs 76 and 66. It is estimated that about 80% of all the moose in the DAU occur in this area. These GMUs are located in south-central Colorado in the Upper Rio Grande drainage on the east side of the Continental Divide and the Lake Fork of the Gunnison drainage on the west side of the Continental Divide. These units total 1,563 square miles and encompass portions of Hinsdale, Mineral, Rio Grande, Saguache, San Juan and Gunnison counties. The main drainages include the Rio Grande, Lake Fork of the Gunnison, Big Blue and Cebolla Creeks. GMUs 76 and 66 are bounded by U.S. Highway 160 and the Continental Divide on the south, the Continental Divide and the Big Blue-Little Cimmarron divide on the west, the Gunnison River on the north, and Highway 149, Mineral-Saguache County line, Cebolla Creek and FS Rd. 600 on the east.

3. HERD MANAGEMENT HISTORY AND INFORMATION

3.1 Background Information

Introduction of moose to southwest Colorado was first considered in 1976 when biologists focused on the Gunnison area. That proposal was not implemented because of opposition by local livestock operators. Other potential release areas were considered, and an environmental assessment (EA) was prepared regarding the release of moose on the Rio Grande National Forest near Creede. The EA process was completed in July 1991 and a finding of no significant impact was made by Forest Supervisor James Webb on 8/7/91. The document approved the release of up to 100 moose and set the preliminary long-term herd objective at 350. The population objective was to be reviewed and possibly modified once the initial goal was obtained.

During December 1991, January 1992 and January 1993, 106 moose were captured in north-central Colorado, northeast Utah and southwest Wyoming for transplant to the upper Rio Grande river basin in southwestern Colorado (Appendix B). Thirteen of the moose died of capture-related causes resulting in a net transplant of 93 animals. Forty-four moose were fitted with radio collars and survivors were tracked until December 1997.

Limited hunting of this herd initially took place in GMUs 76 and 66 during 1999. Demand for these licenses is extremely high. In 2003, a new hunt code specific to the Weminuche Wilderness Area (extending into GMUs 77 and 751) was created to provide a back-county hunting experience, and to achieve better distribution of hunting pressure. See appendix C for more information on hunting permits.

The Southwest Colorado moose herd provides unique watchable wildlife opportunities for many Colorado residents and visitors to the state. The economic impact of this activity is unknown but appears to have some importance.

3.2 Herd Composition

Moose spend much of the day under conifer overstory. Traditional classification counts in this DAU would be unreliable and cost-prohibitive due to this factor, which is further compounded by the rugged topography of the area and low density of moose. The alternative is to model the population within the parameters of data collected from 1991 to 1996 on 41 radio-collared moose, comparing this with updated information gathered opportunistically. That 90's study showed an average of 52 calves per 100 cows. This rate could be expected to decline as the population reaches higher densities. Survival rates were 94% for adult males and 84% for adult females. These include all types of mortality including illegal kills.

3.3 Range

The original transplant sites were limited to the Upper Rio Grande drainage, specifically the area between Goose Creek and Spring Creek Pass along the Colorado Highway 149 corridor in GMU 76. All totaled, twelve release sites were used over two winters of releases. Soon after their release, moose moved into other GMUs including 66, 75, 751, 77 and 79. Currently there are moose in much of south-central Colorado on both sides of the Continental Divide, including more recently colonized areas located in GMUs of 54 and 55 north of Gunnison, 67, 68, 74, 771, 78, 80 and 81 (Map 1). Some moose wandered as far as Grand Mesa, the Four Corners area and even into New Mexico, and were subsequently lost to the main population. The core population of moose occupied about 2,000 square miles in 1996 but continues to expand.

In deciding which GMUs should be included in this DAU, CDOW field personnel considered the currently occupied area and tried to anticipate which units had the potential to be opened for hunting within the 10-year period covered by this plan. Under this approach, new hunting units could probably be opened using a simpler process (*e.g.*, public meeting followed with an issue paper) than asking the Wildlife Commission to approve a revision of the DAU plan for each new unit.

Given the recent moose introduction on Grand Mesa, it was also anticipated that at least one more moose DAU might eventually be needed to cover the remaining portion of the state south of I-70. Field personnel decided that U.S. Highway 50, crossing Monarch Pass and running through Gunnison, would make a logical cut-off for the Southwest Colorado moose DAU.

4. MANAGEMENT SITUATION

4.1 Current Population

The current population is estimated at between 350 and 450 animals in the Upper Rio Grande (GMU 76) and Gunnison Units (GMUs 66/67). There are an additional 20-100 animals in the San Juans west of the Continental Divide, and 15-50 in other parts of the San Luis Valley. The population level in the upper Rio Grande (primarily GMU 76), is still probably below 350 animal objective approved in the original USDA Forest Service Environmental Assessment.

4.2 Current Management Problems

4.2.1. Inventory: It is extremely difficult to estimate numbers of free-ranging wildlife over large geographic areas, especially where animals occur at low densities. Even when aerial and ground counts have been conducted with a known number of large ungulates confined in large enclosures having natural vegetation, tallies have been anywhere between 20% and 40% below actual numbers.

In North Park, sightability of moose during winter helicopter surveys has been investigated and a ratio developed to provide a population estimate of that herd, but this technique would not be applicable to this DAU due to differences in animal concentration, terrain and vegetation. Because of budget and time constraints, obtaining a reasonably accurate estimate of population size in the field will not be realistic. Information gathered from watchable wildlife enthusiasts, hunters, agency personnel and federal land management agencies in the way of incidental sightings may be useful in providing an indication of current population trend. Aerial surveys conducted early in the winter along established routes in areas of higher moose densities, using a fixed-wing airplane, may be another way to obtain useable information on population trend, and possibly herd composition. Spreadsheet modeling can provide a way of gauging the veracity of population estimates. The background work done between 1992 and 1997 with radio-collared moose in the DAU provided information on population parameters which will be useful in constructing population models.

The pattern of dispersal among younger animals can be expected to continue with this population. These animals may or may not return to the main population. Dispersal can constitute a significant drain on the population that is difficult to account for in population models. This factor will tend to be minimized in a DAU encompassing a larger geographic area. This is one of the main reasons for incorporating such a large number of GMUs into this DAU.

Relative density is probably most meaningful when viewed from a habitat utilization standpoint. Habitat should be monitored to determine if the moose population is having undesirable effects on the plant community, particularly stands of willows. This will be a key consideration in the management of this herd.

4.2.2. Disease: During post-release monitoring of radio collared moose, mortalities from unknown causes were noted during the spring and summer months. Disease was the suspected cause of these mortalities. In August 1998 a bull moose died and the cause of death was subsequently determined to be due to a proliferation of the arterial worm, *Elaeophora schneideri*, a parasite which invades the carotid artery and restricts blood flow to the brain. Elaeophorosis is most common in the southwest U.S., with mule deer being the nonpathogenic carrier. It is transmitted to deer, elk and moose by the horse fly, the intermediate host. Elaeophorosis has also been documented in moose in North Park, Colorado and it is generally accepted that Elaeophorosis is more prevalent in the southern part of the state. It appears moose are highly susceptible to this parasite. The impact this disease is having on the moose population is unknown at this time, but could be substantial.

It may be possible to screen harvested animals for this parasite when carcasses are brought to CDOW offices for mandatory checks.

4.2.3. Illegal kill: Illegal kill of moose has been a problem statewide since their first introduction to North Park during the early 1980s. In Middle Park, Colorado (DAU M-3) documented illegal kill exceeded legal kill for the initial five years of established hunting from 1995-1999 (68 illegal vs. 56 licenses). This is common to other western states where moose occur. Most often moose are confused with elk, usually when partially obscured by vegetation, or when standing in the shadows of dense overstory. Even experienced hunters have been known to make this mistake. Most often the accident occurs when hunters are unaware of moose being in the area. Although we attempt to better educate hunters through information campaigns and by making a special point to discuss the importance of identifying your target in hunter education programs, the problem will likely never be completely eliminated. Instances where a hunter maliciously kills or wounds a moose also occur. These cases are handled much more severely by CDOW Officers than the accidental incidences.

4.2.4. Conflicts between user groups: Because moose are such a large animal, hunters are often reluctant to hunt any distance from where they have motor vehicle access. For this reason, highly visible moose tend to be more vulnerable to harvest than those inhabiting the back-country. This tends to produce situations where there may be conflicts between watchable wildlife enthusiasts and moose hunters. In North Park, a hunting closure was instituted around the moose viewing area near Gould. Hopefully, significant conflicts can be avoided in Southwest Colorado. Hunt codes specific to various wilderness areas can be used to direct more harvest into the backcountry. Hunters can also be sensitized to the values of other users through CDOW information efforts.

4.2.5. Orphaning of calves: Cow licenses are needed to control numbers of moose and balance the sex ratio of the population. Moose seldom associate in larger groups, so orphaning of young has the potential of creating problems. In Colorado, calves are perfectly capable of avoiding predation and finding adequate forage at four months of age, but sometimes orphaning may result in calves failing to find their way to normal winter range. This has the potential of lowering survival rates of young animals. Hunters with antlerless permits can be alerted to this potential problem through CDOW information efforts to gain their cooperation in selecting for cows without calves. Maintaining an adequate amount of bulls in the breeding population by keeping permit numbers low can also help reduce late parturition, due to cows being bred during their 2nd or 3rd estrus cycle.

4.3 Potential Management Problems

4.3.1. Human Conflicts: Conflicts may occur when humans encounter moose in their natural habitat, or when moose wander into areas of human habitation. Bull moose can be aggressive and dangerous during the rut, as can cows with dependent young. As with any wild animal, people should exercise a certain amount of caution when encountering moose. Bulls should be viewed from a distance in the fall. Dogs should be restrained from approaching a moose.

Moose have also been known to damage ornamental shrubs around houses. CDOW is responsible for damage caused by big game to livestock and agricultural products. However, they are not liable for damages to personal property. CDOW has the option of immobilizing and transporting an animal which wanders out of their natural habitat and has the potential to cause a problem. In the event that any moose was displaying unusually aggressive behavior without being provoked, it would likely be destroyed by CDOW officers in the event a licensed hunter wasn't available.

5. HABITAT CONDITION AND CAPABILITY

Moose generally occupy forested portions of the DAU, but have been observed throughout the unit from the sagebrush lowlands on the north, oakbrush in the southwest, up to alpine ranges above 12,000 feet. Discounting the exploratory movements after the initial transplant, moose movements in this DAU appear mostly elevational, with animals moving to lower elevations with the snows of fall and winter, and moving to higher elevations in spring and summer. This movement may be a few miles to up to 20 miles, depending on snow patterns. Significant movements also occur during breeding season when both sexes search for suitable mates.

Moose prefer to use riparian areas for foraging, especially willow bottoms, but may be found feeding in a wide variety of habitats. Occasionally they may be seen in meadows in the springtime, seeking tender herbaceous growth, but normally don't stray far into open areas. Areas suitable for cattle are not preferred by moose, and creek bottoms that have experienced heavy use by livestock are generally avoided by moose. For this reason, private lands being used for agricultural purposes are not generally frequented by moose. In North Park and Middle Park, very few conflicts have occurred between moose and agricultural interests; the situation in southern Colorado is likely to be the same.

Experience of the last thirteen years has shown there is adequate forage to support a substantial moose population in southwest Colorado. The management key for sustaining this population level is protection of the handful of key browse species. Where moose become too concentrated, or individuals spend too much time in a given area, substantial damage can be anticipated to shrubs and scrub trees in the riparian zone. Without the opportunity for rest and recovery, the prevalence of these species may become greatly reduced in the landscape. Moose are dependent on browse, and productivity of the herd will undoubtedly drop following a period of over-exploitation of the habitat.

6. ISSUES AND STRATEGIES

6.1 Inventory

Although direct inventory of this moose herd is impractical, general trend information can be gathered from opportunistic observations, during deer and elk classification surveys done by helicopter, during volunteer ground counts, and on established survey routes using fixed-wing

aircraft. Moose observation forms are distributed to all the USDA Forest Service Districts with the hope that visitors and field personnel will submit information on sightings. These observations will be compiled into a database for further analysis on distribution and possibly productivity of the herd. Observations of bulls and relative size of bulls harvested will give an indication of how long males are surviving and sexual composition of the herd.

Known mortalities, *i.e.*, harvested animals, accidental deaths such as road-kills, and carcasses reported from the field will be recorded and incorporated into the spreadsheet population model. This model will be used to gain a general idea of the population size, composition and the relationship to specific objectives. Population modeling efforts with this moose population will be less precise than deer and elk models used by CDOW, due to the lack of a suitable inventory technique. Consequently, it will impractical to manage this population for a fixed number.

6.2 Habitat use

CDOW will assist USDA Forest Service in developing monitoring techniques for habitat impacts from moose browsing. As land managers, the USFS should have the lead in designing monitoring techniques and designating key sites. Soon after moose were transplanted, the Divide District on the Rio Grande National Forest established four permanent transects in willow stands to gain an understanding of the impact moose browsing was having on these key shrub species. These transects haven't provided much useful information because of their limited scope. Rather than intensively monitoring a few sites, it may be more practical to assess habitats over a broader area, using less intensive monitoring. An initial monitoring effort funded with special moose auction/raffle funds will map moose concentration areas, collect habitat information, identify and prioritize monitoring sites and identify areas for potential habitat improvement work. In the event that sites are identified where moose have the potential to heavily impact riparian habitats, browsing exclosures may be constructed for monitoring purposes, or other habitat management strategies may be implemented. Other Forests with significant moose populations will be encouraged to do similar monitoring to detect over-utilization of habitat.

6.3 Public Outreach

CDOW Service Centers and USFS District Offices frequently have contact with moose viewers. This provides an opportunity to gather information on moose sightings and assess satisfaction with the viewing experience. Educational materials can also be made available at these sites. Successful hunters have a mandatory check by CDOW personnel. Comments about the quality of hunt can be entered on the hunter survey form and can be noted by the employee conducting these checks.

Conflicts between user groups can be minimized through educational efforts. Since moose licenses are extremely limited, informational mailings can be made to individual license holders. Hunters frequently seek advice from CDOW personnel prior to hunting and this provides another avenue to alert license holders about the need to be sensitive toward wildlife viewers.

Because of the specie's unique nature, the public may have difficulty understanding CDOW's

management efforts. For example, people may not recognize the importance of maintaining a high sex ratio in the population for breeding purposes and consequently may have trouble accepting a high proportion of cow licenses. Or they may not recognize the limited carrying capacity of the habitat. Public outreach efforts in the form of news releases or informational meetings may be helpful in this regard.

CDOW conducts public meetings whenever a significant change in management is proposed in order to give out information on that change and to gather public input. Other meetings of a general nature are conducted every fall prior to regular big game seasons. Moose management can be a topic of discussion at these meetings, or meetings focusing specifically on moose can be conducted.

6.4 Management Decisions

Because of CDOW's inability to conduct statistically meaningful monitoring activities on the status of this herd, and the lack of accuracy that may result with computer population models for this herd, habitat monitoring will be a key element in management of the Southwest Colorado Moose DAU. As part of the annual permit setting process, CDOW personnel will consult with appropriate personnel from federal land management agencies to determine whether management objectives are being met and whether changes in permit numbers are needed. Permit recommendations developed on the local level will be passed up through CDOW channels for final approval by the Wildlife Commission.

7. MANAGEMENT RECOMMENDATION

7.1 Habitat Objective

If this herd is not kept in balance with its habitat there could be a number of negative consequences. Herd productivity (*i.e.*, production and recruitment of young into the population) could suffer, reducing the number of animals available for hunters. Dispersal may push more animals into areas where they are not desired (*e.g.*, residential areas), leading to conflicts and complaints. Other species could suffer negative impacts as the balance of the ecosystem shifts due to overbrowsing. Also, the habitat carrying capacity for moose will suffer, requiring a substantial period of recovery with a greatly reduced population.

Obviously, it will be in the best interest of CDOW and the land management agencies (primarily the USFS) to avoid detrimental impacts to the habitat. This moose herd must be maintained at a sustainable level through adaptive management. The proper level for this herd can only be determined by closely monitoring habitat impacts through a cooperative effort between both agencies. Habitat surveys, browse transects, browsing exclosures, monitoring of moose distribution and identifying moose concentration areas are some of the techniques that will be used to determine whether moose numbers are reasonable for the available habitat. Keeping moose numbers well below the maximum habitat carrying capacity will help avoid the possibility of problems arising.

7.2 Herd Objective

7.21 Population Objective

An initial population objective of 350 animals for USDA Forest Service lands in the upper Rio Grande drainage (*i.e.*, GMU 76) was set in the USFS Environmental Assessment (Rio Grande N.F.)(Appendix A). This preliminary objective was meant to be flexible once some experience was gained in moose management. The moose population reached huntable levels in GMUs 76 (Rio Grande National Forest) and 66 (Gunnison National Forest) and permits were issued beginning in 1999. These two GMUs form the core units within the DAU. Although some riparian areas are beginning to experience heavy moose use, no excessive use other than extremely localized areas has been reported at this point. We intend to stabilize the population in these two units near its current level through hunting to between 350 and 500 animals. This level appears optimal, in that it will best balance the demand for both consumptive and non-consumptive use against what the habitat is capable of supporting.

GMUs 67, 77 and 751 are approaching the point of being able to have their own hunting seasons. Following these, the next units to open will likely be GMUs 68, 75 & 78. Once CDOW determines that a specific GMU is ready to have moose hunting, federal land use agencies will be consulted and public meetings will be held to discuss the proposed opening and a determine a suitable objective for the specific GMU(s). An issue paper incorporating these recommendations will be forwarded through CDOW staff to the Wildlife Commission for approval. As new units are opened to hunting, the overall DAU objective will be increased by the amount determined suitable for the respective GMU(s). Attempting to establish a population objective incorporating these outlying areas prior to opening hunting would greatly complicate matters, given the absence of available management actions in these unhunted areas.

7.22 Post Hunt Herd Composition

7.22.a (bulls/100 cows). Moose require a higher male:female ratio than deer, elk or antelope for successful breeding since bulls do not form harems. Furthermore, since bull moose have been classified a once-in-a-lifetime trophy by the Colorado Wildlife Commission, it is highly desirable to have older bulls in the population. Archery and muzzle-loading hunting occurs before the rut takes place and rifle season occurs early in the rut. The best situation will be to have between 55 and 65 bulls:100 cows in the post-hunt population. This will allow for a reasonable amount of bull hunting without sacrificing quality, or raising the risk of lowered production due to delayed breeding during 2nd or 3rd estrus cycle. This will be accomplished by issuing the appropriate mix of antlered and antlerless licenses based on computer modeling scenarios.

Hunters harvesting bull moose are required to have their animals checked at a CDOW office. Measurements of the antlers are typically taken at this time. Since 1999, the antler spread of bulls harvested in this DAU has averaged slightly over 41 inches (see Appendix D). Our goal is to harvest a small percentage of the bulls in the population during any one year, in order to maintain this level of quality over time. If too many bulls are harvested,

significant recovery time will be needed since it typically takes 4-5 years to produce a bull of this size following birth.

7.22.b (calves/100 cows). Calf ratios are not directly impacted by management practices and therefore cannot be readily altered. Twinning has been fairly common in moose following their introduction into vacant habitats. CDOW will keep this herd in balance with the capabilities of the habitat in order to maintain reasonable productivity in this herd. Beyond that, and the maintenance of adequate bull ratios, there is not much that can be done to change calf ratios.

During the five year period following the initial transplants, when radio-collared animals were being monitored, pre-season calf ratios averaged 52 calves per 100 cows. Should observed calf ratios fall significantly below this, it could be a sign of trouble in the population.

7.3 Public Satisfaction Objective

Moose have high value for both consumptive and non-consumptive users. Although CDOW derives no income from non-consumptive use, watchable wildlife is an important component of the Long-Range Plan and is also a provision of CDOW's legislative mandate. Moose viewing provides an added attraction for visitors, and in some cases may be the primary motivation for a visit, which benefits local economies.

Moose hunting opportunity is provided only through the license drawing. Bull moose are once-in-a-lifetime trophies. Given this limited opportunity, it is important that hunters are afforded a quality hunting experience. During the first six years of seasons hunters have had the opportunity to harvest larger bulls (83% success, with average antler spread exceeding 41 inches) and overall success for cow hunting has been relatively high (84%). Moose hunters desire a quality hunt and this can be delivered through proper management.

CDOW will assess public satisfaction through feedback given at public meetings, comments received at Service Centers and by individual employees, and input derived from public meetings and survey forms.

8. IMPLEMENTATION

Hunting is already occurring in parts of the DAU. Once the Wildlife Commission selects the herd objectives, the appropriate number of permits to achieve these objectives can be issued. It is recommended that permits continue to be increased slowly over several years so that potential problems with hunter pressure/distribution can be identified before they become severe, and solutions can be developed. Efforts will be made to keep the USFS involved in the management of this species on a local level, particularly with protection of the riparian habitat, through monitoring willow stands. A moose observation database is already in use and data is being collected—this will continue. CDOW will implement trend counts using fixed wing aircraft in areas of higher moose densities and will attempt to refine computer modeling efforts to help in

developing a more accurate population estimate. As the moose population continues to increase in other areas, it is anticipated that more hunting opportunity can be offered, and the overall population objective for the DAU will be increased by the amount determined suitable for individual GMU(s) as they are opened.

Appendix A Decision Notice on Environmental Assessment of Moose Introduction

Appendix B Moose Releases

Winter 91/92:

12/10-11/1991: 4 cows and 1 female calf from North Park released near Spring Creek Pass on North Clear Creek (Sec 36, T42N, R3W)

1/19/1992: 1 cow from Utah released on Willow Creek

1/28-30/1992: 5 yearling bulls, 3 mature bulls, 3 female calves and 11 cows from Utah released on Willow Creek (2 yearling bulls and 1 cow subsequently died)

1/30/1992: 1 yearling bull from Utah released on S. Clear Creek (subsequently died)

Winter 92/93:

12/9/1992: 1 yearling female, 1 cow, 1 male calf, and 1 bull from North Park released on Bellows Creek (bull died)

12/9/1992, 1/15/1993: 2 cows, 2 female calves and 1 male calf from North Park, along with cow and male calf from Wyoming released on Miner's Creek

1/12/1993: 3 cows, 2 male calves and 3 female calves from North Park released on Goose Creek

1/12-13/1993: 5 cows, 2 male calves, 3 yearling bulls and 2 mature bulls from North Park released at Spar City

1/13/1993: 2 cows and bull calf from North Park released at Bristol View (calf died); 2 cows and 2 female calves from North Park released at Hogback; 2 bulls, 2 male calves and 2 cows from North Park released on River Hill

1/13-15/1993: 1 bull and 2 yearling bulls from North Park released at Browns Lake, along with a cow and a male calf from Wyoming

1/15/1993: 4 bulls, 1 male calf, 7 cows, 1 yearling cow and 2 female calves from Wyoming released on North Clear Creek (1 cow and male calf died); 1 bull, 1 yearling bull and 1 cow from Wyoming released on South Clear Creek

1/15, 2/26/1993: 2 bulls and 2 cows from Wyoming released near Santa Maria; a yearling male recaptured at Rifle was also released there later

Appendix C History of Hunting Licenses Issued for DAU M-4

Licenses in M-4	1999	2000	2001	2002	2003	2004
GMU 66	2	2	4	4	4	4
GMU 76	6	6	6	8	14	14

Appendix D Antler Spread of Bulls Harvested in DAU M-4

Year	GMU	Method	Days Hunted	Spread In Inches	Yearly Average	3-Yr. Ave. Running
1999	76	Rifle	1	35.00		
	76	Rifle	1	33.50	34.25	
2000	76	Rifle	2	46.00		
	76	Rifle	3	42.33		
	76	Rifle	1	48.00		
2001	66	Rifle	6	46.25	45.65	
	76	Rifle	2	51.08		
	76	Rifle	1	36.08		
	76	Rifle	3	38.08		
2002	66	Rifle	5	36.00	40.31	41.23
	76	Unk	1	34.42		
	76	Rifle	1	42.58		
	76	Rifle	5	35.33		
	66	Rifle	2	38.33		
2003	66	Rifle	2	41.17	38.37	41.20
	76	Rifle	1	37.08		
	76	Rifle	2	42.00		
	76	Rifle	5	41.08		
	76	Rifle	3	42.17		
	76	Mzl. Ldr.	2	32.33		
	76	Rifle	1	44.00		
	66	Rifle	4	39.00		
2004	66	Rifle	2	47.00	40.58	39.87
	76	Rifle	4	38.25		
	76	Mzl. Ldr.	1	48.58		
	76	Rifle	1	49.00		
	76	Rifle	1	44.50		
	76	Rifle	3	46.30		
	66	Rifle	2	40.50	44.52	41.24
	Average			2.34	41.24	