

MOOSE MANAGEMENT PLAN

DATA ANALYSIS UNIT M-2

Laramie River Herd

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Spring 2006



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DATA ANALYSIS UNIT PLAN FOR M-2

EXECUTIVE SUMMARY

GMUs: 7, 8, 19 and 191 (Northern Larimer County)

Land Ownership: 35% Private, 65% Public

Post-hunt Population:

Previous objective: NA (due to increase in DAU size) 2004 Estimate: 150-200

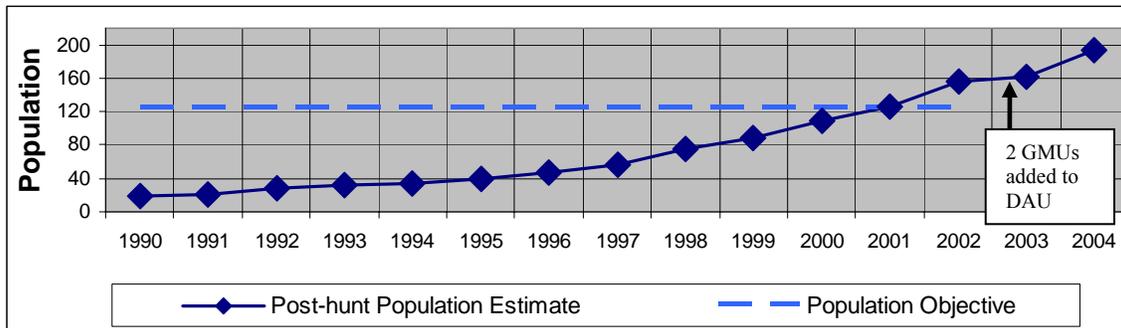
Current: *Alt. #3; 200-250*

Post-hunt Sex Ratio (bulls:100 cows):

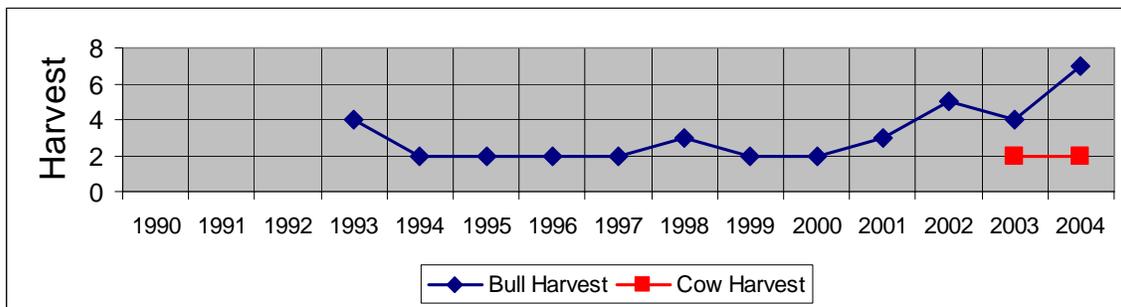
Previous objective: 60 2004 Observed: NA 2004 Modeled: 55

Current: *Alt. #2; 70-85 bulls:100 cows. Average antler spread of ≥ 40 inches*

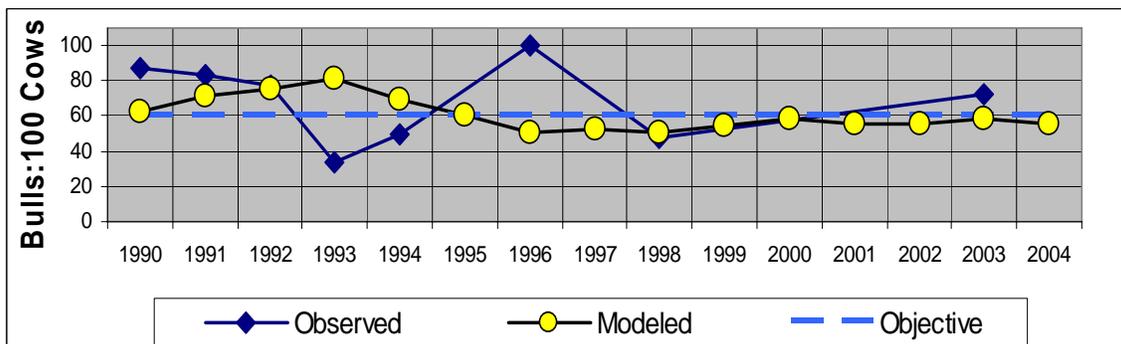
M-2 Post-hunt Population Estimate



M-2 Harvest



M-2 Post-hunt Sex Ratios



Background

The M-2 moose herd began as a reintroduction effort in 1987 with the release of 12 animals. Hunting began in 1993 with the DAU comprising GMUs 7 and 8. As the population has expanded and pioneered into available habitat in surrounding GMUs, both opportunity and DAU size have increased. Currently the DAU includes GMUs 7, 8, 19 and 191 and provides significant watchable wildlife opportunities as well as a comparatively high quality of hunting recreation for bull and cow moose.

The population has increased steadily over the last 18 years with an estimated post-hunt herd size in 2004 of 150-200 moose (probably at the higher end). Due to the difficulty inventorying moose populations, objectives in M-2 rely on computer modeling and field staff judgement with minimum counts and classification samples as observed data. The current post-hunt bull:cow ratio is estimated at 55 bulls:100 cows. When the DAU was most recently flown in 2003 the observed ratio was 73 bulls:100 cows.

Significant Issues

The Laramie River moose herd provides trophy-quality moose hunting and moose watching opportunities. Comments received during the public involvement process were relatively consistent. Very few people desired reducing the size of the Laramie River herd. Almost all comments on population size were for maintaining or increasing numbers. If asked to choose between increased quality of bulls seen in the field (reflected in antler spread or another metric) versus increased opportunity (more bull licenses) respondents favored quality over opportunity 2:1.

Management Alternatives

The following post-hunt population objectives are being proposed for M-2: 1) reduce the population from its present level to 100-150 animals, 2) maintain/slightly reduce the current level to 150-200 or 3) allow the herd to grow slightly/stabilize at 200-250 animals. The vast majority of public comments supported current or increased moose population levels. Managing for a large increase in population size would likely have severe localized habitat impacts.

Sex ratio alternatives were: 1) 45-65 bulls:100 cows, with a quality expectation of less than 40 inches average antler spread on harvested bulls, 2) 70-85 bulls:100 cows, with a quality expectation of greater than 40 inches average antler spread on harvested bulls, 3) 85-95 bulls:100 cows, with a quality expectation of significantly greater than 40 inches on harvested bulls.

Recognizing that M-2 may already be on the high end of the current population estimate (150-200), the preferred population objective is Alternative #3; allow the herd to grow slightly or stabilize at 200-250 animals. The preferred sex ratio alternative is Alternative #2; a bull:cow ratio of 70-85:100, with an average antler quality expectation of > 40 inches on harvested bulls.

This plan was approved by the Colorado Wildlife Commission on May 4th, 2006

LARAMIE RIVER MOOSE MANAGEMENT PLAN

DAU M-2 (GMUs 7, 8, 19 & 191)

TABLE OF CONTENTS

INTRODUCTION.....	5
DAU PLANS AND WILDLIFE MANAGEMENT BY OBJECTIVES.....	5
DESCRIPTION OF DAU, HABITAT AND PAST MANAGEMENT.....	7
Geography.....	7
Climate.....	8
Land Ownership and Use.....	8
Vegetation.....	8
HERD MANAGEMENT HISTORY AND BACKGROUND.....	9
Reintroduction background.....	9
Past and Current Management.....	9
<i>Licenses</i>	9
<i>Success Rates</i>	10
<i>Quality of Harvested Bulls</i>	11
<i>Hunting Closure</i>	11
<i>Disease</i>	11
<i>Watchable Wildlife</i>	12
<i>Observed Population and Sex Ratio</i>	12
Game Damage.....	13
Habitat Management.....	14
CURRENT HERD MANAGEMENT.....	15
Current Post-hunt Population.....	15
Current Sex/Age Composition.....	15
ISSUES AND STRATEGIES.....	15
Issue Solicitation Process.....	15
Issue Identification.....	15
MANAGEMENT ALTERNATIVES DEVELOPMENT.....	15
PREFERRED OBJECTIVE AND ALTERNATIVE.....	17
LITERATURE CITED.....	18
APPENDIX A.....	19
Summary of public input	

DATA ANALYSIS UNIT PLAN FOR M-2

INTRODUCTION

The purpose of a Data Analysis Unit (DAU) plan is to give the Colorado Division of Wildlife (CDOW) direction in managing a big game 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.

DAU PLANS AND WILDLIFE MANAGEMENT BY OBJECTIVES

The Colorado Division of Wildlife manages wildlife for the use, benefit and enjoyment of the people of the state in accordance with the CDOW's Strategic Plan and mandates from the Colorado Wildlife Commission and the Colorado Legislature. Colorado's wildlife resources require careful and increasingly intensive management to accommodate the many and varied public demands and growing impacts from people. To manage the state's big game populations, the CDOW uses a "management by objective" approach (Figure 1). Big game populations are managed to achieve population and sex ratio objectives established for Data Analysis Units.

DAUs provide the framework to manage individual herds of big game animals. DAUs are generally discrete geographically, and attempt to identify an individual big game population. However, individual animal movements may at times straddle or encompass more than one DAU. While DAU boundaries are administrative, they represent the best way to encompass the majority of a herd within a biological area, and allow the most practical application of management tools such as hunting, to reach objectives. DAUs are typically composed of smaller areas designated as game management units (GMUs), which provide a more practical framework where the management goals can be refined and applied on a finer scale, typically through hunting regulations.

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, hunters, 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 when final review is undertaken 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 licenses for the herd (Figure 1). A traditional DAU plan addresses two primary goals: the number of animals the DAU should contain and the sex ratio of those animals expressed as males:100 females. The plan also specifically outlines the management techniques that will be used to reach desired

objectives. The fact that DAU plans are reviewed and revised on a 5-10 year basis provides assurances against the often-dynamic fluctuations experienced by Colorado’s big game herds. Changes in land development, public attitudes, hunter success, hunter access, research results, disease prevalence and game damage may all contribute new information needed when reviewing or revising a DAU plan. The CDOW strives to maintain a tight link between the inclusion of publics in the development of population objectives and the yearly iteration of data collection, analysis and renewed decision-making to reach those objectives.

Individual DAUs are managed with the goal of meeting herd objectives. Herd data, which is typically collected annually, is entered into a computer population model to get a population projection. The parameters that go into the model include harvest data 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**

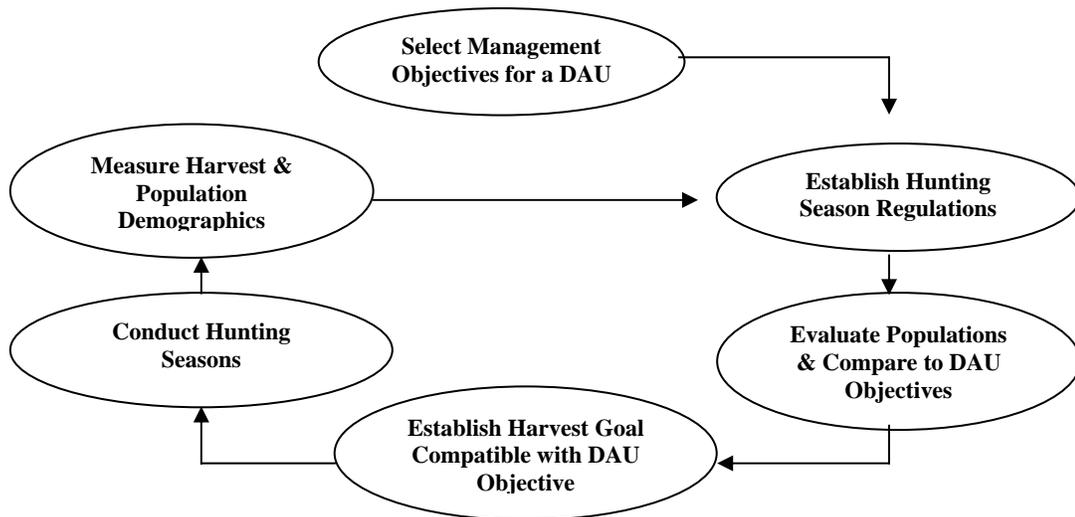


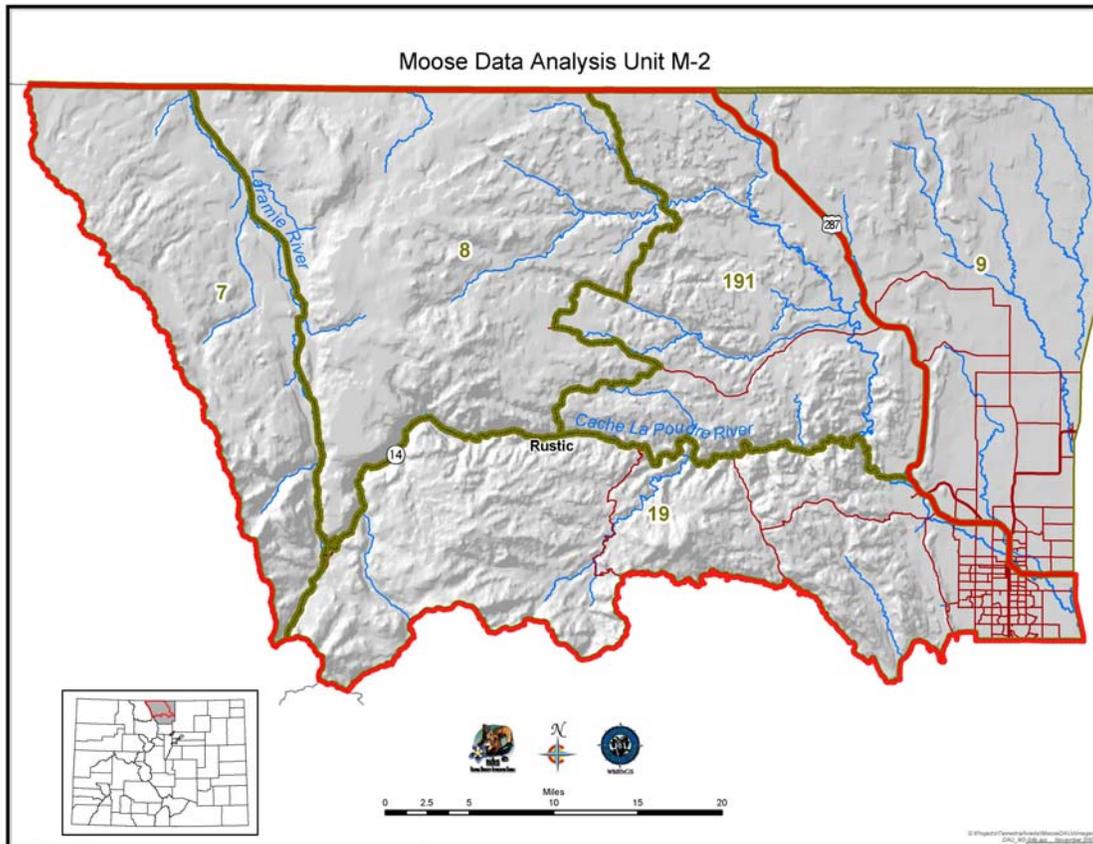
Figure 1. Management by objectives process used by the CDOW to manage big game populations on a DAU basis.

DESCRIPTION OF DAU, HABITAT AND PAST MANAGEMENT

Geography

Data Analysis Unit M-2 is located in western and northern Larimer County, Colorado, in an area that is drained by the Laramie River, and the north fork and mainstem of the Cache la Poudre River (Figure 2). The DAU is comprised of game management units 7, 8, 191 and 19. Primary moose habitat is located along the riparian communities associated with the main drainages mentioned above and their tributaries. Additional habitat is provided by the spruce-fir-aspen complex surrounding the lower riparian areas. Elevations range from 12,795 feet at the highest point in the southwestern part of the DAU to 4,921 feet along the eastern edge near Fort Collins. The DAU covers much of the northern part of the Arapaho/Roosevelt National Forest.

Figure 2. Location of DAU M-2



Climate

The climate of the Laramie River Valley and upper Poudre drainage is characterized by long cold winters and short cool summers. Precipitation and temperatures vary with elevation. The climate is relatively dry with low humidity.

Land Ownership and Use

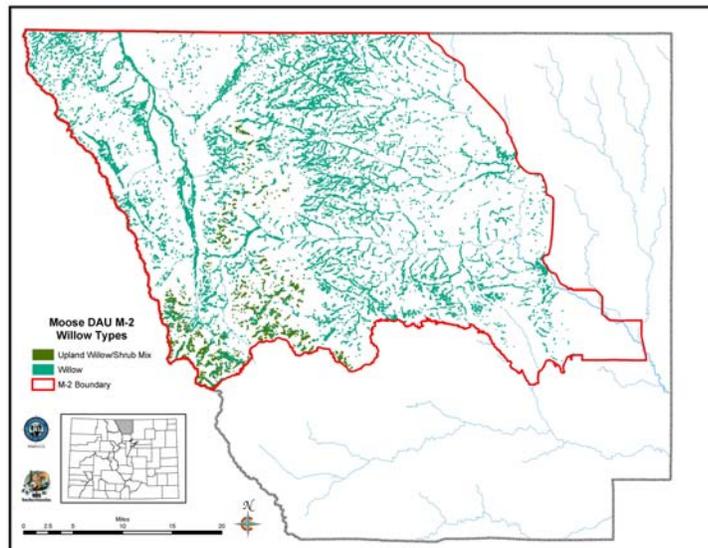
The DAU is comprised of 35% private land and 65% public land. The US Forest Service (USFS) manages the largest area (Arapaho-Roosevelt National Forest); the agency is responsible for 86% of the public land in the DAU or 56% (509,000 acres) of the total land surface. There are 4 USFS wilderness areas in the DAU; Cache La Poudre Wilderness (14 sq. mi.), Comanche Peak Wilderness (96 sq. mi.), Neota Wilderness (15 sq. mi.) and Rawah Wilderness (113 sq. mi.). All areas but the Cache La Poudre Wilderness are considered optimum moose habitat.

Human occupation is limited, particularly in the western (Laramie River valley) and south-western portions of M-2 (upper Poudre, Joe Wright Creek). To the east, namely parts of eastern GMU 8 and most of GMU 191, rural developments are more common. Irrigated hay and ranching form the main landscape use in the western part of the DAU, however, increased fragmentation due to home construction, small acreage pasturing and hobby livestock ranching is occurring, particularly on the eastern side.

Vegetation

Vegetation types range from alpine tundra on the high mountain peaks to spruce-fir forests or lodgepole pine on the middle and western high elevation portions to sagebrush-meadow or foothills shrub complexes at the lower elevations. Riparian areas are found throughout the DAU with many species of willow growing along these watercourses. Vegetation estimates for the DAU include 21,700 acres of willow and 2,000 acres of upland willow/shrub habitat (Figure 3). Willows comprise the primary food source for moose and therefore are one of the main limiting factors in determining carrying capacity and successful range expansion. While this estimated willow habitat is quite substantial in size, much of it, particularly in the eastern half of the DAU is very non-continuous in nature. Each small drainage has a willow component, adding to the DAU acreage total but due to the incompatibility of the surrounding habitat and lack of continuity with larger stands, the habitat in these eastern lower elevation tributaries should probably not be seen as legitimate moose range.

Figure 3. Willow habitat in M-2



HERD MANAGEMENT HISTORY AND BACKGROUND

Reintroduction background

Moose sightings have been documented in Colorado for over 100 years, primarily along the Colorado/Wyoming and Utah borders. Moose populations in southern Wyoming and northern Utah probably contributed to some natural immigration into Colorado in the past.

After years of planning, 12 moose were introduced into the North Park area of Jackson County in 1978. Twelve more moose followed in 1979. The introduction was quite successful with some moose immigrating to the Laramie River Valley (GMUs 7 and 8). Two cow moose lived in the upper Laramie River for about 2 years before being illegally killed in 1981. Other subsequent sightings of moose were reported in the Laramie River. Local residents in the valley wanted to see moose actively introduced to the area. To gauge local landowner and external agency support and interest, the DOW sponsored meetings with the USFS, local ranchers and residents. Ultimately, the USFS completed an environmental analysis and agreed to support a moose transplant to the area.

In October 1982, the CDOW negotiated for the capture and shipment of 12 moose (8 adult cows, 2 cow calves and 2 bulls) from Wyoming for introduction into the Laramie River Valley. Due to various problems, this transplant did not actually occur until February 1987. Animals were captured with alfalfa-baited corral traps near Jackson Hole, Wyoming and were released near the West Branch Trailhead in GMU 7 (Duvall and Schoonveld 1988). Each moose was radiocollared and eartagged, and their movements were monitored for the next 2 years. By the summer of 1987 all moose were still within 12 km of the release site. In the fall of 1987, 2 moose had left the Laramie River valley; one young bull had moved into North Park and one cow had wandered into Wyoming (Duvall and Schoonveld 1988). To date this original moose population in the Laramie River area has increased due to strong production and recruitment, good habitat, possible augmentation from surrounding moose populations and limited hunting pressure.

Pioneering individuals moved into suitable habitat in the Upper Cherokee Park/Eaton Reservoir area, along Long Draw Road, Rocky Mountain National Park (RMNP) and Pingree Park areas. Current moose concentration areas include the core Laramie River Valley, but also much of western GMU 19. Moose almost always be seen at some point along the Long Draw Road from Highway 14 to the RMNP boundary. Hunters, outfitters, wildlife watchers and DOW staff report consistent concentrations of moose in the Comanche Wilderness area, the Rawah Wilderness area and much of north and central GMU 8 (Deadman Road, Pearl-Beaver Road, Sand Creek, west end of Cty Rd 80C). Presently the vast majority, if not all, of what is considered suitable moose habitat in M-2 is occupied, although densities vary according to location.

Past and Current Management

Licenses

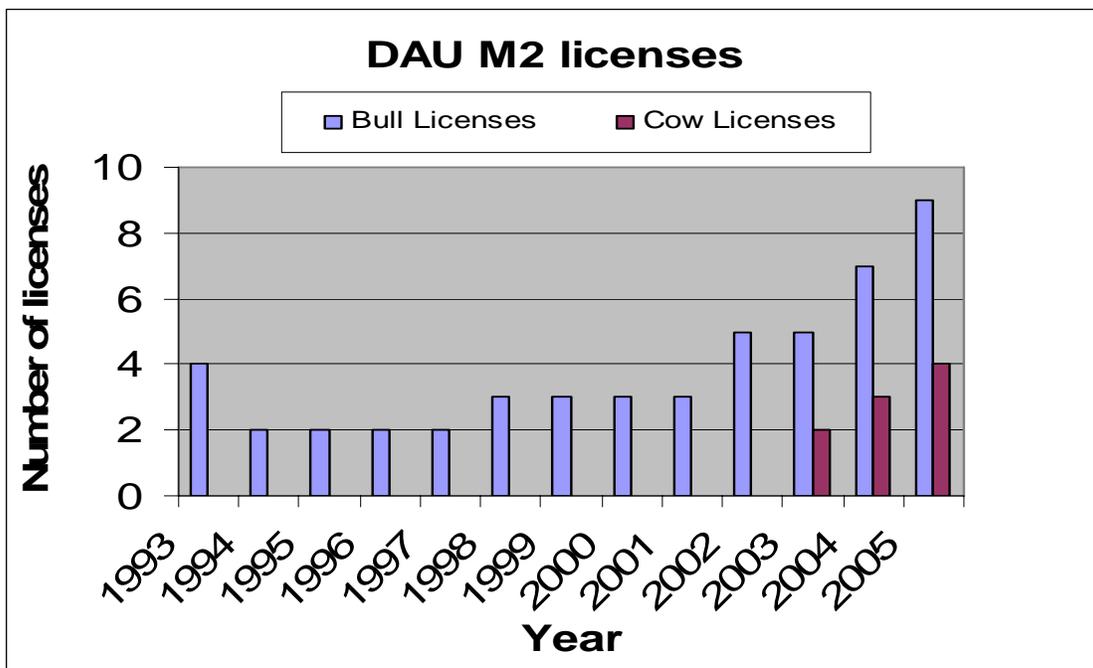
Negotiations with the USFS resulted in an agreement that a moose transplant to GMUs 7 and 8 was contingent upon the initiation of population management with hunting once moose numbers reached a predetermined level (approx. 50 moose). In 1993, the population in the Laramie River was estimated to be about 50 animals, and

following the gathering of public input, the CDOW initiated a hunting season by issuing 4 bull licenses.

Since hunting was initiated over 10 years ago, the number of licenses allocated for DAU M-2 has increased to a total of 9 bull licenses and 4 cow licenses for 2005 (Figure 4). The size of the DAU itself has increased, starting with just GMUs 7 and 8, but expanding in 2004 to include 191 and 19. Currently, GMUs 7, 8 and 191 are blocked together, allowing a hunter who draws a license to hunt in all 3 units. In 2005, one bull and one cow license were allocated to GMU 19, with the license holders restricted to that GMU only. The units were separated in this manner to focus hunter pressure and harvest in units that contain the most moose and avoid overharvest in GMU 19.

In 2005, 13 total moose licenses were issued for the DAU. Since license numbers for the DAU were 10 or greater, one license will be allocated as non-resident in 2006.

Figure 4. M2 license numbers 1993-2005



Success Rates

All moose licenses in M-2 are currently “floated”. This creates a pool of licenses, which have an equal chance of being drawn without regard to method of take. Since overall success (across all methods of take) has been almost 90% over the last 5 years (Figure 5), any method of take is currently considered to have the same high chance for harvest and therefore licenses are not allocated by method.

Figure 5. Statewide and M2 harvest success rates for all methods

Year	M2 Bull %	M2 Cow %	Statewide Bull %	Statewide Cow %
2000	67	NA	91	79
2001	100	NA	86	81
2002	100	NA	84	86
2003	80	100	90	86
2004	100	67	87	75
AVERAGE	89.4	83.5	87.6	81.4

Quality of Harvested Bulls

While M-2 is not currently being intentionally managed for “quality” of bulls; the historical hunting pressure and presence of refuges in a previously non-hunted GMU (19), allowed a large proportion of older age class males to develop in the population. If antler size, measured as total spread or any other quantifiable characteristic, is used as an index to the “quality” of male animals harvested in each DAU, then M-2 could currently be considered a “quality” DAU. Based on antler spread measurements from mandatory moose checks of harvested animals across the state, bulls harvested in M-2 in 2004 averaged 6.6 inches wider than bulls harvested in the remainder of Colorado (43.7 inches in M-2, 37.1 inches for remaining statewide). This was based on 41 submitted check forms from other DAUs and 6 check forms from M-2. Due to non-compliance with mandatory check submissions these 47 check forms don’t represent the total number of bulls legally harvested in 2004 (61 bulls).

Hunting Closure

In 2004, with the addition of moose hunting in GMU 19, a moose hunting closure was established within ¼ mile of Hwy. 14 (Poudre Canyon) on either side of the road. This closure encompasses part of all 4 GMUs. The closure was formally proposed as a way to maintain moose viewing opportunities and to prevent potential conflicts between moose viewers and hunters.

Disease

Elaeophra schneideri, a parasite which invades the carotid artery and restricts blood flow to the brain of infected deer, elk and moose, has been reported in the adjacent North Park population. It is most common in the SW United States, with mule deer being the nonpathogenic carrier and the horse fly as the vector. While moose mortality from this parasite has not been documented in M-2, it appears moose are quite susceptible to this parasite (Lankester and Samuel 1998).

The parasitic roundworm, *Parelaphostrongylus tenuis*, commonly referred to as brainworm, has been documented in moose in eastern states, but never as far west as Colorado. The white-tailed deer is the normal host and is unaffected by the parasite, however severe neurological damage will occur in infected moose (Denney 1976, Lankester and Samuel 1998). This disease has not spread to the western part of the continent, even though white-tailed deer occur in much of the West. The Laramie River has a small population of white-tailed deer, so there is at least a theoretical potential for this disease to infect the M-2 herd.

Moose DAU M-2 overlaps one of Colorado's highest chronic wasting disease (CWD) prevalence mule deer herds. CWD was documented for the first time in free-ranging moose in September 2005 in a bull moose harvested just southwest of M-2. This case was detected as part of the mandatory statewide testing protocol for hunter harvested moose. Moose are also apparently susceptible to CWD infection after oral exposure to 5 g of infectious brain material under experimental conditions (T. J. Kreeger, personal communication).

Watchable Wildlife

Moose are undoubtedly one of the most sought after species of "watchable wildlife" in Colorado. Due to their relative tolerance of people, moose lend themselves to being easily viewed and photographed. Managing the M-2 moose herd to preserve opportunities for non-consumptive use has always been an important goal. It is the intent of the CDOW to consider non-consumptive use of this moose population along with managed hunting as legitimate considerations when selecting management objectives and strategies.

Observed Population and Sex Ratio

One major biological management objective that has been advanced by some moose biologists is the maintenance of a relatively high bull:cow ratio in the population. Unlike elk, a healthy moose population should be composed of a high proportion of bulls, particularly mature bulls (Schwartz 1998). While studies in Alaska working on moose inhabiting the open tundra (where moose tend to herd or spend time in groups) have not showed a negative relationship between bull:cow ratios and calf:cow ratios, work by researchers on taiga-inhabiting moose have shown that reducing bull:cow ratios below a certain threshold can affect population performance (Schwartz 1998). This is due to the relatively solitary nature of Shiras moose, the wooded habitat they live in and the mechanisms by which mating occurs across a large spatial scale. Unlike other cervid species which tend to concentrate and thereby facilitate breeding of multiple females by one male, bull Shiras moose in wooded habitat may only have time to tend and breed a small number of females during the rut. Maintaining relatively high bull:cow ratios at or above a threshold level (>65 bulls:100 cows), will insure an adequate number of bulls for breeding, reduce the proportion of cows that cycle into second estrus, provide opportunity for hunters and non-consumptive users to observe mature bulls and increase the potential for hunters to harvest mature animals.

Population estimates are difficult to gather due to the solitary nature of moose, the large expanse of habitat containing a relatively small number of moose, and the cost of intensive aerial surveys. The M-2 moose population has been modeled using bull:cow and calf:cow ratios obtained from helicopter flights conducted over the primary portion of winter range (Figure 6). Figure 7 shows the total number of animals observed from these surveys. The actual population size exceeds these trend numbers due to an imperfect detection probability of moose that are below the helicopter and the fact that only specific areas were surveyed for moose. With the increasing population of moose in M-2 and their expanding range, some moose are wintering in small isolated areas that can't be searched in an efficient manner when aerial surveys are conducted.

Figure 6. Observed bull:cow and calf:cow ratios from aerial surveys 1989-2003

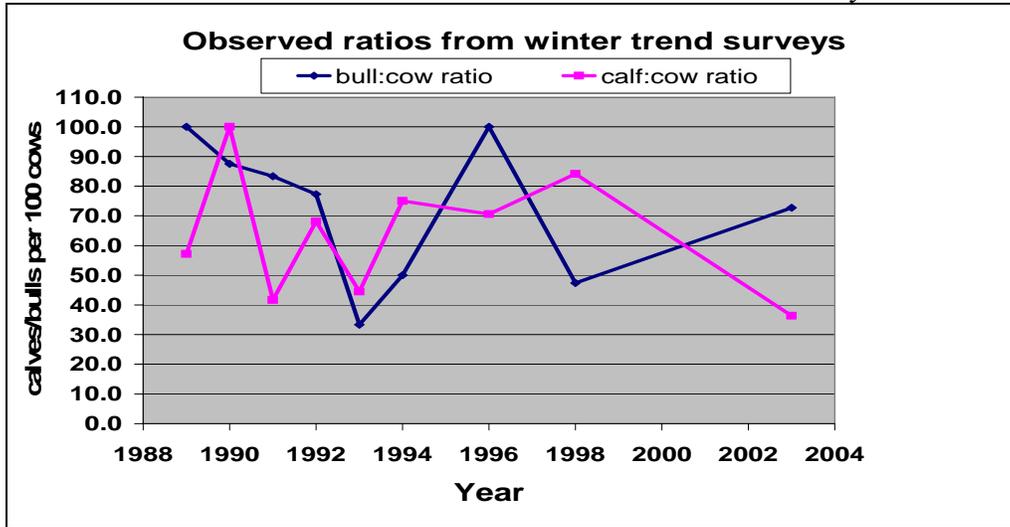
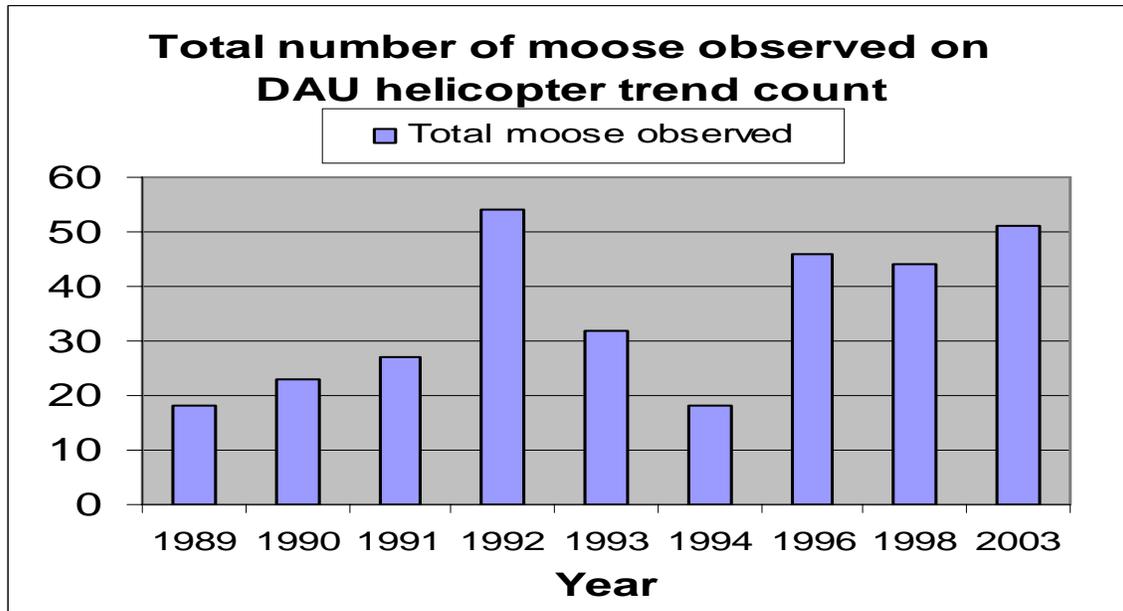


Figure 7. Total moose observed during aerial surveys 1989-2003



Game Damage

Currently, there is no significant reported game damage occurring due to the M-2 moose population. The possibility exists however, of increased damage to private lands from moose as a result of increasing population levels. Should damage occur, adequate provisions are incorporated into existing game damage laws to effectively deal with claims. For landowners in GMUs 7, 8, and 191, the Northern Larimer County Habitat Partnership Program Committee can also be useful in helping to provide financial compensation for documented losses.

The CDOW will continue to work with the USFS to assure healthy habitat conditions on public lands within the Arapaho-Roosevelt National Forest. The total

population objective recommended in this document will aim to maintain moose numbers at a level to prevent habitat overuse or degradation.

Habitat Management

A carrying capacity study based on available willow forage was done in the Laramie River Valley in 1992 (Kufeld and Steinert 1992). While this study is almost 15 years old, it provides the most relevant information available for assessing carrying capacity. The results of this study indicated that the winter carrying capacity of the Laramie River Valley area was approximately 250-270 moose. However, there are other factors such as game damage and localized range degradation which should be considered when setting a desired maximum population for this herd. As a result, the long-range population goal for GMUs 7 & 8 should probably be less than 250, while GMUs 19 and 191 (which were not considered in the willow forage study), with a reduced quantity of available habitat relative to the Laramie River, would contribute an additional small proportion to the DAU population total.

As the moose population in GMUs 7 and 8 has grown, impact to willow communities has become a concern. Moose habitat, particularly winter range, in some cases can be very localized, and the potential for overuse of certain riparian areas can exist. There is no willow monitoring or habitat assessment program currently in M-2 that would allow formal quantitative conclusions about habitat conditions.

Moose prefer a mixed, subclimax community (riparian/willow, older growth clearcut, fire-impacted, aspen, etc.) but climax coniferous forests are used for shelter, escape, cover and bedding. Mature stands of lodgepole pine or spruce/fir can be crucial to overwinter survival, both as a secondary source of forage as well as thermal cover (Kufeld and Bowden 1996). It is therefore beneficial to maintain coniferous forest areas adjacent to willow bottoms. This provides a source of year-round foraging habitat, as well as supplemental foods sources and winter cover. Currently these habitat conditions are adequate in M-2.

Any future habitat improvement projects should be directed at increasing “desirable” willow species in riparian areas and not just increasing total amount of willows available. Moose studies suggest that in habitats such as those found in M-2, Geyer willow (*Salix geyeriana*), Booth willow (*Salix boothii*), Drummond’s willow (*Salix drummondiana*), and yellow-twigged willow (*Salix monticola*) will be the primary willow food source (Wilson 1971, Duvall and Schoonveld 1988, Kufeld and Steinert 1992). In the Laramie River Valley, Steinert and Kufeld (1992) found Geyer and Booth willow to represent almost 50% of the willow biomass. Steinert and Kufeld (1990) report that in North Park, Geyer willow is by far the most plentiful willow species, but it is vastly underutilized relative to abundance. Hanna et. al (1989) report that Geyer willow was less nutritious and less digestible to moose than other willow species in Wyoming. Similar to carrying capacity estimates for Shiras moose near Lander, Wyoming (Hanna et. al 1989) and North Park (Steinert and Kufeld 1990), the estimate for the Laramie River Valley (Steinert and Kufeld 1992) assumed 15% utilization of Geyer willow and 50% utilization of all other remaining willow species. While Steinert and Kufeld (1990) didn’t see any use of Booth willow in North Park, Hanna et. al (1989) reported that moose in Wyoming preferred it. Evaluation of Geyer willow condition may not provide much useful information assuming it is utilized at a much smaller rate than its proportional abundance.

CURRENT HERD MANAGEMENT

Current Post-hunt Population

Based on the M-2 population model, as well as observed data from aerial inventories and field personnel sightings (see observed data section above) the 2005 post-hunt population is estimated at 160-190 animals.

Current Sex/Age Composition

Annual computer modeling, as well as aerial classification flights projects a 2005 post-hunt bull:cow ratio of 60-75 bulls:100 cows and a calf:cow ratio of 35-50 calves:100 cows.

ISSUES AND STRATEGIES

Issue Solicitation Process

A letter inviting sportsman to attend the DAU planning meeting and/or requesting written comments on management was sent to all hunters who applied for a cow or bull moose license in DAU M-2 for 2005.

Input on the M2 plan was obtained by advertising in local newspapers about both the DAU plan meeting as well as the creating an opportunity for members of the public to submit written comments to the CDOW. A public meeting was held April 26, 2005 in the Glacier View Meadows subdivision, which is located in the geographical center of the moose DAU. Attendees filled out a questionnaire highlighting what they felt the major management issues were, as well as providing general comments on management, moose/human conflicts, quality versus opportunity, etc.

All written comments that were received during the entire comment period are attached as Appendix A.

Issue Identification

The following issues were consistently raised by respondents and DAU meeting attendees.

- 1- "Quality" – high bull:cow ratios, with less available licenses versus "Opportunity"- more licenses issued annually with fewer large males in the population. Comments reflected approximately a 2:1 ratio favoring quality over opportunity.
- 2- M-2 has an increasing moose population and very few comments reflected a desire to see a reduction in population. Most wanted current numbers or more moose.

MANAGEMENT ALTERNATIVES DEVELOPMENT

Several population objectives are listed, obviously many other possible alternatives exist. Population control will be achieved through limited hunting. It is important to note that exact population estimation of low-density, locally-isolated moose herds is expensive and logistically difficult. Population estimates given below as alternatives will be based on observed counts of moose during classification flights, CDOW field staff population estimates and computer modeling of the population as part of the annual license setting procedure. Because it is difficult to accurately inventory moose populations in Colorado, additional DAU objectives based on condition of willow communities, hunter satisfaction surveys, and population trends monitored using standardized surveys may be considered in the future.

Post-hunt Population Level

Population Alternative #1

Reduce the post-hunt population to 100-150 animals

This option would require significant increases in both bull and cow licenses in the short-term. This would result in a reduction in “quality” of the bulls harvested during the short term as the population was lowered to the new objective. Ultimately, this lower population level would result in a lower level of hunting opportunity than exists with the current herd and would probably have a reduced amount of watchable wildlife opportunity. Based on current habitat quality in relation to current population size, this reduced herd would have very little impact of overall habitat conditions. While very unlikely, localized overutilization could occur at times, as it would with almost any population size. The public did not support this option.

Population Alternative #2

Maintain/slightly reduce the post-hunt population to 150-200 animals

This option would necessitate a harvest regime that would stabilize the population at approximately its current level. This would possibly mean a short-term increase in hunting opportunity followed by a stable number of licenses issued each year to balance the annual population increase. Habitat quantity across the entire DAU is sufficient to support this level of herd size, although localized overutilization may occur at times.

Population Alternative #3

Allow the post-hunt population to slightly increase or stabilize at approximately 200-250 animals which should be a level compatible with existing habitat in the entire DAU. Based on Kufeld and Steinert (1992) this population alternative is still significantly below the carrying capacity of just the Laramie River Valley itself. This alternative would permit moose numbers to increase slightly across the DAU from present levels if the herd is at the lower end of the estimate, presumably with some significant increases in animal numbers in eastern parts of the DAU. If the herd is closer to the 200 end of the current 150-200 estimate this alternative would be more of a stabilization. Current license numbers would increase as the population increased, and then remain at a level appropriate to maintain the herd within the population/habitat parameters. This population level would require more intensive habitat monitoring, as this herd would be at the maximum level it is believed the habitat quantity can support. Localized overutilization may occur in several areas where moose densities are highest. This population level will provide the greatest overall increase in both consumptive and non-consumptive recreation. However, as the population nears carrying capacity, density dependence responses may occur such as decreased calf survival, lower pregnancy rates and decreased body and antler size.

Herd Composition- Sex ratios

Composition Alternative #1

45-65 bulls:100 cows

This alternative represents the lowest level of quality in the bull segment of the population relative to the other options. This composition would have reduced watchable wildlife opportunities and might result in lowered production due to open or late-bred cows. Average antler spread of harvested bulls would be expected to be ≤ 40 inches.

Composition Alternative #2

70-85 bulls:100 cows

This alternative approximates the current level of bull ratios and bull quality (current M-2 average spread is 43.7 inches). Average antler spread of harvested bulls would be managed to be ≥ 40 inches.

Composition Alternative #3

85-95 bulls:100 cows

This option would require, at the least, a reduction in bull harvest in order to obtain a nearly equal sex ratio. Given a herd at or above the population objective this could also be accomplished with more intense cow harvest. With a large component of mature bulls in the population, this alternative would represent the maximum “quality” for both consumptive and non-consumptive users. Average antler spread of harvested bulls would be managed to be significantly greater than 40 inches.

PREFERRED OBJECTIVE AND ALTERNATIVE

Population Alternative

Population alternative #3 (200-250 post-hunt population) is the preferred alternative based on public input and field staff evaluation of habitat conditions, recreational opportunity, conflicts and current herd levels. Although the accuracy of the M-2 population model cannot be verified with available data, the current moose population in M-2 is estimated to be near the low end of this population range. This alternative would allow the herd to be managed at a high population level, while acknowledging that stabilization of this herd, mainly through increases in cow harvest, is not very far away. Almost no public input received reflected a desire for less moose; DOW field staff believe that the herd can be managed at this high level (which is still within the range of the current population projection), but that numbers in certain areas of the DAU are reaching maximum thresholds that the habitat can support.

Composition Alternative

Herd composition alternative #2 (70-85 bulls:100 cows and/or average antler spread of harvested bulls ≥ 40 inches) is recommended. This bull ratio will provide significant recreational opportunity for harvest and non-consumptive use, while assuring that cows are bred in their first estrus therefore maximizing productivity. This ratio can be maintained by issuing the appropriate level of bull and cow licenses each year after evaluation of observed field data and annual averages of antler spread from harvested bulls. If the quality of harvested bulls is decreasing below 40 inches, reductions in bull harvest can increase the age structure of the male component and increase mature animals with “quality” antler growth.

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APPENDIX A

Summary of public input

COMMENTS

* other than waiting for a license system works well

* continue to manage for bigger, quality bulls

* manage for quality bulls & keep up the good work

* believes in quality not quantity

* believes in quality vs. opportunity, worried about game damage conflicts with the landowners and is unaware as to the probability of moose herds being infected by CWD – delighted with our efforts thus far in reintroducing/maintaining the moose herd.

* I would think that the number of hunters allowed, would reflect a fair harvest number for hunters and also the quality of bulls to be good. Maybe not trophy quality but respectable. I certainly wouldn't want to see moose go the same direction as elk in this state have gone (great numbers with NO quality). Let's manage the animals – NOT all of the special interest groups with their agendas!!

* to see the herd managed for "Quality" bulls- when he finally gets his once in a life time tag, he wants a MONSTER.

* based on my 30 yrs of hunting in GMU 8, (mostly along the Trail Creek & Green Mtn. area) in this time the moose population has grown from none to moose in about every draw. Although the moose are fun to observe, I've noticed that as the moose population has steadily increased, the elk population has steadily decreased. Last year I hunted the full muzzleloader season and never seen an elk. My buddy saw 3 and this was the worst elk season for finding animals that we've ever experienced. Whether moose has affected this change by dominance or by disrupting the elk calving, I don't know. As for changing the moose tags, the only thing that I could suggest is to maybe double the number of tags and/or maybe transplanting some of the moose from this area.

*as an avid big game hunter in CO for more than 25 yrs. I dream of some day having an opportunity to hunt moose. I believe hunting bull moose in CO should be limited to small numbers to allow bulls 6-8 yrs to reach maturity. Harvesting a young bull really doesn't interest me, as I would like to mount the bull in addition to having top quality meat for the freezer. Obtaining a license should allow hunters a good chance to harvest a good representative of the Shiras/Wyoming Moose species. I believe CDOW is doing a fine job of managing the moose herds, informing hunters of further strategic mgmt practices & asking hunters for their comments/suggestions.

* I have owned land and have hunted in the Sand Creek area for over 20 yrs. I have seen the quantity & quality of hunting in Unit 8 decrease to the point that I purchase a license just to save an elk or deer. In the last 20 yrs I have seen this area's herds come to a point of near extinction! Moose have gradually increased in numbers however MUST be limited on harvest. I have seen more moose while hunting elk than elk.

What I favor:

****No hunting for deer for the next 3-5 yrs. in Unit 8**

****Reduced licensing for elk harvest in Unit 8**

****I do not know how many licenses are issued in units 7&8 for moose; I favor the present restricted issuance.**

Although I have to repair my fencing every spring due to elk/moose running through, I don't mind the inconvenience, I'd rather have more animals.

*meat hunter, large bulls aren't important – don't have information on game damage but think those

who have had damage should be compensated fully or animals causing damage should be removed. We can't offer good hunting at the expense of private land owners.

*prefer management for quality bulls. Suggest using this herd as transplant stock for starting moose in other areas of Colorado. Colorado needs more moose.

*would like to see GMU's 7-8-19&191 managed for opportunity with regards to moose, I think this would allow greater elk quality due to reduced competition and as well as increasing opportunity for moose.

*have quality rather than quantity of permits. The only real suggestion that I have is to allow only residents the opportunity to hunt moose in Colorado. This would free up more permits for residents. There are many states that only allow their residents the right to hunt certain species.

*maintained strictly for quality (including plan for bull to cow ratio) – if the habitat can support this species, I support introduction anywhere in our state of Colorado. I firmly believe this animal is a key resource that can provide a platform to educate people how to preserve wildlife & how important it is to protect our land, water & wildlife resources from over development & extractions, be it in commercial or private form – it is imperative we have strong moose herds to supply a truly natural food source for the migration and probable establishment of wolves (*Canis lupus*) in our state. This more than likely would concentrate wolves around these herds & mitigate impact to sheep & cattle entities.

***Answer 1** – would like this herd managed more towards opportunity & less towards quality. A large portion of the GMU is within the Wilderness Boundaries (Rawah) and also held under private ownership (Larimer River). I believe that even with an increase to the current quota there will continue to exist exceptional bulls, all be it that they may reside deeper in the Wilderness or on private property.

***Answer 2** – I do not see significant issues related to conflicts between moose and other wildlife or domestic wildlife. I do appreciate and recommend signage along major maintained roadways (Larimer River Road & CR 80) identifying moose as being in the area)

***Answer 3** – I would appreciate CDOW opening up for moose hunting unit 19. I would support a decision to make licenses more specific than they exist now (i.e. separate quota & licenses for unit 7-8-19&191 respectively). Utilizing sound & accurate field and biology data, I would support additional cow moose license becoming available.

*would like to see these units “along with statewide” managed or maintained for quality over quantity. Not concerned about the amount of numbers in some areas but would like to see many more moose introduced to the state's largest flat top with the most amount of water per 15 sq. mile. ** The Grand Mesa.** I was happy to see the few that did make it in there, which were transferred from the creed herd.

Answer 1 – FOR MAXIMUM OPPORTUNITY. I believe that any moose harvested should be considered a trophy regardless of sex or antler size.

Answer 2 – I also believe that moose hunting in Colorado should be a ONCE IN A LIFETIME OPPORTUNITY, regardless of the sex of the animal. I am not concerned about hunting pressure since all moose hunter (most often) will not be hunting during the same time period, i.e. archery/muzzleloading vs. rifle season. Also there are not that many licenses available in most units, even statewide.

Answer 3 – Am I concerned about too many moose in some areas? Maybe! US Hwy 14, between GMU 19 and the others, could be a concern if too many moose occupied that corridor. I seem to see moose along the highway every time I take that trip and have seen moose on the main surface. How many moose will the habitat support may be a major question and are we there? Have there been moose/auto conflicts? Have there already been moose/non-hunter conflicts?

** I do not know if a bull moose antler point restriction would work to grow larger bull antlers, i.e. trophies. Sort of like the 4 pt restrictions for bull elk in some areas. I don't believe we have the quality of moose hunters in Colorado that could make the distinctions. I am excited about the DOW's moose efforts and also the opportunity to receive one of these very prized licenses – Keep up the good work –

* as a longtime hunter & photographer I would so much prefer the experience, whether hunting with a rifle or camera, of running into a large mature bull, an animal that has had the chance to live a little. One of the most exciting experiences a person can have while hiking the high country of Colorado is to run into a large mature bull moose at close range, and it would be wonderful if we could preserve, at least a few areas where hunting pressure is at a minimum to provide us with more quality animals.

*continue to offer limited, once-in-a-lifetime opportunity to hunt some of the most impressive bull moose in the country. **Suggestion:** The only season in which to hunt moose while no other regular deer/elk season is in progress is the rifle moose hunt in early October, an eight day season. There is currently a span of roughly 2 ½ weeks between the end of the archery elk/deer season and the beginning of the first rifle elk season. I believe more moose hunting could be done during this time, giving archery/muzzleloader hunters a chance to hunt moose while the animals are under less pressure from the many deer/elk hunters that are in the field during September. Colorado should manage quality rather than quantity.

*in favor of managing conservatively to allow superior bulls time to develop.

*Please continue to manage as trophy hunts

*Have hunted in area 8 for 25+ years. During the 2004 archery elk season I hunted west of deadman hill and saw fewer elk last season than any prior season and saw more moose than any other season. The quantity of elk had been decreasing for a few years and I believe that the moose have driven the elk out of the area. I could be mistaken around the quantity of elk for they may have moved someplace that I couldn't find, but there was less sign & sightings of elk not only by me but many other hunters. I would like to see the moose herd reduced in the area!! Hopefully this would allow the elk herd to increase!!

*I have spoken with hunters & DOW officers in this area, and none of them have ever drawn a license –with some of them going on their 9th or 10th year of application and I am on my 4th year of application. If it is going to take ten or more years to draw a license, then I would like to see the herd maintained for quality (larger bulls). I usually only see 1 or 2 moose during the elk/deer season so I'm not sure how big the herd is or if it is getting out of control. Keep up the great job of protecting our hunting future!

*like to see the moose herds managed as such that there is less hunting pressure on the moose herd & that conservative license numbers are issued to hunters. I believe this will maintain the opportunity for the general public to view these mature, magnificent animals in the wild & provide hunters the opportunity to pursue them at home in Colorado instead of in other western states. I don't believe we have too many moose, that moose are causing crop damage to the extent game management tactics should be changed or that moose are a road hazard-we just don't have the numbers in the state to support those claims throughout these GMU's.

*I am in favor of limiting licenses to the extent necessary to maintain the quality of hunting. I have been hunting in Colorado since 1963 and believe Colorado is managing the game population correctly. I have been seeing more & more big bulls in recent years and that tells me you could issue more permits. The bulls I have been seeing have been large bulls, just don't issue so many that all of them are taken before they get large.

*I hunt in unit 19 & see a lot of moose in which I think you could issue more tags. One of my biggest concerns are if you get to many moose in the area, they will move the elk out. I saw this happen to an area in Montana.

*I think you should manage these units for big bulls but at the same time keep the populations at a

reasonable number. I also believe that if you take a small portion of cows & calves, it will help them stay in smaller herds or groups which will help keep good habitat for the future of the moose. This might help them from being in places they shouldn't be. Bottom line is if I only have one shot at a bull moose in a lifetime I want a great opportunity at a trophy moose. Would also like to say that you are doing a fine job on managing these units for elk hunting, it is the best I have ever seen it in the 17 yrs. I have been hunting.

*In my opinion the moose herd is doing so well that you could loosen up on the licensees in these areas and not hurt the herd or the bull quality. Last year in Unit 19 for an example of why just because licensees are given out, the biggest bulls in the area are not necessarily taken. My friend drew the rifle moose tag for 19 and shot the first bull he saw on opening day, a nice bull but not as big as some we had seen during summer scouting trips and elk season. Also in the long draw area was the hunter who bought the expensive "big money" tag. Even with that tag, he took the first bull he saw and it was a young bull. I am usually against more restricted game management units but with moose I think it could be a good thing. I would suggest to split up 19, 1 tag for Long Draw, 1 tag for Crown Point, 1 tag for Pingree and 1 tag for the Buckhorn. The same thing for 7-8-191.

*I would like to see this herd managed for whatever the DOW concludes is in the best interest of the overall health of the north park herd. I also believe if the herd is managed for overall health, populations and habitat carrying capacity, quality is axiomatic and opportunity will come. Quality is NOT inches of horn. Quality is in the overall hunter-prey experience. I say let the people that are unhappy make their ignorant claims, accusations and suggestions. The DOW is the most educated and knowledgeable as to the needs of the north park herd.

As long as the DOW listens to hunters and fishers as the primary balance provider for this resource and not the non-hunting and non-fishing "spectator", I will respect the DOW's recommendations to the Wildlife Commission.

* Concerns regarding CWD and if this will effect the moose population. Less hunting pressure and more mature animals are what I favor, but the health of the herd is my foremost concern. Adding a moose section to your website would be great. Information on things like herd health, reproduction rates, transplants, special observations the division is making and populations estimates.

*I would like to see the moose managed to maximize total herd numbers and hopefully in doing so there would be a corresponding increase in the # of licenses. Thanks for your concern and keep up the good luck.

*I think you need to give the herd 2-3 more years of growing then start to issue a few more licenses.

*Hunters that are lucky enough to draw bull moose tags should be provided a quality experience with quality animals rather than poor quality bulls. Colorado is currently producing exceptional Shiras bulls and it would be detrimental to bull moose quality if the CDOW suddenly increased bull tags which would likely lower the quality of this once in a lifetime experience. Those hunters not interested in quality animals but would enjoy the opportunity to hunt moose for meat have the option of applying for cow tags. As the total number of moose and moose tags increase in Colorado it may come to a point where an allotted number of tags are issued for archery, muzzleloader and rifle seasons. Another option for increasing moose draw odds without increasing the number of moose tags would be to increase the number of season dates available. Additional moose hunting season outside of the rut would provide more hunting opportunity with possible less harvest success. Shorter hunting season dates during the rut and longer hunting season outside of the rut may be a way of providing more opportunity (more seasons) in the same framework of time. Additional late season date with primitive weapons may also be considered. Some states such as NV, ID & MT require applicants to purchase a hunting license before they are eligible to apply for tags or gain preference pts. Although this is a pretty expensive proposition for nonresidents it definitely weeds out applicants that aren't serious about drawing a tag and desire to go hunting. One last option that is not currently offered in Colorado is archery only moose units. Colorado currently has archery only units for mt. goat & bighorn sheep but doesn't have archery only moose units.

*Thank you for requesting input on moose management in Larimer County. I have weekly contact with moose while visiting my cabin which is located between the CSU Pingree Park campus and Rocky Mtn National Park. I visit year round, hiking in the snow during the winter (moose do not visit this area often in the winter). The high amount of brush in the river valley makes spotting & voiding a moose very difficult. Our local area has lost value for hiking or fishing because of the moose danger. An old mean moose took up residence next to my cabin for two years which made it difficult to use the cabin. One time I escaped from this moose by running & diving into a thicket of trees. The moose continued to stalk me all the way to the cabin. He waited around outside the cabin for about an hour. Some of my neighbors at Pingree Park have also been trapped in their cabins for extended lengths of time and most have been chased by moose. I am particularly concerned about the small children who visit our area and the busloads of school children and the elderly adults that visit the Pingree Park campus in very large numbers. I wonder if the Pingree Park management realized the danger to their visitors? I am a very strong supporter of environmental & wildlife protection & enhancement. Perhaps management to reduce the number of territorial old bulls in areas of conflict would be useful.

*Came into the office, couldn't make it to the Moose meeting but wanted to let us know that he would like to see more moose released state-wide.

*Couldn't attend the meeting but would like to see this area maintained for quality or larger bulls, less hunting pressure and conserve license numbers.

*Size limit should not be applied to bull licenses to create a trophy status area. The opportunity to harvest a trophy is "In the Eye of the Beholder".

Comments from DAU meeting question form

- 1) Would like to see more moose, keeping quality of bulls high. Only limit moose numbers after severe willow impacts and then only through female harvest. Large bulls have a higher watchable wildlife value, but any moose is nice to see.
- 2) M2 should be managed for quality, not opportunity, as it has taken years to get it to the where it is at. Would like to see increased numbers of animals in M2. Would only be willing to see limitations on populations after agricultural damage. Any moose seen provides a good watchable opportunity.
- 3) M2 should be managed for quality over more opportunity. Thinks the number of moose we have now is about right. Doesn't think potential conflicts should drive a limit on moose numbers. Think both bulls and cows provide a valuable watchable wildlife opportunity.
- 4) M2 should be managed for quality, not maximum opportunity. 70-85 bulls:100 cows should be used as the quality benchmark, not antler spread. The overall number of moose in M2 is about right at current levels. Overuse or degradation of habitat should be used to evaluate when to limit moose numbers. A bigger, older bull has a greater watchable wildlife value than smaller bulls or cows. Do habitat monitoring and assessment before increasing licenses any more. Watch cow:calf ratios and try to correlate better with habitat.
- 5) M2 should be managed for maximum opportunity, not quality. Would prefer to see more moose in M2. Seeing any size moose of either sex provides a valuable watchable wildlife experience.
- 6) M2 should be managed for a compromise between quality and maximum opportunity. Believes that a few more bull tags could be issued in GMU 19 without impacting quality. Would like to see more moose in M2, believes the human residents of area are highly tolerant. Believes that bulls, and specifically large mature bulls provide an increased watchable wildlife experience versus smaller bulls or females. With the large number of moose present in GMU 19, would like to see an increase in archery opportunity.