

Basalt Deer Herd Management Plan Data Analysis Unit D-53

Game Management Unit 444



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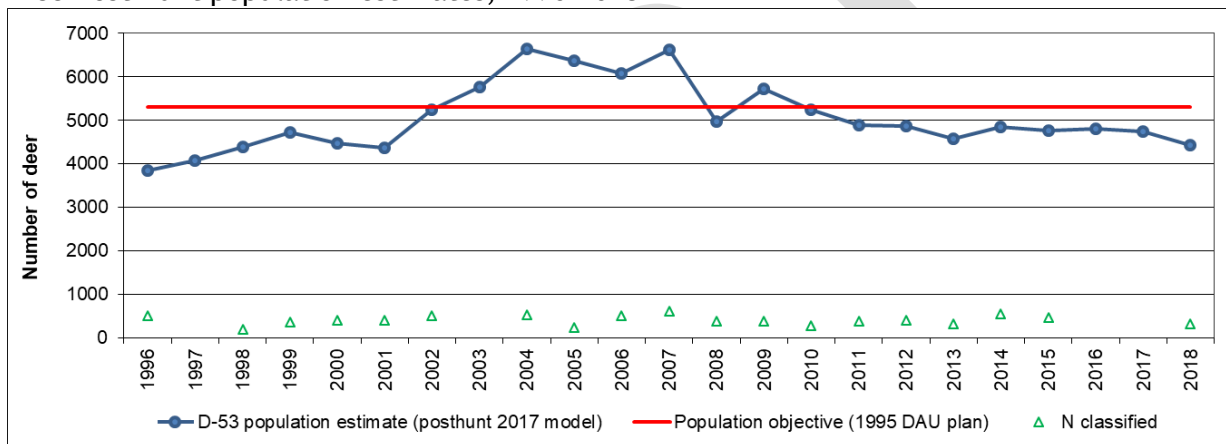
**LIVE LIFE
OUTSIDE**

Basalt Deer Herd Management Plan, DAU D-53

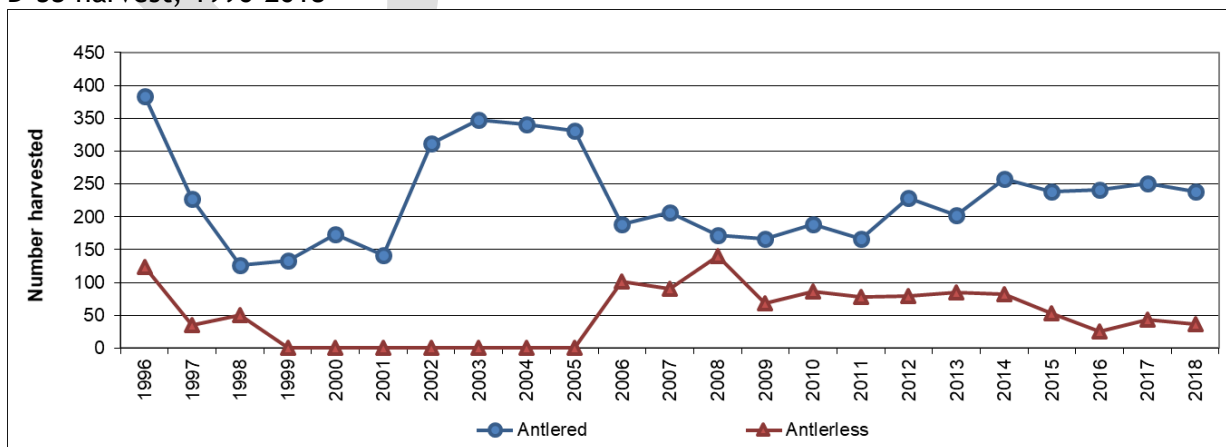
EXECUTIVE SUMMARY

Game Management Unit:	444
Current (1995 DAU plan) population objective:	5,300 deer
Current (post-hunt 2018) population estimate :	4,440 deer
Proposed Population Objective	
Alternative 1:	2,500-4,500 (midpoint 3,500)
Alternative 2 (preferred):	4,000-6,000 (midpoint 5,000)
Alternative 3:	5,500-7,500 (midpoint 6,500)
Current (1995 DAU plan) Sex Ratio Objective:	30 bucks per 100 does
Most recent (2014, 2015, 2018) 3-year average sex ratio:	42 bucks per 100 does
Proposed Sex Ratio Objective	
Alternative 1:	24-32 (midpoint 28)
Alternative 2:	28-36 (midpoint 32)
Alternative 3 (preferred):	32-40 (midpoint 36)

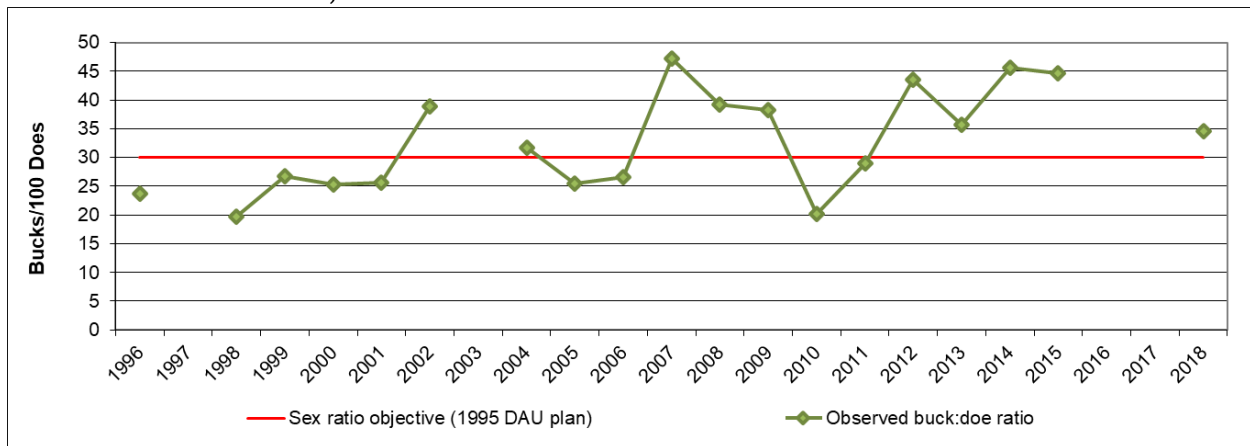
D-53 Post-hunt population estimates, 1996-2018



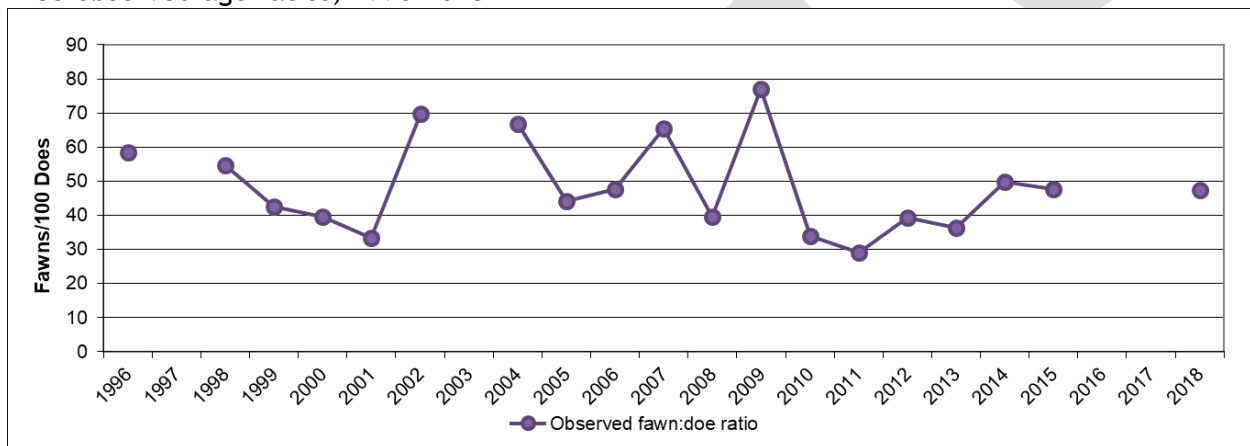
D-53 harvest, 1996-2018



D-53 observed sex ratios, 1996-2018



D-53 observed age ratios, 1996-2018



Background

The Basalt mule deer Data Analysis Unit (DAU) D-53 is located in Pitkin, Eagle, and Garfield Counties within northwest Colorado and consists of Game Management Unit (GMU) 444. The unit covers 960 km² (371 mi²), 65% of which are public lands. D-53 is bounded roughly in the area between the Fryingpan River, Roaring Fork River, Colorado River, the top of Red Table Mountain, and the ridgeline of the Sawatch Range¹. Major towns within and adjacent to the unit include Basalt, El Jebel, Carbondale, Glenwood Springs, as well as the smaller communities of Meredith and Thomasville.

When D-53 was established in 1995, the population objective was set at 5,300 deer and the sex ratio objective was set at 30 bucks per 100 does. Since that time, the estimated population has varied within -28% to +25% of the objective, between 3,850 and 6,650 deer. The population declined after the severe winter of 2007-08 and, much like other neighboring deer populations in the area, has never recovered. Within the past 5 years, the population has been on average 11% below the 1995 objective and the population trend has been generally stable. The current (2018) post-hunt population estimate is 4,440 deer or 16% below objective. The buck ratio, on the other hand, reached the 1995 objective by the year 2003. It has fluctuated over time but has generally been on an increasing trend. The most recent 3-year (2014, 2015, 2018) average is 42 bucks per 100 does, which is 40% over objective. CWD prevalence in this herd is not well characterized due to very low sample size, but so far no CWD-positive deer have been detected.

¹ For a complete description of the boundaries of GMU 444, see page 4 of the main text of this document or any big game brochure.

Although the herd's objectives were established in 1995, D-53 has never had a formal written management plan. Given the significant changes in land use and the deer herd's current and potential performance, an update of D-53's population and sex ratio objectives is due.

Significant Issues

The major issues for this deer herd involve the cumulative effects of decades of human population growth and impacts of human activities on deer habitat in the Roaring Fork Valley. The result has been a loss of habitat quantity and quality and less solitude from human disturbance. The unit's carrying capacity for mule deer has declined compared to conditions in past decades when the current objectives were set over 2 decades ago. Significant issues include habitat loss and fragmentation from land development, declining habitat condition, and impacts of human recreation on deer. Other management concerns include the need to balance competing herd management objectives.

Management Objective Recommendation

CPW is recommending a population objective range of 4,000-6,000 deer. This alternative provides the most flexibility in population management relative to the herd's current status. Within this objective range, the herd could either remain stable or be allowed to increase if habitat conditions, land use changes and/or weather conditions are favorable for population growth. CPW is recommending a sex ratio objective of 32-40 bucks per 100 does. This objective range balances the hunting public's desire for quality bucks while still maintaining enough buck licenses to provide hunting opportunities every year or few years. Because of limited public lands in the western one-third of the unit, managing lower than Alternative 3's sex ratio objective range would likely increase hunter crowding and private land trespass issues to undesirable levels. With no documented CWD in this unit yet, a slightly higher sex ratio can be sustained; but if CWD is detected and the prevalence rate reaches 5% or higher, then a revision of the sex ratio objective may be needed to adjust the sex ratio downward.

Strategies to Address Issues and Management Concerns and to Achieve Herd Management Objectives

CPW will continue to work collaboratively with our partners in the federal land management agencies, private landowners, county governments, local municipalities and NGOs to protect and enhance the remaining mule deer habitat. Important habitat conservation methods include habitat treatments, conservation easements or land acquisitions, maintaining landscape connectivity and movement corridors, and adhering to seasonal recreation closures on winter range areas. To achieve the new objectives of a population size of 4,000-6,000 deer and a sex ratio of 32-40 bucks per 100 does over the next 10 years, CPW will continue to set licenses annually, keeping in mind such issues as providing sufficient hunting opportunity for both buck and doe harvest, and sustaining a stable, if not growing, deer herd.

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INTRODUCTION AND PURPOSE

Herd management plans

Colorado Parks and Wildlife (CPW) manages wildlife for the use, benefit, and enjoyment of the people of the state in accordance with the CPW’s Strategic Plan and mandates from the Parks and Wildlife Commission and the Colorado Legislature. Colorado’s wildlife resources require careful and increasingly intensive management to accommodate the many and varied public demands and growing impacts from people. To manage the state’s big game populations, the CPW uses a “management by objective” approach (Figure 1). Big game populations are managed to achieve population objective ranges and sex ratio objective ranges established for data analysis units (DAUs).

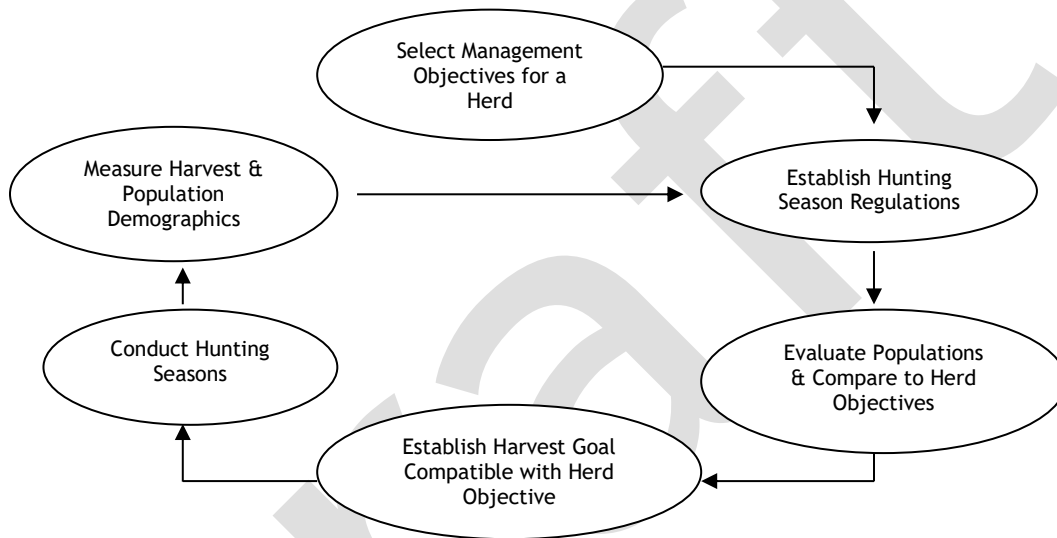


Figure 1. “Management by objectives” process used by the CPW to manage big game populations on a herd (Data Analysis Unit or “DAU”) basis.

The purpose of a herd management plan (also known as a “Data Analysis Unit” or “DAU” plan) is to provide a system or process which will integrate the plans and intentions of Colorado Parks and Wildlife with the concerns and ideas of land management agencies and interested publics in determining how a big game herd in a specific geographic area should be managed. In preparing a herd management plan, agency personnel attempt to balance the biological capabilities of the herd and its habitat with the public’s demand for wildlife recreational opportunities. Our various publics and constituents, including the U.S Forest Service, the Bureau of Land Management, sports persons, guides and outfitters, private landowners, local chambers of commerce and the general public, are involved in the determination of herd’s population and sex ratio objectives and related issues. Public input is solicited and collected by way of questionnaires, public meetings and comments to the Parks and Wildlife Commission.

A Data Analysis Unit, or DAU, is the geographic area that represents the year-around range of a big game herd and delineates the seasonal ranges of a specific herd while keeping interchange with adjacent herds to a minimum. A DAU includes the area where the majority of the animals in a herd are born and raised as well as where they die either as a result of

hunter harvest or natural causes. Each DAU usually is composed of several Game Management Units (GMUs), but in some cases only one GMU makes up a DAU.

The primary decisions needed for a herd management plan are how many animals should exist in the DAU and what is the desired sex ratio for the population of big game animals e.g., the number of males per 100 females. These numbers are referred to as the population and sex ratio objectives, respectively. Secondly, the strategies and techniques needed to reach the population size and sex ratio objectives also need to be selected. The selection of population and sex ratio objectives drive important decisions in the big game season setting process: namely, how many animals need to be harvested to maintain or move toward the objectives, and what types of hunting seasons are required to achieve the harvest objective.

Population Dynamics, Maximum Sustained Yield, and Density Dependence

Numerous studies of animal populations, including such species as bacteria, mice, rabbits, and white-tailed deer have shown that the populations grow in a mathematical relationship referred to as the "sigmoid growth curve" (Figure 2). There are three distinct phases to this cycle. The first phase occurs while the population level is still very low and is characterized by a slow growth rate and a high mortality rate. This occurs because the populations may have too few animals and the loss of even a few of them to predation or accidents can significantly affect population growth.

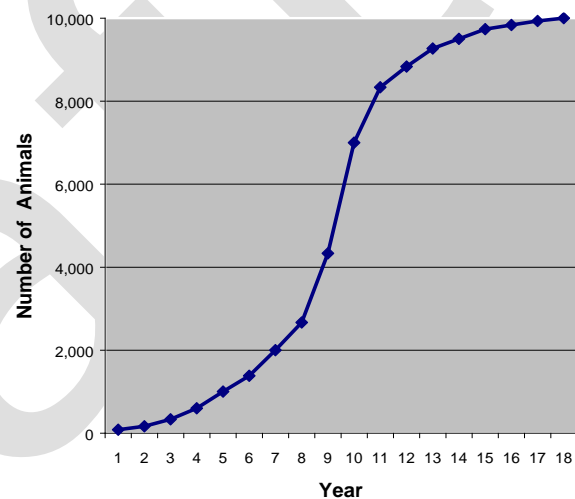


Figure 2. Sigmoid growth curve.

The second phase occurs when the population number is at a moderate level. This phase is characterized by high reproductive and survival rates. During this phase, food, cover, water and space are not a limiting factor. During this phase, for example, animals' body condition is usually excellent, age of first reproduction may occur earlier, and litter sizes can be higher. Survival rates of all sex and age classes are also at maximum rates during this phase.

The final or third phase occurs when the habitat becomes too crowded or habitat conditions become less favorable. During this phase the quantity and quality of food, water, cover and space become scarce due to the competition with other members of the population. These types of factors that increasingly limit productivity and survival at higher population densities are known as density-dependent effects. During this phase, for example, adult mule deer does may only produce one fawn rather than twins, and survival of all age-sex classes of deer (bucks, does and fawns) will decrease. During severe winters, large die-offs can occur due to the crowding and lack of food. The first to die during these situations are fawns, then bucks, followed by adult does. Severe winters affect the future buck to doe ratios by favoring more does and fewer bucks in the population. Also, because the quality of a buck's antlers is somewhat dependent upon the quantity and quality of his diet, antlers development is diminished. If the population continues to grow it will eventually reach a point called the

maximum carrying capacity or "K". At this point, the population reaches an equilibrium with the habitat. The number of births each year equal the number of deaths; therefore, to maintain the population at this level would not allow for any "hunnable surplus." The animals in the population would be in relatively poor body condition, habitat condition would be degraded from over-use, and when a severe winter or other catastrophic event occurs, a large die-off is inevitable.

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

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

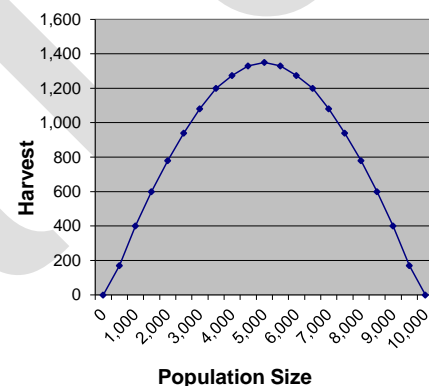


Figure 3. Maximum sustained yield (MSY) occurs at a moderate population size due to density-dependent population growth rate processes.

Actually managing deer and elk populations for maximum sustained yield is difficult, if not impossible, due to the amount of detailed biological information about habitat and population size required. Additionally, carrying capacity is not static; the complex and dynamic nature of the environment cause carrying capacity to vary seasonally and annually. In most cases we would not desire true MSY management even if possible because of the potential for overharvest and the number of mature males is minimized because harvest reduces recruitment to older age classes. However, the concept of MSY is useful for understanding how reducing population densities and managing populations near the mid-point of the habitat's carrying capacity can stimulate herd productivity and increase harvest yields. Knowing the exact point of MSY is not necessary if the goal is to manage toward the mid-range of possible population size. Long-term harvest data can be used to gauge the effectiveness of reduced population size on harvest yield.

Research in several studies in Colorado has shown that density-dependent winter fawn survival is the mechanism that limits mule deer population size because winter forage is limiting (Bartmann et al. 1992, Bishop et al. 2009). Adult doe survival and reproduction remain high but winter fawn survival is lower at higher population sizes relative to what the winter habitat can support. The intuition to restrict, or even eliminate, female harvest in herds in which population recruitment is low and when populations are below DAU plan objectives may actually be counterproductive to management goals and objectives. As Bartmann et al. (1992) suggest, because of density-dependent processes, it would be counterproductive to reduce female harvest when juvenile survival is low. Instead, a moderate level of female harvest helps to maintain the population below habitat carrying capacity (ideally on the “left” or lower side of MSY) and should result in improved survival and recruitment of fawns. Increased fawn recruitment allows for more buck hunting opportunity and a more resilient population.

Thus, the key for DAU planning and management by objective is to set population objectives in line with what the limiting habitat attributes can support. A population objective range appropriately set should be below carrying capacity.

DESCRIPTION OF DAU

Location

The Basalt Deer Data Analysis Unit (DAU) D-53 is located in northwest Colorado and consists of Game Management Unit (GMU) 444 (Figure 4). D-53 covers an area of 960 km² (371 mi²). It is bounded on the north by the Colorado River, Cottonwood Creek, Eagle County Road 10A (Cottonwood Pass Road), Forest Service Road 514 (Red Table Mountain Road), and the Fryingpan-Eagle River Divide; on the east by the divide between Lime Creek and the North Fork of the Frying Pan River and its tributaries and the Cross Creek-Homestake Creek drainages; on the south by Ivanhoe Creek and the Fryingpan River; and on the west by the Roaring Fork River. Major towns within and adjacent to DAU D-53 include Basalt, El Jebel, Carbondale, Glenwood Springs, as well as the smaller communities of Meredith and Thomasville above Ruedi Reservoir. The Colorado River and Interstate 70 are on the northern edge of the unit. Highway 82, Cottonwood Pass Road, Eagle-Thomasville Road and the Frying Pan Road provide access to the area. The Holy Cross Wilderness is on the east end of DAU D-53. This unit lies in Pitkin, Eagle, and Garfield Counties. DAU D-53 makes up about 20% of the Roaring Fork River watershed, and also the south side of Glenwood Canyon and Cottonwood Creek watershed.

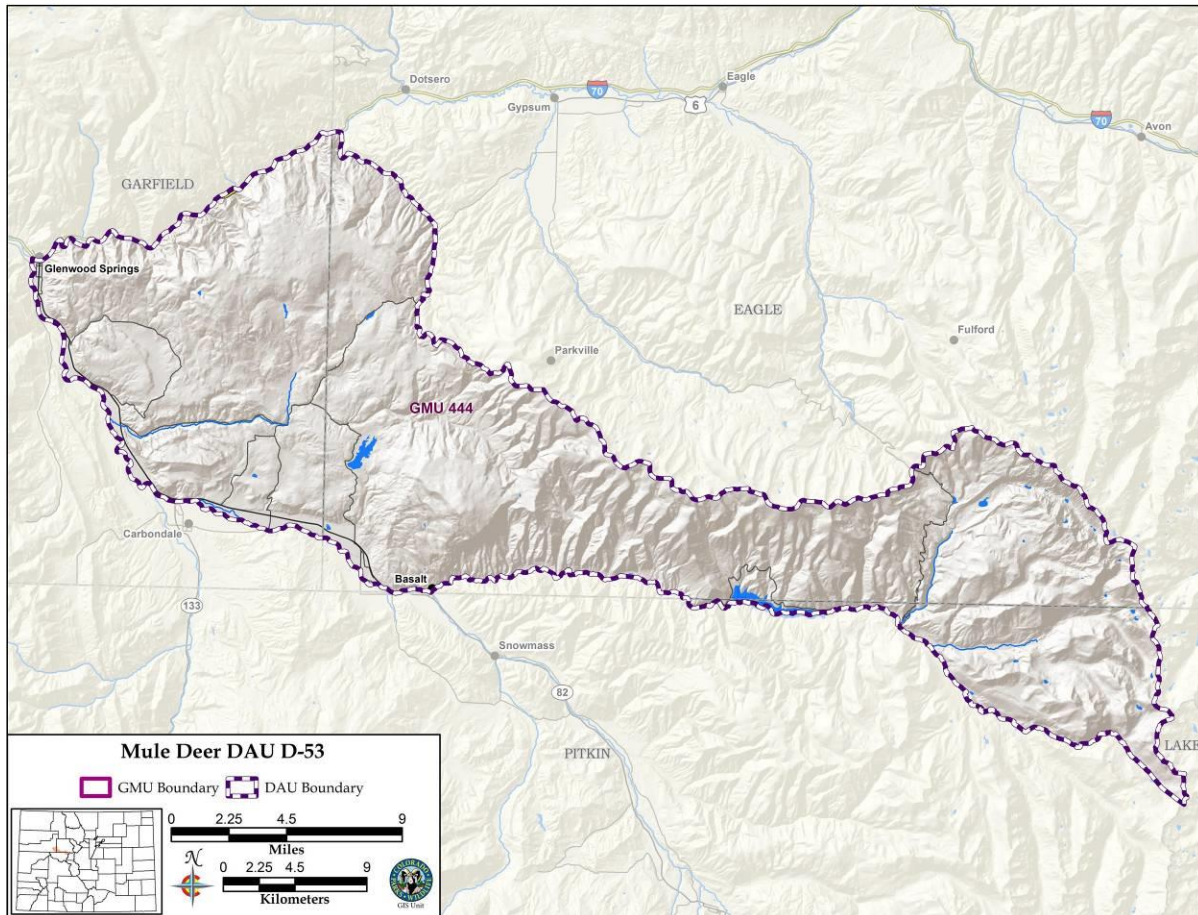


Figure 4. Location of mule deer D-53.

Historic D-53 Boundary Changes

Prior to 1980, the former boundaries of GMU 44 covered what is currently GMUs 44 and 444, and the whole area was managed as one D-14. In 1980, this GMU was split into the current GMUs 44 and 444, but continued to be managed as D-14. During most of the 1980's the population objective was 18,000 deer. In 1988, the population objective was reduced to a more realistic and achievable level of 12,300 deer.

After GMU 44 became a totally limited license area in 1992, it was deemed necessary to make GMU 444 a separate D-53. This was accomplished in 1995, when D-53 was created, containing GMU 444. The old population objective of 12,300 for both GMUs combined was split between the two new D-53s with D-14 being 7,000 and D-53 being 5,300.

Physiography

Climate and Precipitation

The climate in D-53 varies with altitude. Low elevations on the west side of the D-53 have moderate winters and warm summers, and high elevations have long, cold winters and short, mild summers. Precipitation varies from 15 inches annually at 6,000 feet to 30-40 inches at 13,000 feet above sea level. Moisture comes throughout the year, although winter and spring months have more precipitation than summer and fall months. Deep snow forces

deer to winter at the lower elevations, mostly to the west of Ruedi Reservoir. Prevailing winds are out of the west and southwest. Temperature varies from a low of -20 degrees to a high of 95 degrees.

Topography

DAU D-53 is aligned in a northwest-southeast direction and can be divided into three distinct areas. The eastern edge contains peaks greater than 12,000 and 13,000 feet above sea level, mostly in the Holy Cross Wilderness. The middle of the unit consists of Red Table Mountain (11,000 to 12,000 feet) sloping down southwest to the Frying Pan River (6,800-8,300 feet). The west end of the unit is foothills and valleys sloping down to the Roaring Fork and Colorado River valley floors (around 6,000 to 7,000 feet). Elevations range from a low of 5,740 feet above sea level (Colorado River at Glenwood Springs) to the high of 13,139 feet at Savage Peak. The Colorado, Roaring Fork, and Frying Pan Rivers are in this unit.

All natural surface water in this area drains into the Colorado River, mostly through the Roaring Fork. The DAU comprises about 20% of the Roaring Fork watershed (including the Roaring Fork, Cattle Creek, and Frying Pan River watersheds) and the south side of Glenwood Canyon, and Cottonwood Creek watersheds. Water from Mormon Creek, the South Fork of the Frying Pan, the Frying Pan, and Ivanhoe Creek is diverted to the Arkansas Valley, Pueblo, and Colorado Springs by the Frying Pan-Arkansas project. Ruedi Reservoir, on the upper south edge of this DAU, was built to provide replacement water storage to protect prior water rights downstream.

Ecoregion and Vegetation

DAU D-53 lies within the Southern Rockies Level III ecoregion (Chapman et al. 2006). The vegetation in this unit is largely determined by elevation and aspect (Figure 5). Vegetation types by the National Land Cover Database classifications (Homer et al. 2015) are shown in Table 1. The mountain peaks above approximately 12,500 feet are mostly bare rock or alpine communities. Spruce-fir forests dominate areas between the elevations of 10,000 and 11,500 ft. Aspen and aspen-conifer mixes dominate the slopes from 8,000 to 10,000 feet. Mountain shrubs show up on lower slopes between 6,000-8,000 feet. Pinyon-juniper woodland covers the foothills, and sagebrush parks appear on the more level sites as elevation drops. Riparian vegetation runs along the creeks and rivers. Mule deer prefer a diversity of vegetation types in close proximity to each other. These variations occur because of changes in slope, aspect and microclimates or natural disturbance factors such as wildfire.

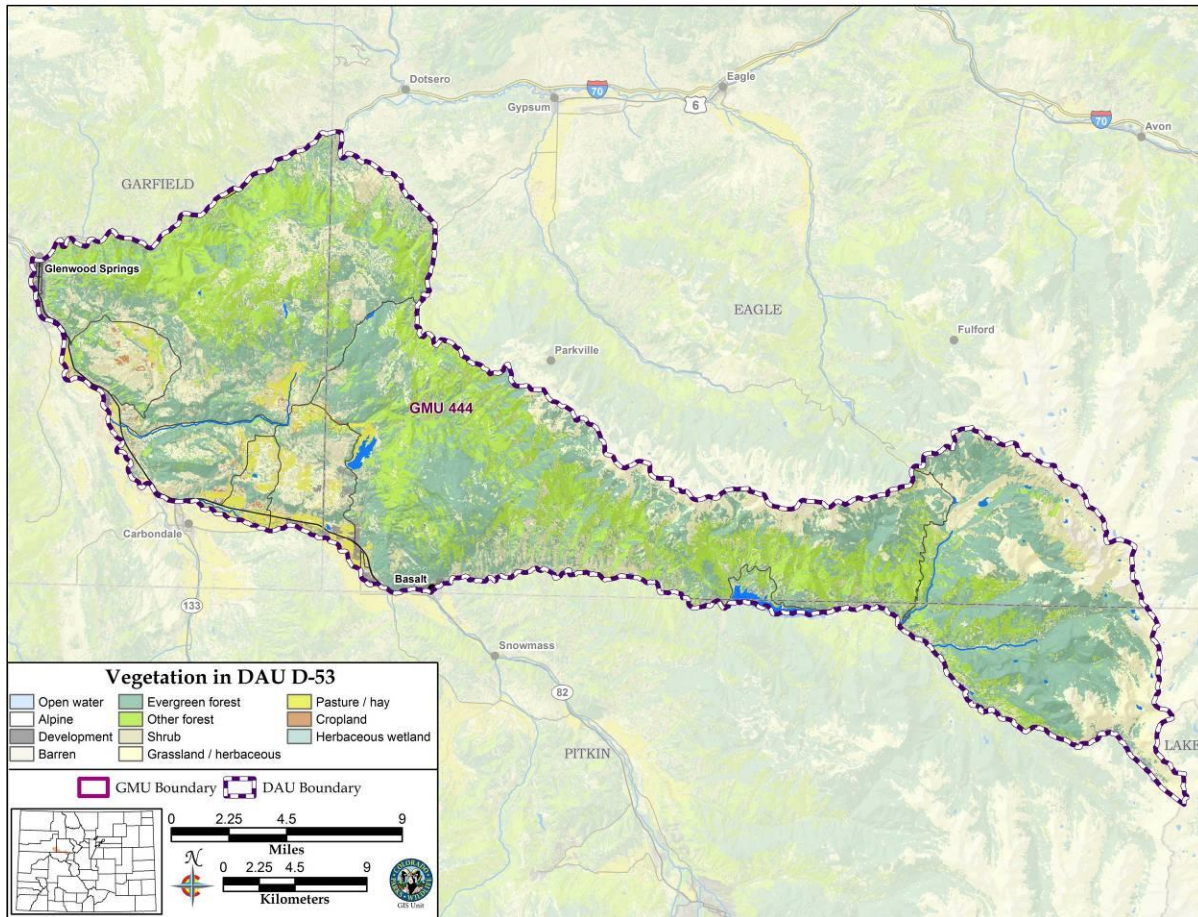


Figure 5. Vegetation classes in mule deer DAU D-53.

Table 1. Vegetation classes in mule deer DAU D-53 by National Land Cover Database (NLCD) classifications.

NLCD Vegetation Classes	Km ²	Mi ²	%
Evergreen Forest	395.2	152.6	41.2%
Other Forest	235.6	91.0	24.5%
Grassland / Herbaceous	175.8	67.9	18.3%
Shrub	100.1	38.7	10.4%
Pasture / Hay	22.4	8.7	2.3%
Barren	14.6	5.6	1.5%
Developed	6.6	2.6	0.7%
Cropland	4.8	1.9	0.5%
Open Water	4.7	1.8	0.5%
Alpine	0.1	0.0	0.0%
Total	960.0	370.7	100.0%

HABITAT RESOURCE and CAPABILITIES

Land Status

Land Ownership

The central and upper (east) portions of DAU D-53 are primarily public lands, whereas the lower (west) end of the unit is mostly private lands (Figure 6). D-53 covers 960 km² (371 mi²) of land (Table 2): 55% is U.S. National Forest land, 35% is private land, and 9% is Bureau of Land Management land. Colorado Parks and Wildlife has 2% of land in the DAU, most of which is the Basalt State Wildlife Area and the Coke Oven State Wildlife Area. The remaining 0.1% of land is a mix of county, city, and various non-governmental organization properties.

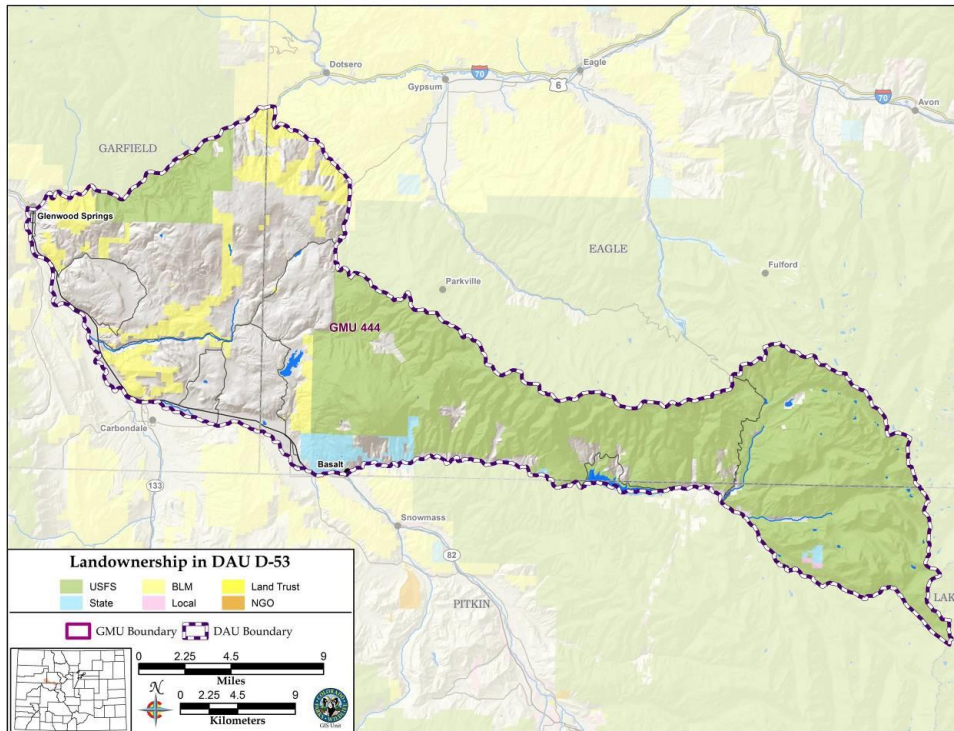


Figure 6. Land ownership in mule deer DAU D-53.

Table 2. Land ownership in mule deer DAU D-53.

Land Owner	Km ²	Mi ²	% of DAU
USFS	523.9	202.3	54.6%
PRIVATE	330.9	127.8	34.5%
BLM	85.2	32.9	8.9%
CPW	19.0	7.3	2.0%
COUNTY	0.6	0.3	0.1%
CITY	0.2	0.1	0.02%
NGO	0.1	0.04	0.01%
LAND TRUST	0.02	0.01	0.002%
SCHOOL DISTRICT	0.02	0.01	0.002%
Total	960.0	370.7	100.0%

Habitat Distribution

All of the land in D-53 is considered mule deer summer range (Figure 7). Most deer migrate to higher elevations in the summer. But in the lower-elevation subdivisions of Missouri Heights and Spring Valley, some deer now remain as non-migratory, year-round residents, taking advantage of the watered lawns, lack of hunting pressure, and reduced predation risk in these housing areas.

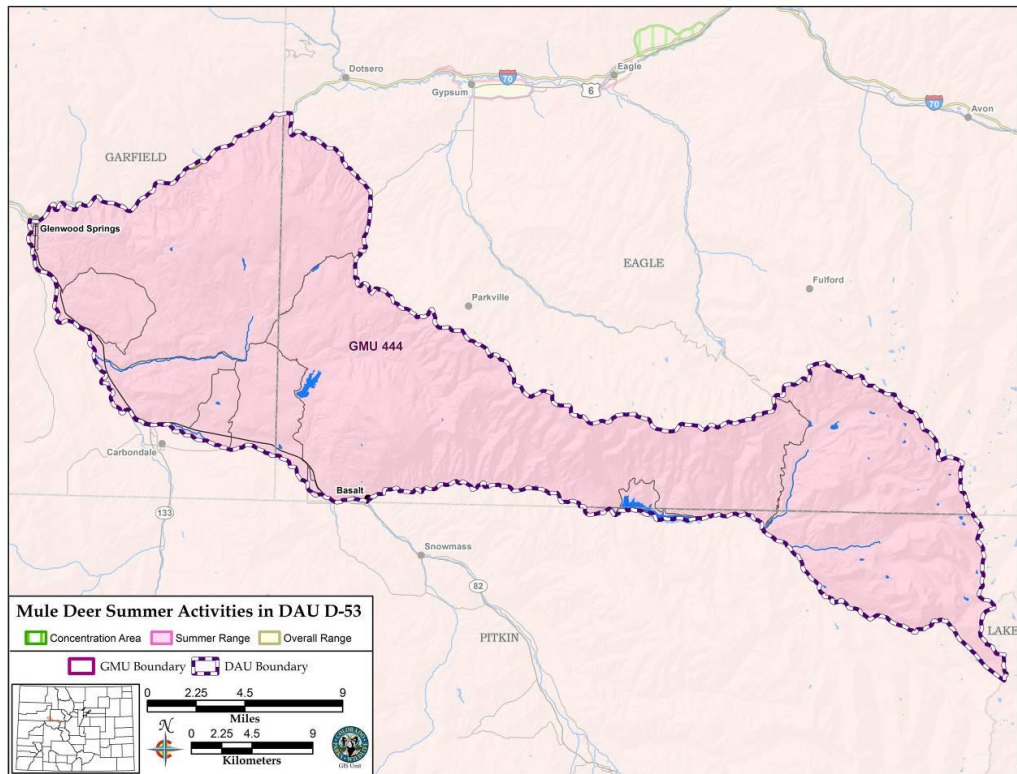


Figure 7. Mule deer summer range in DAU D-53.

Mule deer winter range comprises 38% of the DAU, at the lower elevations in the western portion of the unit (Figure 8 and Table 3). Most of the deer winter range in D-53 is along Highway 82 and in the Missouri Heights/Spring Valley area. This area has been heavily impacted by land development. Nearly two-thirds of winter range is on private lands; another 18% of winter range is on BLM lands; and 12% is on USFS lands.

Winter concentration areas (defined as areas on the winter range that have a density of at least 200% more deer than the surrounding winter range density in the average five winters out of ten), comprise 7% of D-53, mostly on private lands.

Severe winter range (defined as that part of the overall range where 90% of the deer are located when the annual snowpack is at its maximum and/or temperatures are at a minimum in the two worst winters out of ten) is 7% of the DAU, generally overlapping with the winter concentration areas.

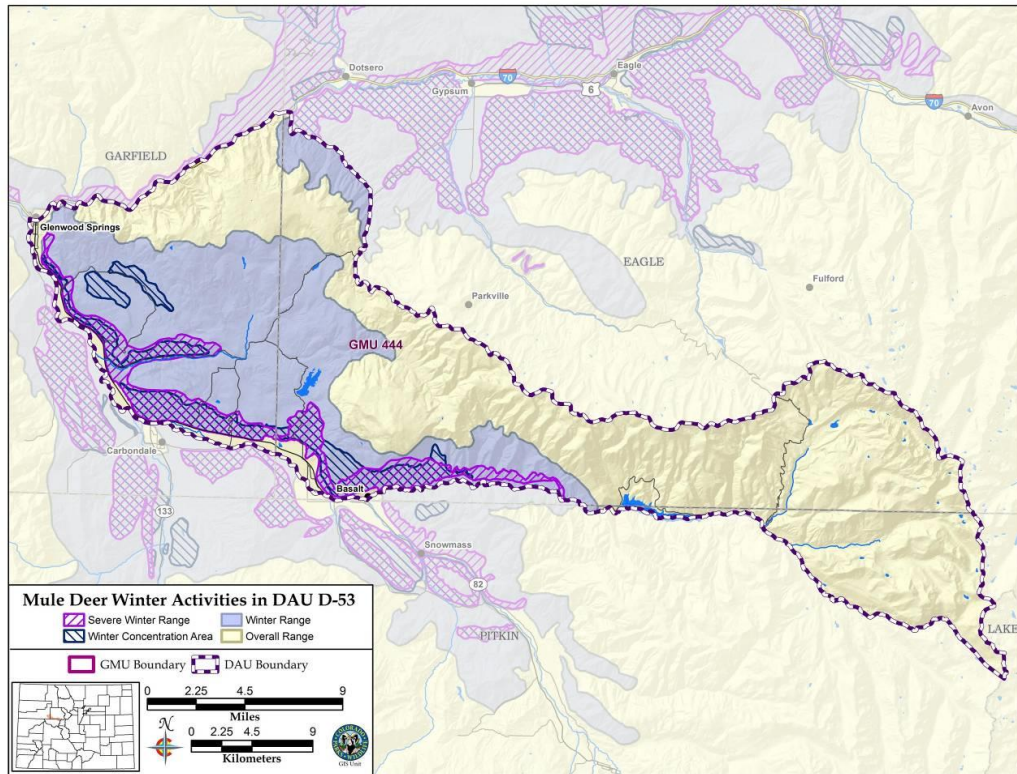


Figure 8. Mule deer winter range, winter concentration areas, and severe winter range in DAU D-53.

Table 3. Mule deer winter range, winter concentration areas, and severe winter range by land owner category in DAU D-53.

Land Owner	Winter Range			Winter Concentration			Severe Winter Range		
	Sq. Km	Sq. Mi.	%	Sq. Km	Sq. Mi.	%	Sq. Km	Sq. Mi.	%
PRIVATE	240.4	92.8	65.6%	32.9	12.7	52.9%	35.8	13.8	51.5%
BLM	64.8	25.0	17.7%	13.4	5.2	21.5%	18.6	7.2	26.8%
USFS	44.0	17.0	12.0%	2.5	1.0	4.0%	4.9	1.9	7.1%
CPW	17.2	6.6	4.7%	13.4	5.2	21.6%	10.2	3.9	14.7%
CITY	0.2	0.1	0.04%						
NGO	0.005	0.002	0.001%						
Total	366.6	141.6	100.0%	62.3	24.0	100.0%	69.6	26.9	100.0%
Percent of DAU			38.2%			6.5%			7.2%

Land Use

Outdoor Recreation

The largest industry in the area is outdoor recreation. Ample access to public lands and the scenic mountainous landscape attract many tourists to the area and provide abundant opportunities for outdoor recreation. These activities are diverse and include motorized, mechanized, horseback, and foot travel. Big game hunters, hikers, campers, mountain bikers, motorcyclists, wildlife watchers, four-wheelers, snowmobilers, cross-country and backcountry skiers, trail-runners and dog-walkers enjoy exploring the mountainous terrain. Anglers fish the gold-medal waters of the Frying Pan River. Ruedi Reservoir provides opportunities for boating, fishing, and other water sports. Rafting and paddling are popular on the Roaring Fork and Colorado Rivers. The five major ski areas (Aspen Skiing Company's four mountains and Sunlight Ski Area), two developed hot springs pools, and the Glenwood Adventure Park are adjacent to this DAU and supply many residents with jobs. Hotels, restaurants, gift shops, gas stations, and other local businesses benefit from these visitors.

Hiking, mountain biking, and motorized travel have increased significantly in the past decade or more, as outdoor recreation activity in the Roaring Fork Valley has boomed. The networks of recreational trails and roads fragment the habitat by bringing human activity further and more frequently into not just winter range, but now also transitional and summer ranges for deer and other wildlife (Figure 9). Updated federal land management plans have been adopted by both the BLM and the USFS in recent years (BLM 2015 and USFS 2012). Included in these plans are new travel management plans which decreased the miles of motorized trails or restricted use to designated trails. However, the BLM plan also designated Special Recreation Management Areas (SRMA); specifically within D-53, Red Hill SRMA was established. SRMAs emphasize recreation as the primary desired activity within the designated areas and will allow motorized, mechanized, and pedestrian trails to continue to be constructed. In addition, areas which previously had limited human use have been developed to provide recreational opportunities, such as the Basalt to Gypsum motorcycle trail on USFS lands. All of these decisions and trends in recreation on public lands have resulted in an increased level of human activity throughout the unit and the fragmentation of wildlife habitat. Wilderness areas and public lands have become such popular recreation destinations that solitude for wildlife from humans has become almost non-existent.

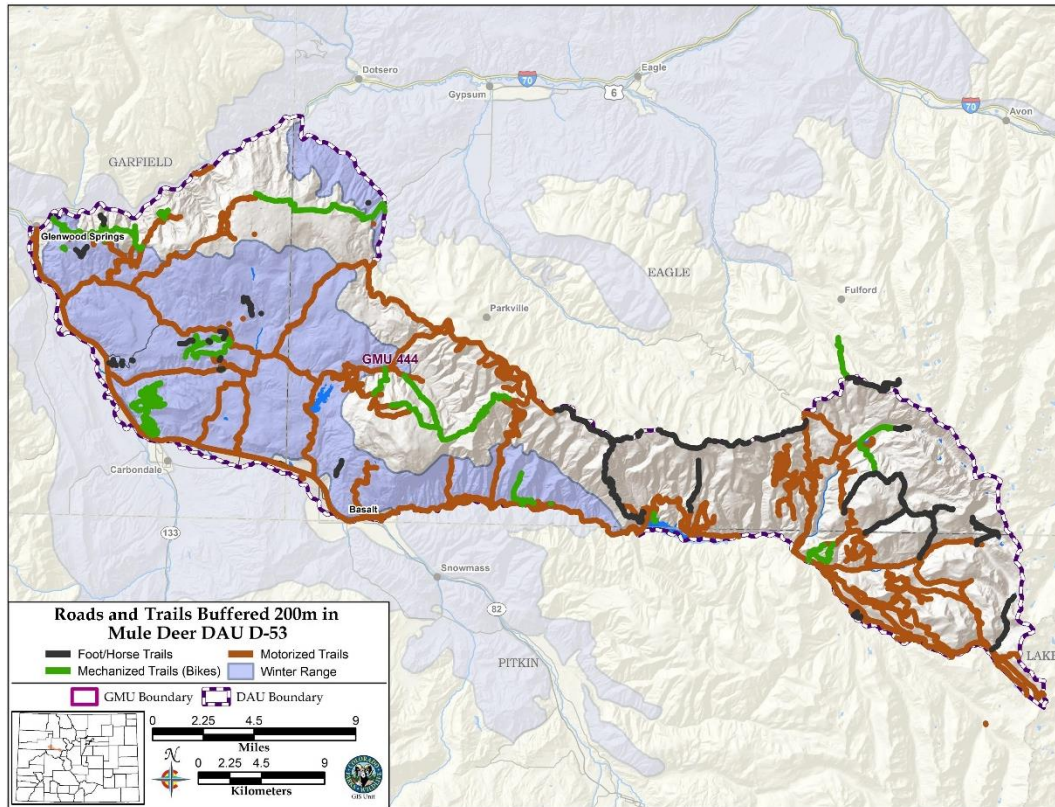


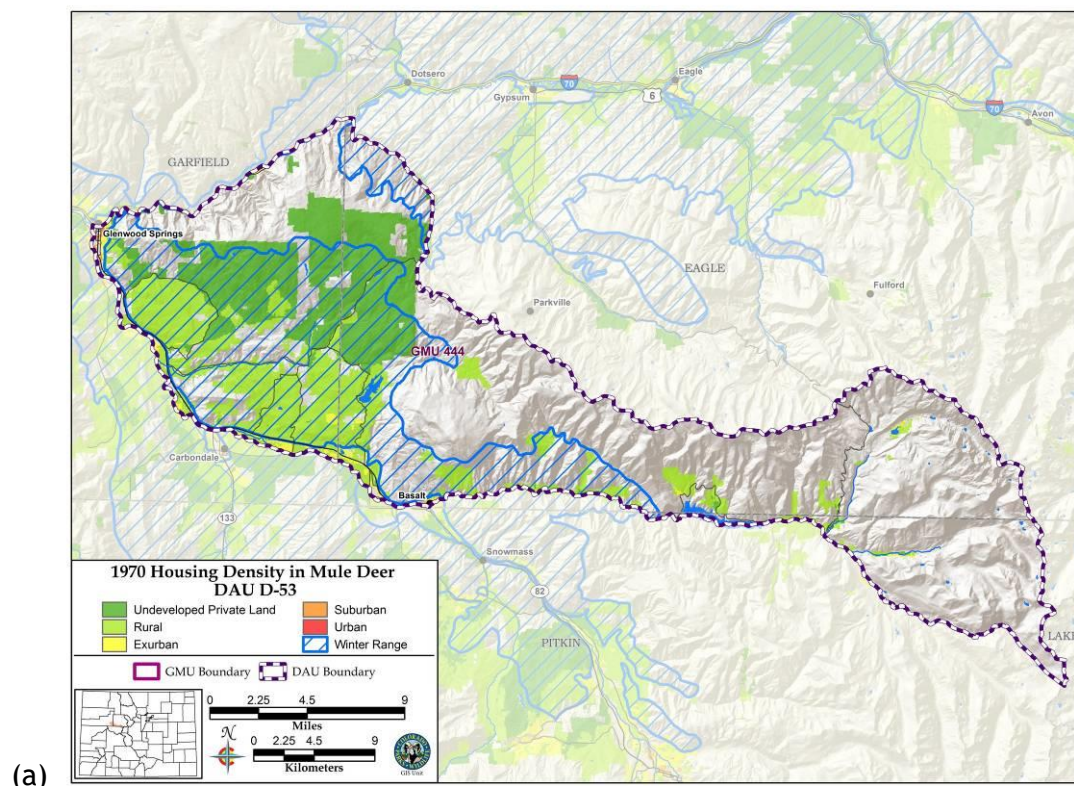
Figure 9. Roads and trails in mule deer DAU D-53, depicted with a 200-meter buffer zone of human disturbance. When deer are 200 m from a trail, there is an estimated 50% chance that the deer will flee if they encounter a hiker or biker (Taylor and Knight 2003). In addition, trails and roads divide once-continuous wildlife habitat into smaller, disconnected fragments.

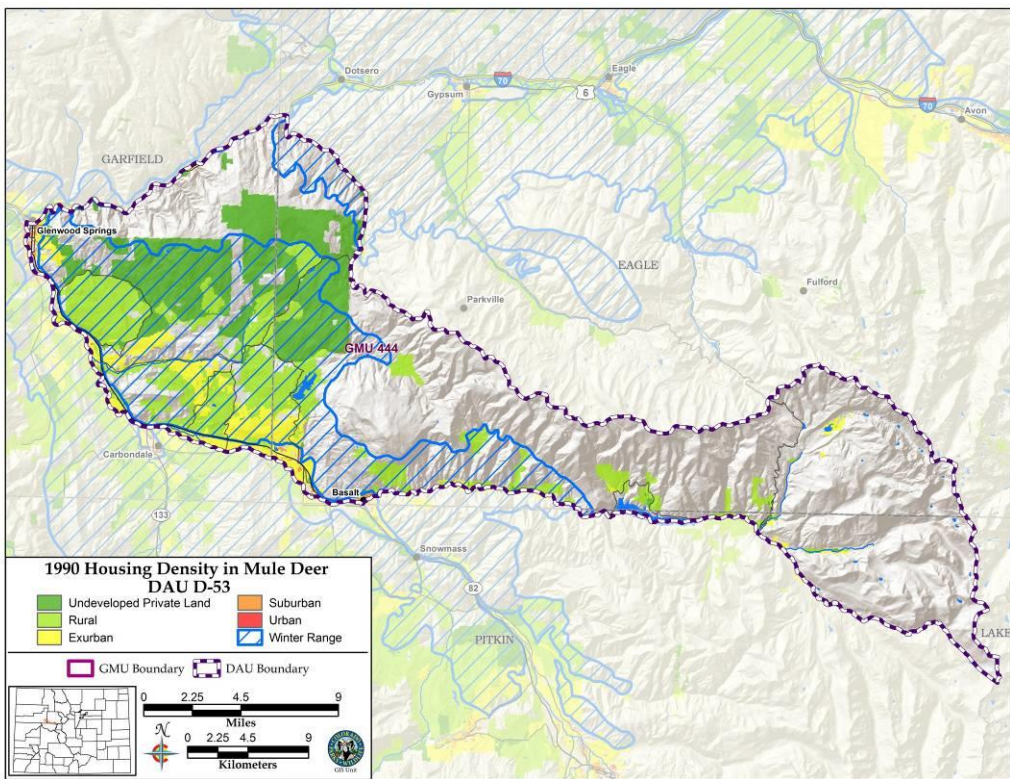
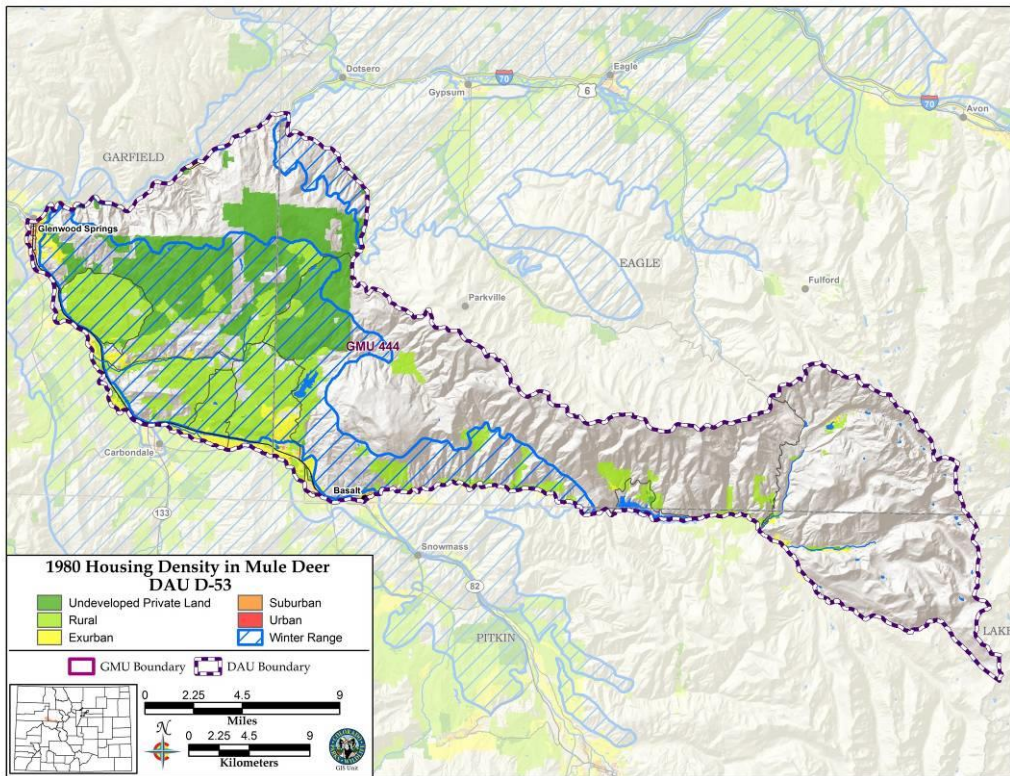
Land Development/Real Estate

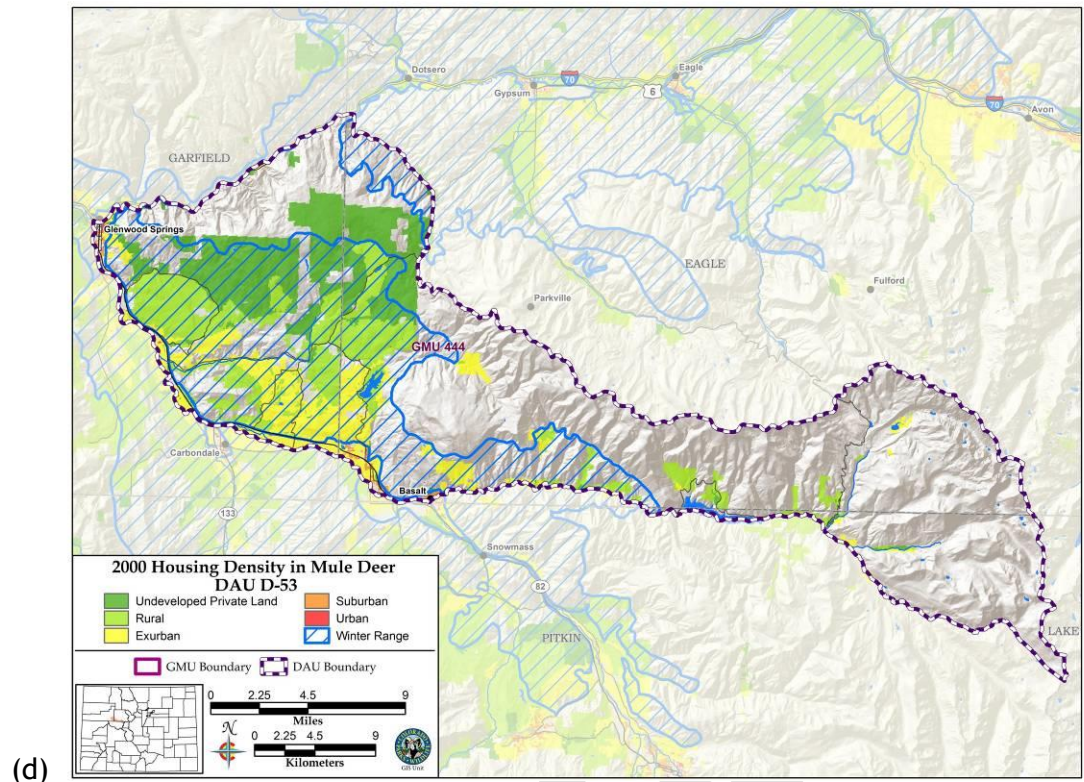
Construction and real estate sales/development are the other major industries in the area. The human population in the Roaring Fork Valley has grown consistently since the 1960s (Appendix A). As the ski industry in Aspen grew, it began to attract people to move and settle down in the valley. Ranch lands in the lower portion of D-53 (Missouri Heights, Spring Valley, and the Basalt and El Jebel areas) began to be subdivided in the 1970s and 1980s and converted into housing developments. Over the decades since then, the housing density in mule deer winter range in this unit and surrounding areas has continued to grow, shifting from a once rural landscape to an increasingly ex-urban environment (Figure 10 and Figure 11). In 1970, only 3% of private lands on mule deer overall range and 1% of mule deer winter range in D-53 had housing densities considered to be ex-urban, suburban, or urban. By 2010, those percentages had grown to 35% for both overall mule deer range and winter range (Figure 11). Increasing residential housing development has been shown to correlate with declining mule deer recruitment rates (Johnson et al. 2017).

The continued in-fill development and build-out of approved developments within towns has resulted in increasing human populations. With the approval of the new developments, there is a continued loss of working agricultural ranches within the unit.

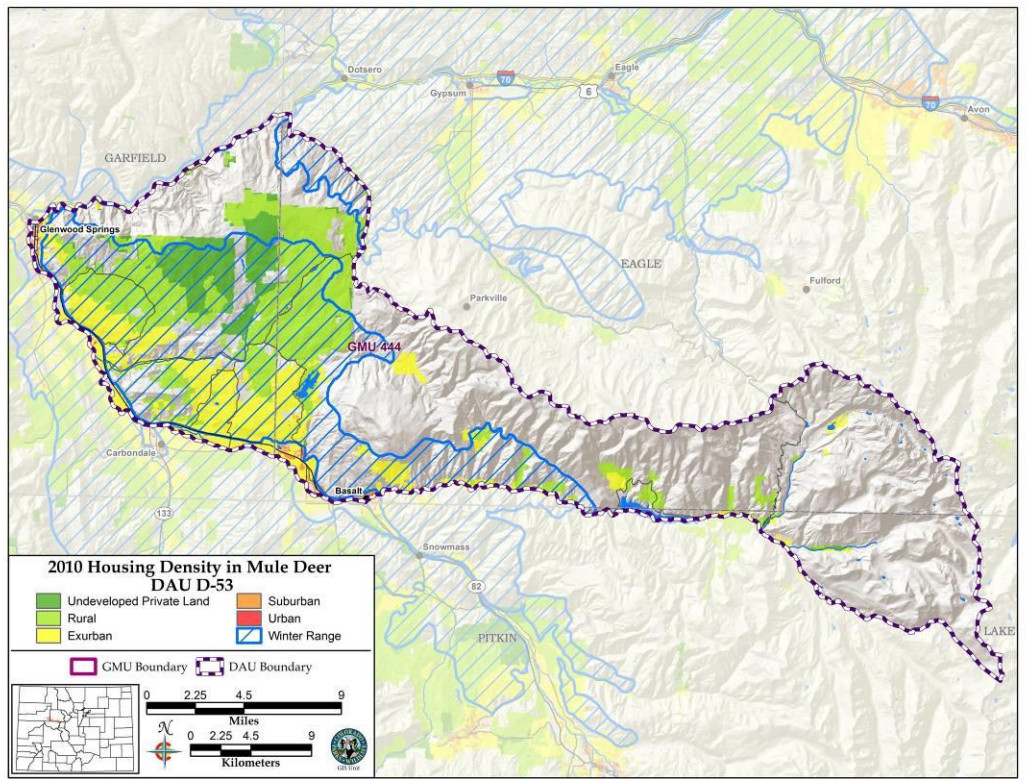
The unaccounted-for and often overlooked aspect of development is the indirect impacts from the increasing human population and the desire to enjoy the surrounding scenic lands that also function as wildlife habitat. Conversion of ranchlands into housing subdivisions in and adjacent to D-53 negatively impacts wildlife habitat either directly or indirectly. As more people occupy the landscape, they compete with wildlife for habitat, with the wildlife typically on the losing end. Loss and fragmentation of habitat, especially on deer winter range, has resulted in a lower habitat carrying capacity for deer.







(d)



(e)

Figure 10 (a-e). Housing densities in mule deer DAU D-53 from 1970-2010. Data from GIS model developed by Sushinsky et al. (2014).

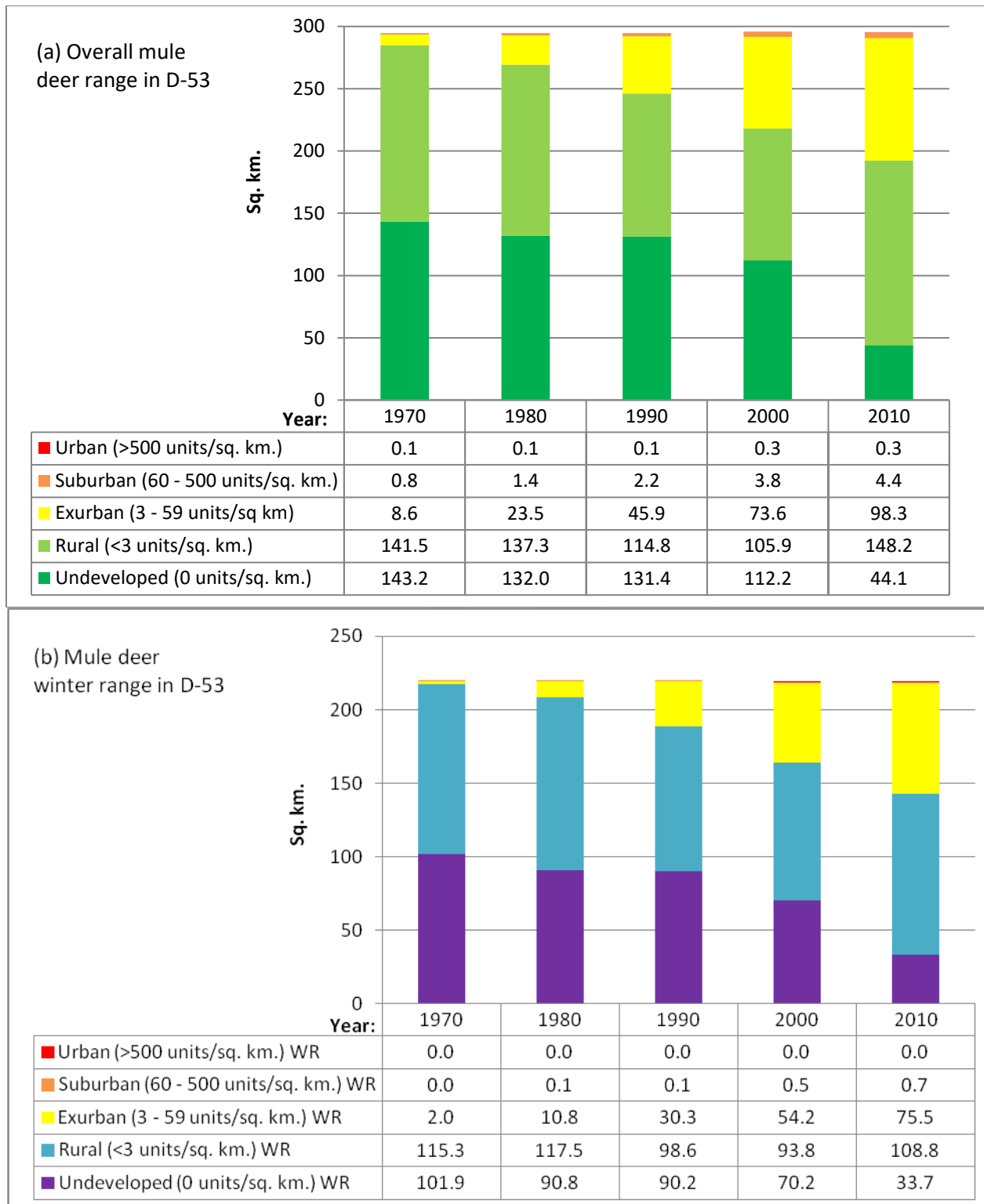


Figure 11 (a & b). Housing densities on private lands in D-53 on (a) overall mule deer range and (b) mule deer winter range.

Data from GIS model developed by Shushinky et al. (2014).

Livestock Grazing

Public lands in the DAU are used for livestock grazing, although this use has declined with the general decline in agriculture in the area. Classes of livestock using these allotments include mostly cattle and horses, and some domestic sheep and goat. There are 16 active BLM grazing allotments that are within or significantly overlap the DAU. Use occurs primarily in the spring, summer, and fall. The USFS has 11 active grazing allotments occurring totally or mostly within the DAU. The period of livestock use is variable, but primarily occurs from late June through October. Domestic livestock can compete with mule deer and elk for herbaceous forage, although moderate levels of grazing can also help promote shrub growth by limiting grasses. Grazing practices have changed greatly since the 1960s, such that impacts of livestock on the land are much less than earlier in the late 19th and early 20th centuries.

Some private lands are irrigated for hay production or are kept as dryland pasture. These private lands are beneficial to deer because they preserve open space in their winter range and can provide quality forage in the spring, fall, and winter. However, if unhunted, these properties (as well as landscaped suburban neighborhoods) can become refuges for deer from hunting pressure, making population management of local sub-herds of deer more complex.

Logging

Logging contributes only a very small part to the local economy. If done in a mosaic pattern, rather than clear-cutting, logging can benefit deer and elk summer range by increasing forage productivity for up to 10-20 years post-cut. Timber harvesting in the area has been ongoing since the 1900s. The 1950-60s spruce bark beetle outbreak killed the majority of mature spruce, and accessible areas were heavily logged through the late 1980s. In the past, timber stands were logged using a variety of methods including shelterwood, patch clearcut, group selection and salvage harvests. Current timber stands are composed of Engelmann spruce, sub-alpine fir, Douglas-fir, lodgepole pine, aspen and small amounts of Ponderosa pine. Most of the timber stands are mature and considered susceptible to insects, disease, and other stressors. Recent mountain pine beetle infestations in lodgepole pine stands have led to increased harvesting activities through clearcut, patch cut and sanitation/salvage harvests. Logging in GMU 444 in the past centered on Basalt Mountain, Red Table Mountain, and along the Thomasville-Eagle Road. The Forest Service has current and future logging plans for the Lime Park, Jakeman, Coyote Park, Crooked Creek, and Burnt Mountain areas.

Habitat Capability and Condition

Deer winter range in D-53 is in poor to fair condition due to maturation and succession of plant communities, as well as habitat loss and fragmentation due to land development. As a result of past decades of fire suppression and lack of large-scale habitat improvement projects, pinyon and juniper woodlands encroached upon sagebrush shrublands and converted them to much less productive sites. Pinyon and juniper stands tend to be mature with a closed canopy that severely reduces understory vegetation. Also, many of the mixed mountain and sagebrush shrublands are over-mature and less productive. Browse seedlings and young plants are not abundant, and in many areas the grass/forb understory is sparse and lacks diversity.

Heavy livestock grazing, in combination with drought, occurred on many rangeland areas in western Colorado from the late 1800s to the 1960s. Since the late 1960s, the BLM and USFS have developed improved grazing management approaches that have addressed many of the historic livestock problems. Also, due to the general decline in agriculture in the area, there is much less public land grazing today compared to 40+ years ago.

Higher elk populations in the 1990s and 2000s, combined with loss of deer and elk winter range on private lands to land development, resulted in higher elk densities on public land winter range for both deer and elk, which probably contributed to heavy browsing of shrubs. Heavily browsed shrubs are evident on winter range areas in some parts the DAU. However, in the past decade, warmer, drier winters have allowed elk to use mid-elevation areas that were historically transitional range during early and late winter. This distributional shift, along with the reduced elk population, has reduced some of the elk grazing/browsing intensity on mule deer winter range.

Land development in the Roaring Fork Valley was constant from the 1970s to the mid-2000s, resulting in significant loss and fragmentation of winter range habitat (Figure 10; also see “Land Development/Real Estate” section above). While deer still might winter in these areas (and some deer are now even year-round residents), the land is not as productive due to loss of habitat to roads, structures, fences, and vegetation alterations, and deer must face the added stress of human disturbance. The growth of residential developments adjacent to public lands has also made it more difficult to achieve landscape-scale habitat improvement projects because some homeowners object to habitat changes that will impact their views or otherwise affect their property.

Due to the loss and degradation of important deer and elk winter range in this unit and generally throughout western Colorado, the continued conservation and rejuvenation of existing habitat is paramount. In more recent years, there have been several habitat improvement projects implemented on State Wildlife Area and USFS lands (Table 4). These projects include prescribed burns, removal of pinyon-juniper encroachments, and improvement of sagebrush, oak, and mountain shrub habitats. Notably, in 2011 the USFS began a 10-year, >45,600-acre wildlife habitat improvement project on the Aspen-Sopris Ranger District involving prescribed fire and mechanical treatments of pinyon-juniper woodland, shrublands, and aspen habitats (USDA Forest Service 2011). These projects will include almost 17,000 acres of habitat within D-53. Portions of treatment units #31 (upper Cattle Creek) and #33 (west side of Basalt Mountain) have been burned and/or mechanically treated over the past several years.

In addition to prescribed burns, in July 2018 a human-caused wildfire began at the shooting range on Basalt State Wildlife Area. The fire spread northward and burned more than 12,500 acres including all of the Lake Christine section of the State Wildlife Area and adjacent USFS, BLM, and private lands from Basalt Mountain to upper Cattle Creek. CPW has begun re-seeding the accessible areas of the State Wildlife Area with a dryland pasture mix supplemented with various shrub and forb species appropriate for the elevation and soil types. Areas that are too steep or rocky will likely either have to wait for natural re-introduction of vegetation or aerial seeding. Weed control plans are being developed to ensure minimal invasive weeds in the burn area. Although the fire was destructive in the immediate timeframe, in the long term as vegetation becomes re-established, the burned habitat should prove to be beneficial as rejuvenated, high quality forage for deer, elk, and bighorn sheep.

Table 4. Past and currently ongoing habitat treatment projects in DAU D-53.

<u>Years</u>	<u>Location</u>	<u>Acres</u>	<u>Treatment Type</u>	<u>Agency or Organization(s)</u>
2006-2008	Basalt State Wildlife Area (SWA)	75	Weed control	CPW/Habitat Partnership Program (HPP)/Rocky Mountain Elk Foundation (RMEF)/Eagle County Weed Fund
2009	Basalt SWA	200	Pinyon-juniper removal	CPW/HPP
2011	Basalt SWA	48	Pinyon-juniper removal	CPW/HPP
2016-2018	Basalt SWA	150	Weed control	CPW/RMEF/Eagle County Weed Fund
2011-2021	White River National Forest, Aspen-Sopris ranger district (Treatment units #11, 14, 15, 25, 31, 33, 34, 35, 36, 38)	16,918	Mechanical and prescribed fire - oak, aspen, pinyon-juniper	USFS

Conservation Easements

There are 29.3 km² of conservation easements on private lands in D-53 (Figure 12). These conservation easements constitute 9% of the private land in the unit and 5% of mule deer winter range. Because winter range is highly limited in this DAU and because of the high monetary incentive for development of private lands in this area, conservation of any remaining winter range habitat is imperative.

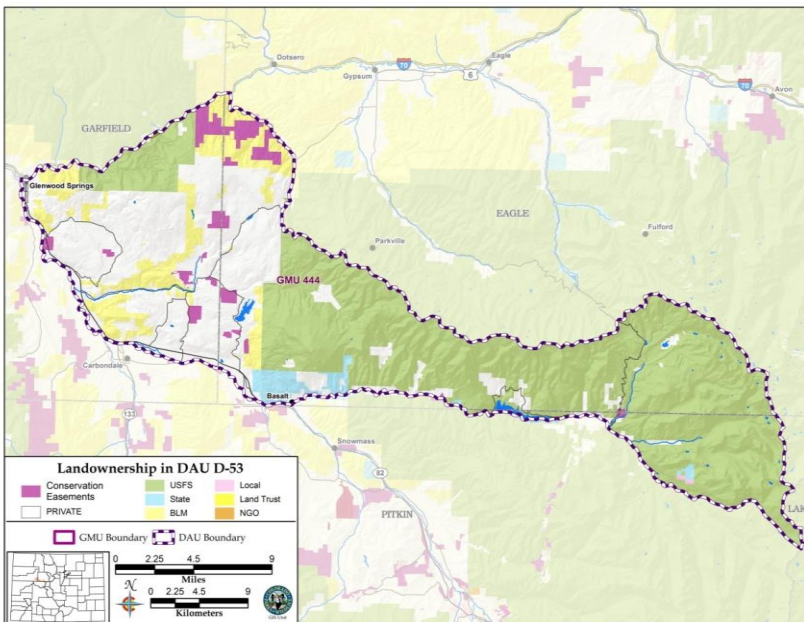


Figure 12. Conservation easements in mule deer DAU D-53.

Conflicts with Agriculture

There have been no game damage claims related to D-53 mule deer.

HERD MANAGEMENT HISTORY

Overview of Procedures to Estimate Population Size

Estimating population size of wild animals over large geographic areas is a difficult and inexact exercise. In several research projects, attempts have been made to accurately count all the known number of animals in large fenced areas. All of these efforts have failed to consistently count all of the animals. In most cases fewer than 30% of the animals can be observed and counted.

CPW biologists estimate deer population sizes using population modeling methods developed by White and Lubow (2002). These population models integrate multiple biological factors, including observed post-hunt sex and age ratios, hunter harvest, and estimated mortality rates and wounding loss rates. At present, these population modeling methods represent CPW’s best estimate of populations. It is recommended that the population estimates presented in this document be used as an index or as trend data and not as an absolute estimate of the deer population in the DAU. As better information becomes available, such as new estimates of age-specific or sex-specific survival rates, wounding loss, sex ratio at birth, density estimates, or modeling techniques, better population estimates may be derived in the future.

Post-hunt Population Size

When D-53 was established in 1995, the population objective was set at 5,300 deer. Since that time, the estimated population has been within -28% to +25% of the objective, between 3,850 and 6,650 deer (Figure 13). The population declined after the severe winter of 2007-2008. Within the past 5 years, the population has been on average 11% below the objective and the population trend has been stable to slightly declining. The current (2018) post-hunt population estimate is 4,440 deer or 16% below objective.

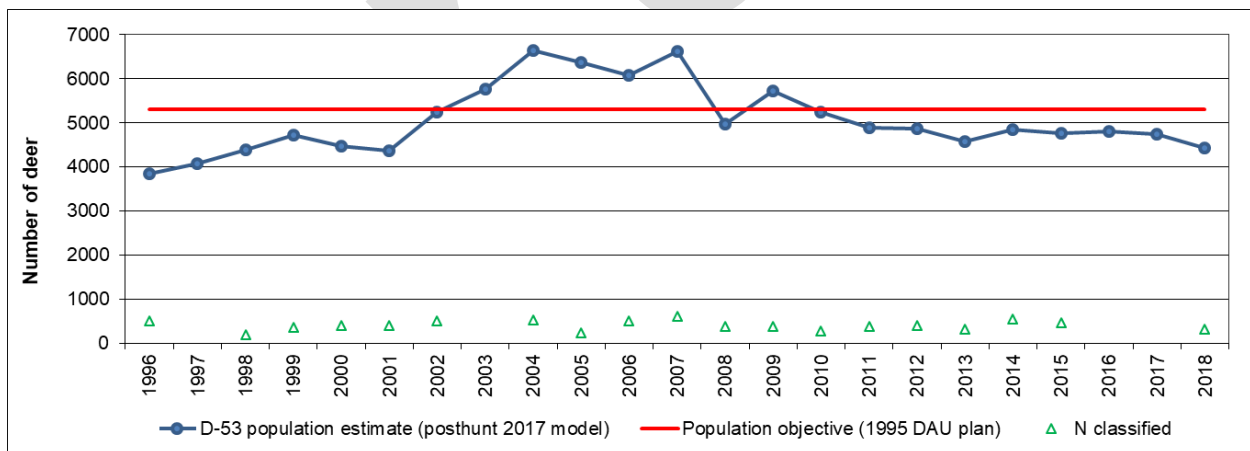


Figure 13. Post-hunt population size estimates in mule deer DAU D-53, 1996-2018.

Post-hunt Herd Composition

Buck:Doe Ratio

The buck ratio objective for D-53 was set at 30 bucks per 100 does when the DAU was established in 1995. By 2003, the 3-year average buck ratio reached this objective and has fluctuated over time but has generally been on an increasing trend (Figure 14). The most

recent 3-year (2014, 2015, 2018) average is 42 bucks per 100 does, which is 40% over objective.

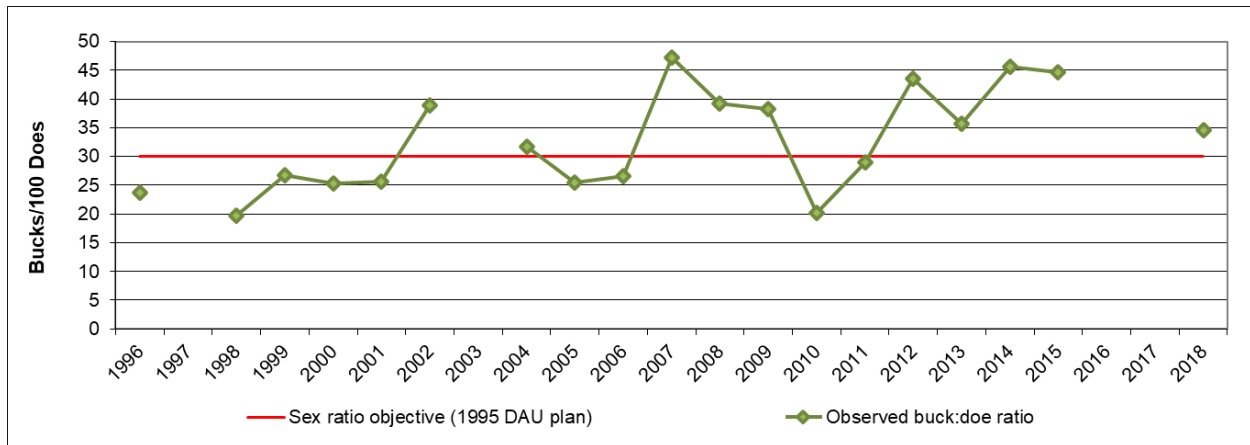


Figure 14. Post-hunt buck:doe ratios observed in mule deer DAU D-53, 1996-2018.

Fawn:Doe Ratio

The fawn:doe ratio has fluctuated over time, sometimes widely from year to year, likely in large part in response to weather conditions (Figure 15). The most recent 3-year (2013-2015) average is 45 fawns per 100 does. With D-53 having assumed survival rates of 0.905 (annual survival) for does and 0.650 (overwinter survival) for fawns, a fawn ratio of 45 fawns per 100 does should yield a stable population (Unsworth et al. 1999).

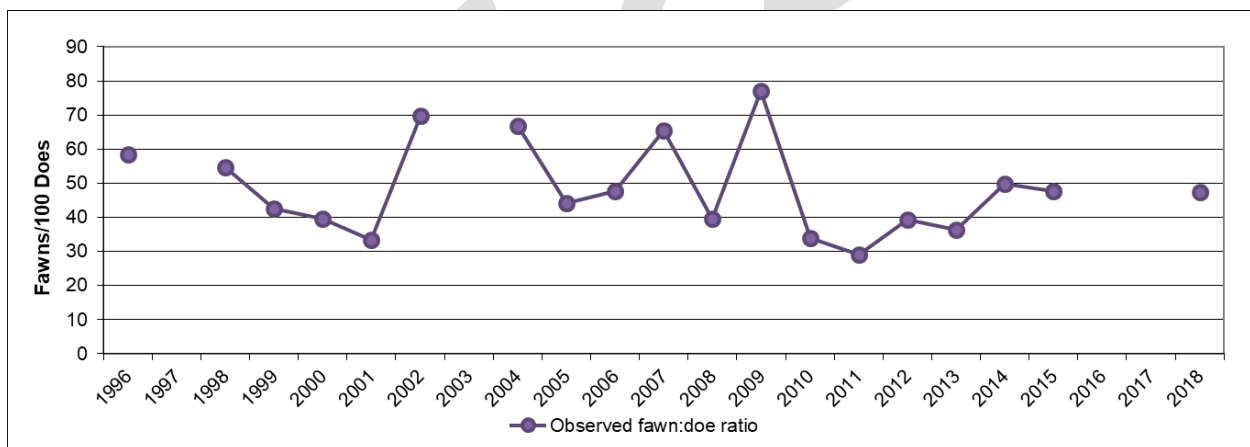


Figure 15. Post-hunt fawn:doe ratios observed in mule deer DAU D-53, 1996-2018.

Hunting Licenses and Harvest Statistics

License Allocation

Deer license quotas in D-53 have been set at fairly stable levels with some larger adjustments made in the mid- to late 2000s (Figure 16). In 2006, doe seasons were reinstated in the unit, after being closed to doe hunting since 1999. In 2009, buck rifle licenses were reduced to address hunter crowding problems on the limited amount of public land in the lower portion of the unit on Missouri Heights and Spring Valley. In 2015, doe licenses were severely reduced to only 10 licenses per doe huntcode (Figure 17) due to CPW Leadership Team’s direction to cut doe harvest in DAUs that were below population

objective. Buck license quotas were increased slightly in both 2016 and 2017 to begin to manage the buck ratio toward the objective of 30 bucks per 100 does and also to offset the recent lost hunter opportunity for doe licenses. However, due to complaints of hunter crowding on public lands and hunter trespass issues, buck license quotas were slightly reduced in 2018 back down to 2016 levels (Figure 18).

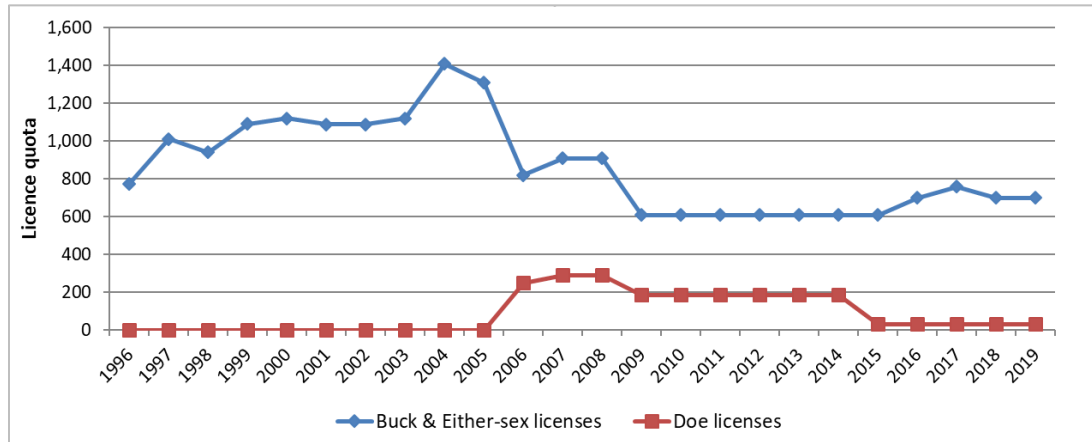


Figure 16. Overall deer license quotas in mule deer DAU D-53, 1996-2019.

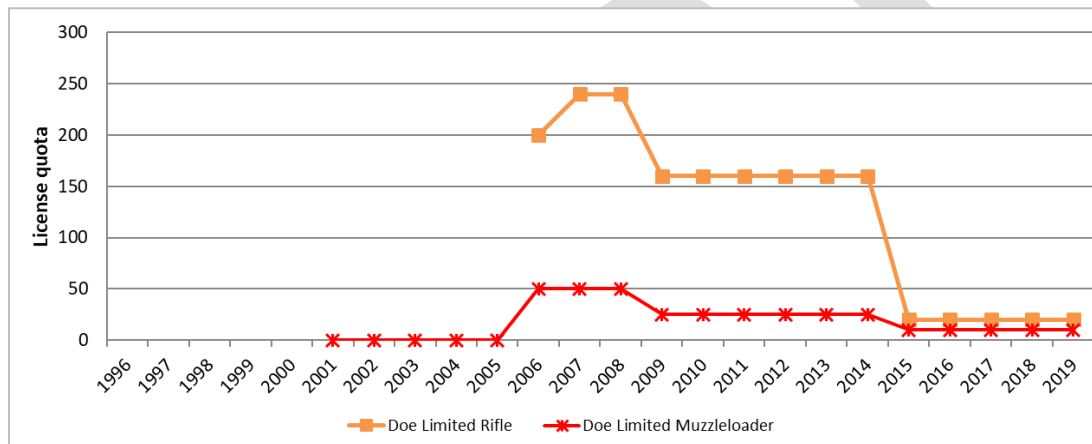


Figure 17. Doe license quotas in mule deer DAU D-53, 1996-2019.

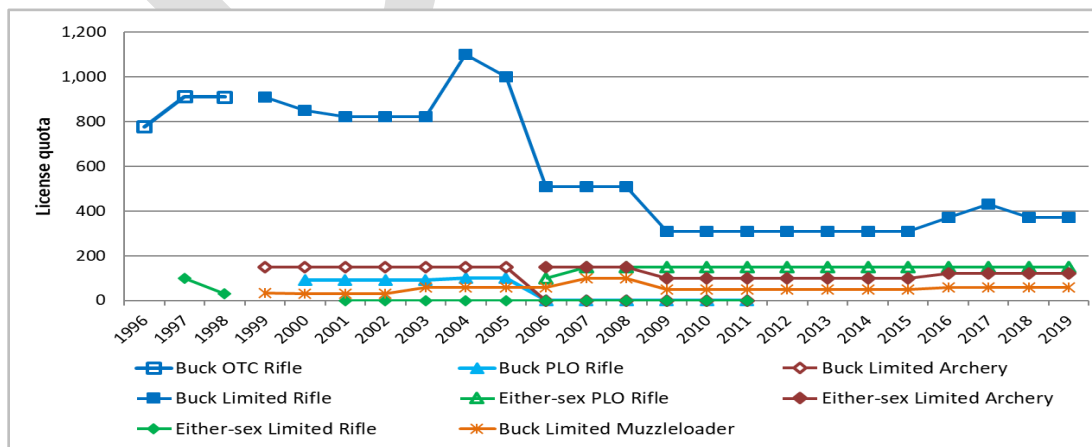


Figure 18. Buck and either-sex license quotas in mule deer DAU D-53, 1996-2019.

Harvest and Success Rates

Deer harvest in D-53 varies annually (Figure 19) based on both license availability (Figure 16-Figure 18) and success rate (Figure 20). The 3-year (2016-2018) average buck harvest in D-53 has been 244 bucks. Doe harvest was stable through the first half of the 2010s, averaging 69 does harvested annually, but has declined in the past few years due to doe license reductions. Note that some doe harvest comes from the either-sex private land only (PLO) seasons, so overall doe harvest can exceed the number of doe-only licenses. The 3-year (2016-2018) average doe harvest has been 35 does.

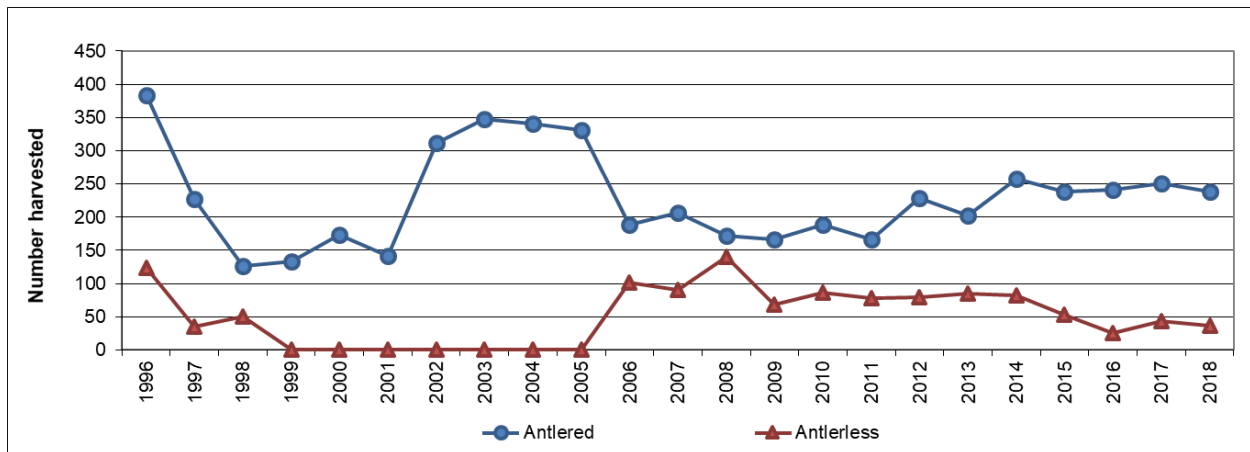


Figure 19. Mule deer harvest in D-53, 1996-2018.

Success rates are often dependent on weather conditions. A wet summer with good growing conditions for plants allows deer to be more dispersed, whereas drought conditions may lead them to favor localized concentrations of wetter habitat such as near riparian areas and higher elevations. Snow cover can help hunters track deer, but can also limit road access. Rainy weather can deter some hunters. Later seasons generally see higher success rates because deer are becoming more concentrated on transitional and winter range and bucks in rut are more active and mobile.

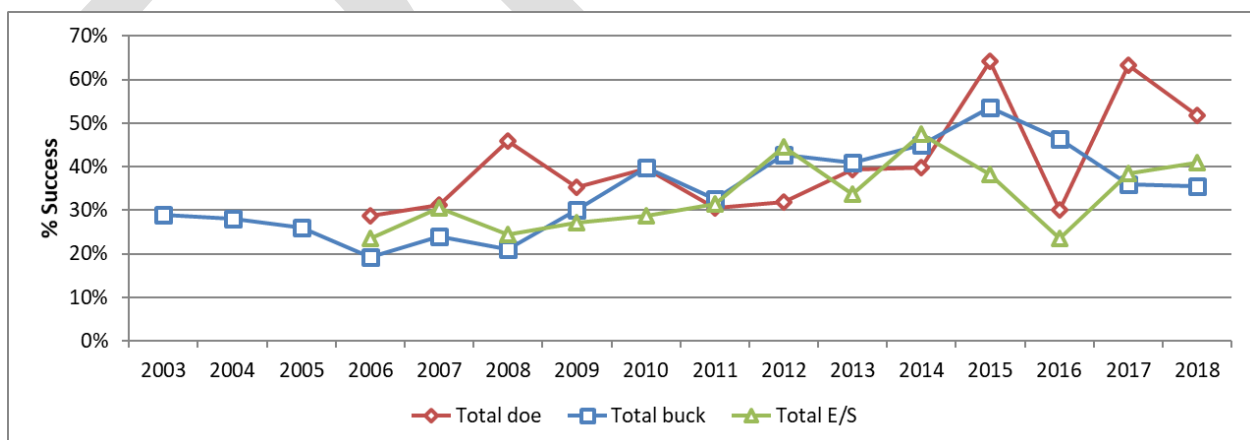


Figure 20. Overall hunter success rates in mule deer D-53, 2003-2018.

License Demand and Preference Points

Buck and either-sex licenses in D-53 have been relatively easy to draw. The quotas for D-53 buck licenses are set to provide enough buck hunting opportunity while also taking into consideration hunter crowding issues. Because D-53 has been above its current buck ratio objective (see “Buck:Doe Ratio” section above), the herd could sustain higher buck harvest and more buck licenses, but because of hunter crowding issues on the limited amount of public lands in the lower/western part of the unit, buck license quotas were kept relatively low for many years and were only moderately increased in 2016 (Figure 18).

At present, buck license quotas are generally meeting demand (based on 1st choice application rates) for these licenses (Table 5). In 2018, either-sex archery, buck muzzleloader, and 2nd season buck licenses could be drawn at Choice 2 (Table 6). Buck licenses for 3rd and 4th seasons are more limited in quota and, being later seasons that coincide with the start of the deer rut, they are generally more sought-after. Nevertheless, a 3rd season buck tag can be drawn at Choice 1 with 0 preference points, and a 4th season buck tag can be drawn with 1 point for Colorado residents and 3 points for non-residents (Table 5).

Table 5. Minimum preference points needed to draw rifle buck licenses in mule deer DAU D-53, 2005-2018.

			Key:	0-4 Pts	5-9 Pts	10-14 Pts	15-19 Pts	20+ Pts	Year							
D-53																
Season	Huntcode	Item	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Buck 2nd rifle	DM444O2R	Quota	1000	300	300	300	200	200	200	200	200	200	200	240	280	240
		Num. 1st choice apps	188	152	166	117	166	140	123	125	139	173	146	170	186	208
		Resident Pref Pts	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Non-Resident Pref Pts	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buck 3rd rifle	DM444O3R	Quota		200	200	200	100	100	85	85	85	85	85	100	115	100
		Num. 1st choice apps	118	55	89	54	50	59	79	105	90	122	93	96	134	134
		Resident Pref Pts	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Non-Resident Pref Pts	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Buck 4th rifle	DM444O4R	Quota		10	10	10	10	10	25	25	25	25	25	30	35	30
		Num. 1st choice apps		58	75	48	46	53	58	44	67	70	70	72	82	82
		Resident Pref Pts		1	3	2	2	2	2	1	1	1	1	2	1	1
		Non-Resident Pref Pts		0	5	3	2	3	4	3	3	4	4	3	3	3

Doe licenses, which were significantly limited starting in 2015 (see “License Allocation” section above), were drawn at Choice 1 or 2 and required 0 to 2 preference points in 2018 (Table 6). Either-sex private land only (PLO) licenses have been readily available (Table 6). There is limited access to hunt private lands, so these tags are generally only used by local landowners and their family and friends.

Table 6. Draw statistics for mule deer licenses in DAU D-53 in 2018.

Season	Hunt Code	# of Lics Sold	Sold Out	# of 1st Choice Apps	Drawn Out At in Primary Draw			
					Adult Res	Adult NR	Youth Res	Youth NR
E/S archery	DE444O1A	120	At Choice 2	72	Choice 2	Choice 2	Choice 2	No Apps
Buck muzz.	DM444O1M	57	At Choice 2	46	Choice 2	Choice 2	Choice 2	0 Pref Points
Doe muzz.	DF444O1M	10	At Choice 2	9	0 Pref Points	0 Pref Points	Choice 2	No Apps
Doe 2 nd rifle	DF444O2R	9	At Choice 1	47	2 Pref Points	None Drawn	0 Pref Points	0 Pref Points
Doe 3 rd rifle	DF444O3R	10	At Choice 1	19	1 Pref Points	1 Pref Points	None Drawn	No Apps
Buck 2 nd rifle	DM444O2R	240	At Choice 2	208	Choice 2	Choice 2	Choice 2	0 Pref Points
Buck 3 rd rifle	DM444O3R	95	At Choice 1	134	0 Pref Points	0 Pref Points	0 Pref Points	1 Pref Points
Buck 4 th rifle	DM444O4R	29	At Choice 1	82	1 Pref Points	3 Pref Points	None Drawn	No Apps
E/S PLO 2nd	DE444P2R	101	At Choice 5	11	Leftover	Leftover	Leftover	Leftover
E/S PLO 3rd	DE444P3R	46	At Choice 5	16	Leftover	Leftover	Leftover	Leftover

Land Access and Refuges from Hunting

In the central and eastern portions of D-53, there is abundant public land, mostly US Forest Service lands and State Wildlife Areas (Figure 6). These lands are accessible by the Frying Pan Road and various USFS roads and trails (Figure 9). Basalt State Wildlife Area and upper Cattle Creek are well-used by deer hunters. The middle and upper portions of the Frying Pan drainage are more lightly hunted for deer. Lime Park and Burnt Mountain see higher deer hunter numbers due to the accessibility of USFS roads in those areas.

The western one-third of the unit is mostly private land with pockets of BLM and USFS lands (Figure 6). Red Hill near the town of Carbondale is heavily used for hiking and mountain biking, so it is generally not hunted. Fisher Creek and Coulter Creek are heavily hunted and can experience high hunter crowding. Lookout Mountain has moderately high hunting pressure on the south side, but less use on the north side. Little Grand Mesa, Consolidated Reservoir, and Cottonwood Creek are mostly surrounded by private property and have limited public access routes; these areas provide good mid-elevation habitat and solitude for deer and other wildlife. Deer that reside on some of the remaining large private ranches experience low hunting pressure from ranch owners, their friends, and in some cases, paying clients.

Some of D-53's deer have become year-round residents of the subdivisions on Missouri Heights and Spring Valley, habituating to human presence and benefiting from landscaped properties. These subdivisions are not hunted due to their homeowner associations' prohibitions on hunting. Even though discharge of firearms is lawful in unincorporated areas of the county, it is not safe to hunt in most areas of these subdivisions. Much of Missouri Heights is not surveyed during CPW's deer and elk classification flights to avoid disturbing the human residents in the subdivisions.

CURRENT MANAGEMENT ISSUES AND STRATEGIES

Mule deer population management issues in D-53 have been discussed throughout this document in various earlier sections. The combination of these impacts on deer is that D-53 has lower-quality habitat and less solitude from human disturbance compared to past decades. Therefore the unit's carrying capacity for mule deer has declined.

Recreation Impacts

Human disturbance from outdoor recreation is a major wildlife management concern as recreation activities have grown and expanded in the Roaring Fork Valley in the past decade (see "Outdoor Recreation" section). This heightened level of human activity on the landscape is a disturbance to deer, particularly during winter and fawning periods. Deer may react to a human by being vigilant, which reduces the amount of time they would otherwise be feeding; or by fleeing, which expends energy they would otherwise not have used and can cause abandonment of fawns. Repetitive disturbance may result in abandonment of quality habitat for inferior locations. Whatever the reaction, deer incur an energetic cost. Cumulatively, these behavioral stressors can have population-level effects that result in a net effect of lower fawn recruitment and reduced population growth rate.

Seasonal closures to motorized and mechanized travel are in place from December 1 to April 15 each winter on BLM lands on Basalt Mountain, Fisher/Cattle Creeks, and Red Hill (BLM 2015) and on CPW's Basalt State Wildlife Area. Dogs (except during pre-authorized field

trials during August and September only) and mountain bikes are prohibited on Basalt State Wildlife Area at all times. CPW has also instituted a spring closure on shed-antler hunting on public lands in this unit: it is unlawful to collect shed antlers on public lands from January 1 through April 30 at any time of day or night².

However, seasonal closures and similar restrictions are only as effective as they are complied with, enforced, and socially accepted. With limited BLM and CPW staff to patrol and enforce these regulations, it is admittedly difficult to ensure compliance with these closures. Many seasonal closure dates are compromises and do not extend far enough into spring to maximize herd health and welfare. Often when the lower elevations become snow-free, many recreationists are eager to hit the trails in the spring; however, deer, elk, and other wildlife still rely on these winter and transitional ranges where spring green-up is occurring and before their summer ranges are melted out. In the spring, when female deer are in the third trimester, transitional ranges become vital habitats for the does to gain the body fat necessary to produce viable healthy fawns and to be healthy enough to lactate. Likewise, in early winter when lower elevations are snow-free but upper elevations are under snow cover, most deer have migrated to winter range and need to conserve as much body fat as possible to last through the winter. It is important for recreationists to be aware of their potential impacts on wildlife, to follow the seasonal closure dates, and to encourage their peers to do so as well.

Habitat Loss and Fragmentation from Land Development

As detailed in the “Land Development/Real Estate” section above, substantial land development in the Roaring Fork Valley has occurred in the past 30+ years, including on mule deer winter range areas on Missouri Heights and Spring Valley. Because of the high monetary value of land in the DAU, along with a decline in the livestock industry, there is great financial incentive for large ranches to subdivide and develop into residential housing. Conservation easements are difficult to secure because of the high cost of land. With 2/3 of mule deer winter range in D-53 being private lands, the need for conservation of existing habitat on private lands is critical.

Habitat Condition

As discussed in the “Habitat Capability and Condition” section above, big game habitat condition on winter ranges has declined throughout the DAU. It appears that the causes of most range problems include: plant succession towards later seral stage or climax communities, historic inappropriate livestock grazing, and localized excessive big game use (a possible result of loss of traditional winter ranges to development and over-populations of deer in the 1960s). Land development has limited the use of prescribed burns on the adjacent public lands because of concerns about the risk of fire damaging personal property.

Competing Herd Management Objectives: Buck Ratio and Population Growth

When managing simultaneously for population size and buck ratio, there can be tradeoffs. For example, deer populations managed for high buck ratios have been correlated with lower fawn ratios (Bergman et al. 2011). Adult bucks may be outcompeting fawns for forage and space, leading to lower fawn recruitment. Since 2011, the population size of D-53 has averaged 10% below the current objective (see “Post-hunt Population Size” section above). Doe licenses have been highly limited since 2015 to attempt to increase the

² From 2015-2017, antler shed collection on public lands in GMU 444 and several surrounding units was prohibited from January 1 to March 14, and also from legal sunset to 10 A.M. from March 15 to May 15. In 2018, these dates were revised to Jan 1-April 30, and the units affected were revised to all GMUs west of I-25 (with additional timing restrictions for Gunnison Basin units).

population; yet the deer population size has not grown in response. The current fawn ratio (see “Fawn:Doe Ratio” section above) is only sufficient to maintain the population, but is not high enough to yield population growth. Meanwhile, the buck ratio has exceeded the current sex ratio objective for most of the past decade and is on an increasing trajectory (see “Buck:Doe Ratio” section above). At present, the buck ratio is 40% over the objective. Buck licenses were increased in 2016 and again in 2017 to offer more hunting opportunity and to attempt to manage toward the current objective. (However, buck licenses were reduced in 2018 back down to 2016 quotas due to perceived hunter crowding and problems with hunters trespassing onto private lands during the 2017 season.) The relatively high buck ratio seen in D-53 could be contributing to the inability to increase the overall deer population. Either the objectives need to be revised, or an increase in buck harvest is needed to reduce competition with fawns and enable the overall population to grow.

Chronic Wasting Disease

Chronic Wasting Disease (CWD) is an infectious prion disease that affects cervids including mule deer. Deer infected with CWD usually die within 2 years of infection (Miller et al. 2012) and compared to uninfected deer, CWD-positive deer have both an overall higher mortality rate as well as a higher rate of being preyed upon by mountain lions (Miller et al. 2008). In herds that have a high prevalence rate of CWD, mortality due to CWD will eventually cause population declines (Miller and Fischer 2016). In addition, although there has not been evidence so far of transmission to humans, Miller and Fischer (2016) recommend a cautious approach of not consuming meat from CWD-positive animals. The CWD infection rate in mule deer bucks is about twice that of does (Miller and Conner 2005), so herds with high buck-to-doe ratios are more likely to have a higher CWD prevalence.

CPW has developed a Chronic Wasting Disease Response Plan with specific management guidelines to keep CWD prevalence in mule deer herds to <5% (CPW 2018). The CWD Response Plan outlines a 15-year monitoring plan in which certain selected herds will have mandatory testing of harvested bucks every 5 years. For herds that are not selected for the mandatory testing program, CWD surveillance will rely on voluntary testing of harvested deer and opportunistic testing of other dead deer (e.g., roadkills, winter- or predator-killed deer, or suspected CWD-symptomatic deer that are culled) (CPW 2018). Cost is the major factor limiting all herds from being tested. According to the CWD Response Plan, “when detections suggest prevalence is at a level of concern and increasing in a herd, it will be prioritized for mandatory testing” (CPW 2018).

In DAU D-53, the prevalence of CWD is not well known because few deer have been submitted for CWD-testing and it is not currently among the mandatory testing units. In the most recent 5-year sample (2014-2018), there was only 1 buck and 2 does voluntarily submitted for testing (none of which tested CWD-positive).

If a herd’s CWD prevalence reaches or exceeds 5%, the CWD Response Plan recommends the following harvest management actions (CPW 2018). CPW herd managers may take *any* or *all* of these actions in order to reduce CWD prevalence to below the 5% management threshold:

1. Reduce the population to the lower end of the objective range (increase overall harvest)
2. Reduce the buck:doe ratio to the lower end of the objective range (increase buck harvest)

3. Reduce the age structure (shift timing of buck harvest to later seasons to target older-age bucks)
4. Focus harvest in CWD hotspot locations

In addition, regardless of the CWD prevalence level within a herd, these routine practices should be followed (CPW 2018):

5. Avoid artificially concentrating deer via agricultural feed, salt, or mineral blocks
6. Use proper carcass disposal procedures to avoid spreading CWD via exposed carcasses

If these CWD management actions fail to reduce CWD prevalence in a herd to below the management threshold (5% prevalence) within 60 months (5 years), the Herd Management Plan update should be revised to lower the population and sex ratio objectives in order to reduce CWD prevalence to below 5% (CPW 2018). Furthermore, if CWD prevalence exceeds 10%, then a Herd Management Plan revision should be done within 12-18 months (CPW 2018).

PUBLIC INVOLVEMENT

Hunter Questionnaire

In October-November 2017, we contacted 1,302 households in which one or more household members had either drawn a GMU 444 deer license or applied for a GMU 444 deer license as their first choice within the past 3 years (2014-2016). We mailed postcards to these households with a request to complete an online survey on D-53 deer management. There were 178 people who completed the online survey (14% response rate). Links to the complete survey results are available in Appendix B.

Key highlights of the hunter survey results:

- 93% (n=166) of respondents have hunted deer in D-53; 7% (n=12) have not.
- Distribution of hunters is fairly uniform (note: the question allowed respondents to choose >1 portion of the unit, so the total exceeds 100%)
 - Western portion: 38%
 - Central portion: 40%
 - Eastern portion: 41%
- Perceived crowdedness (% rated as “moderately” or “very” crowded)
 1. Overall:
 - Mainly from other hunters (46%)
 - Also from passenger vehicles (35%), ATV/UTVs (30%), mountain bikers (27%), and hikers/trail runners (27%)
 - Somewhat from dirt bikers (20%)
 - Not much from horseback riders (7%)
 2. By type & geography:
 - Other hunters: slightly more crowded in western & eastern portions of the unit, but central is not far behind
 - Hikers/trail runners: evenly distributed
 - Horseback riders: more in eastern portion
 - Mountain bikers: more in central & western portions
 - Dirt bikers: more in central & western portions
 - ATV/UTV: more in eastern portion
 - Passenger vehicles: more in eastern portion
- Ranking of reasons to hunt deer in D-53 (% rated as “very important”)

1. To spend time in nature (63%)
 2. To spend time with family/friends (55%)
 3. To obtain wild game meat (41%)
 4. To contribute to wildlife management of deer (35%)
 5. To obtain a trophy buck (22%)
 6. To contribute economically to the local community (15%)
 7. To reduce property damage caused by deer (6%)
- Ranking of concerns about deer management in D-53 (% rated as “Very Concerned”):
 1. Loss and fragmentation of deer habitat due to land development (64%)
 2. Inability to increase the deer population (44%)
 3. Effects of predation on the deer population (40%)
 4. Disturbance and displacement of deer by non-hunting outdoor recreation (37%)
 5. Difficulty of drawing a deer license (37%)
 6. Quality of bucks (36%)
 7. Declining quality of forage due to changes in plant communities & lack of natural wildfires (36%)
 8. Effects of hunting on the deer population (18%)
 - Preferred population objective = Increase from the current population (52%)
 - Preferred buck ratio objective = Maintain the current buck ratio (63%)
 - Common and/or notable comments:
 - Distribution of deer on private vs public lands; many deer are not huntable on private lands and in subdivisions.
 - Too many lions and bears, need to increase harvest on predators.
 - Crowding, poaching, trespassing in western portion of unit; increasing licenses on public land would create more crowding.
 - Some people are seeing ample deer and want an increase in deer licenses; vs. other people are not seeing enough deer compared to several years or several decades ago and want a reduction in deer licenses.
 - Geographic variation: western portion is more limited due to private land & hunters don't see as many deer on public land; in eastern portion, responses varied - some seeing plenty of deer & some seeing few deer.
 - License numbers - responses varied: Some said there are not enough licenses, could not draw a tag; vs. others said they were able to draw 1st choice and want no changes; vs. others said to limit the licenses more to increase the population and buck maturity.
 - Human recreation activities are increasing, especially dirt biking & mountain biking. Lots of mountain biking on Basalt Mountain, resulting in fewer deer and elk seen.
 - Disturbance from logging operation.
 - Buck quality is average; some want a point restriction, while others are satisfied with the quality.
 - Harassment by anti-hunters at Woods Lake & Lyle Lake trail.
 - Roadkill, increasing vehicle traffic.
 - Disease concerns - ticks, CWD.

Draft Plan public comment period, late September - October 2018

The draft herd management plan was opened for public comment from Sept 18 - Oct 31, 2018. The draft plan was posted on the CPW herd management plan website and also a

media press release was sent out. We also held a public meeting for both the D14 and D53 herd management plans at the CPW office in Glenwood Springs and had 17 attendees.

A second online questionnaire was available for the public to comment on the proposed herd management objectives. Links to the summary of the 17 responses to the online questionnaire are available in Appendix C.

Presentations were given to Eagle, Garfield, and Pitkin Boards of County Commissioners and to the Lower Colorado River Habitat Partnership Program (HPP) committee; and BLM and USFS were also asked for comments. Written comments from these entities are attached in Appendix D.

MANAGEMENT ALTERNATIVES and PREFERRED OBJECTIVES

CPW is considering 3 alternatives for the population objective (Table 7) and 3 alternatives for sex ratio objective (Table 8) for this update of the D-53 management plan. Note that the population objective alternatives and the sex ratio objective alternatives are **not paired**; for example, Alternative 1 for population objective does not necessarily need to be selected along with Alternative 1 for sex ratio objective.

Population Objective Alternatives

The current (2018) D-53 population estimate is 4,440 deer and the current population objective is 5,300 deer. The alternatives being considered would aim to either decrease, maintain, or increase the population from its current size. The ranges of population size within each alternative allow for some annual variation in population size due to non-hunting related factors such as weather variability and due to the inexactness of population modeling methods (see “Overview of Procedures to Estimate Population Size” section above).

Table 7. Proposed alternatives for D-53 population objective

Proposed Population Objective	
Alternative 1:	2,500-4,500 (midpoint 3,500)
Alternative 2:	4,000-6,000 (midpoint 5,000)
Alternative 3:	5,500-7,500 (midpoint 6,500)
Current (1995 DAU plan) population objective:	5,300 deer
Current (post-hunt 2018) population estimate :	4,440 deer

Under Alternative 1 (2,500-4,500 deer), the deer population in D-53 would be managed below its current (2018) population estimate. Deer hunting opportunities would be fairly abundant under this alternative. Doe license quotas would be initially increased to reduce deer numbers slightly. Buck license quotas could also be increased initially to help meet the lower population objective. With a lower-density deer herd experiencing less competition per deer for resources, the population growth rate may increase and the herd should be able to rebound more quickly from a severe winter. If fawn recruitment increases as a density-dependent response and offsets the increased doe harvest, it may be possible to maintain the increased doe license quota in the long term. However, at a lower population size, there would be numerically fewer bucks available to hunt (although buck quotas would also depend on the buck ratio objective selected).

Under Alternative 2 (4,000-6,000 deer), the deer population size would be managed at or above its current level. Doe license quotas would be similar to pre-2015 levels (i.e., quotas before CPW sharply reduced doe quotas). Buck license quotas would also probably remain similar, although it will depend on which sex ratio objective is selected. The population growth rate, the ability of the herd to recover from a hard winter, and the hunting opportunities under Alternative 2 would be intermediate to that of Alternatives 1 and 3.

Under Alternative 3 (5,500-7,500 deer), the deer population would need to be increased by at least +24% from its current size. This scenario is unlikely to be achievable without major changes in habitat and landscape conditions. After many years of attempting to achieve the current (1995 DAU plan) population objective of 5,300 deer, the population has remained below this objective for most of the past decade. Therefore, increasing the population to more than 5,500 deer is not likely to occur without significantly reducing doe and buck license quotas for many years and/or conducting large-scale habitat improvement projects to rejuvenate the forage. At a higher deer density, the population would be slower to grow and would not rebound quickly from a severe winter.

Sex Ratio Objective Alternatives

The most recent 3-year average (2014, 2015, 2018) observed sex ratio is 42 bucks per 100 does and the current objective is 30 bucks per 100 does. Because D-53 was originally set up to be a hunter opportunity (rather than trophy) unit, the alternatives under consideration all aim to reduce the observed buck ratio from its current level downward by varying degrees. However, all three alternatives would be similar to or higher than the current objective. The ranges within each alternative allow for annual variation in sex ratio that can occur naturally due to factors such as environmental fluctuations and differential over-winter mortality rates of bucks and does.

Table 8. Proposed alternatives for D-53 sex ratio objective

Proposed Sex Ratio Objective	
Alternative 1:	24-32 (midpoint 28)
Alternative 2:	28-36 (midpoint 32)
Alternative 3:	32-40 (midpoint 36)
Current (1995 DAU plan) Sex Ratio Objective:	30 bucks per 100 does
Most recent (post-hunt 2014, 2015, and 2018) 3-year average sex ratio:	42 bucks per 100 does

Under Alternative 1 (24-32 bucks per 100 does), the sex ratio would need to be reduced significantly by -24% to -43% from the current 3-year average. Buck license quotas would be increased substantially, so there would be more opportunity to hunt bucks. However, hunter crowding on public lands would likely be higher than in the past. At a lower buck-to-doe ratio, there would be relatively fewer bucks competing with fawns and does for forage and space, so fawn recruitment and population growth rate are likely to improve. Assuming that the older bucks tend to preferentially selected for harvest by hunters, the age structure of the buck segment of the deer herd would become younger.

Under Alternative 2 (28-36 bucks per 100 does), the sex ratio would need to be reduced moderately by -14% to -33% from the current 3-year average. Buck license quotas would moderately increase. There would be slightly more opportunities to hunt bucks, hunter

crowding may increase somewhat, and fawn recruitment and population growth may improve. The age structure of bucks in the herd would be intermediate to that of Alternatives 1 and 3.

Under Alternative 3 (32-40 bucks per 100 does), the sex ratio would need to be reduced slightly by -5% to -24% from its current 3-year average. Buck license quotas would remain similar to current levels or may be increased slightly. Hunter crowding on public lands would likely be similar to present conditions. The quality of the available bucks would remain similar, but population growth rate may be slower than under Alternatives 1 and 2 due to relatively more bucks in the population competing with fawns and does. Older bucks might not survive a hard winter and it could take longer to recover to a higher buck ratio objective compared to Alternatives 1 and 2.

Preferred Alternatives and New Objectives

Preferred post-hunt population objective range = 4,000-6,000 deer (Alternative 2).

Alternative 2 is the CPW staff-preferred population objective alternative because this objective range provides the most flexibility in population management relative to the herd's current status. Within this objective range, the herd could either remain stable or be allowed to increase if habitat conditions, changes in land use, and/or weather conditions are favorable for population growth.

Preferred post-hunt sex ratio objective range = 32-40 bucks per 100 does (Alternative 3).

Alternative 3 is the CPW staff-preferred sex ratio objective alternative because it would balance the hunting public's desire for quality bucks while still maintaining enough buck licenses for people to be able to draw a license every year or few years. Because of limited public lands in the western one-third of the unit, managing lower than Alternative 3's sex ratio objective range would likely increase hunter crowding and private land trespass issues to undesirable levels. With no documented CWD in this unit yet, a slightly higher sex ratio can be sustained; but if CWD is detected and the prevalence rate reaches 5% or higher, then a revision of the sex ratio objective will be needed to adjust the sex ratio downward.

STRATEGIES TO ADDRESS ISSUES AND MANAGEMENT CONCERNS

Few of the issues and management concerns identified in this management plan are wholly within CPW's regulatory purview. Addressing many of the issues and management concerns requires close coordination with other federal, state, and local governmental entities and other organizations. CPW will continue to work collaboratively with our partners in the federal land management agencies, private landowners, county governments, local municipalities and NGOs to protect and enhance the remaining mule deer habitat. Important habitat conservation methods include habitat treatments, conservation easements or land acquisitions, maintaining landscape connectivity and movement corridors, and adhering to seasonal recreation closures on winter range areas.

STRATEGIES TO ACHIEVE HERD MANAGEMENT OBJECTIVES

To achieve the new objectives of a population size of 4,000-6,000 deer and a sex ratio of 32-40 bucks per 100 does over the next 10 years, CPW will continue to set licenses annually, keeping in mind such issues as providing sufficient hunting opportunity for both buck and doe harvest, and sustaining a stable, if not growing, deer herd.

ACKNOWLEDGEMENTS

Thanks to Michelle Flenner (GIS specialist, CPW) for conducting spatial analyses and preparing the maps for this document.

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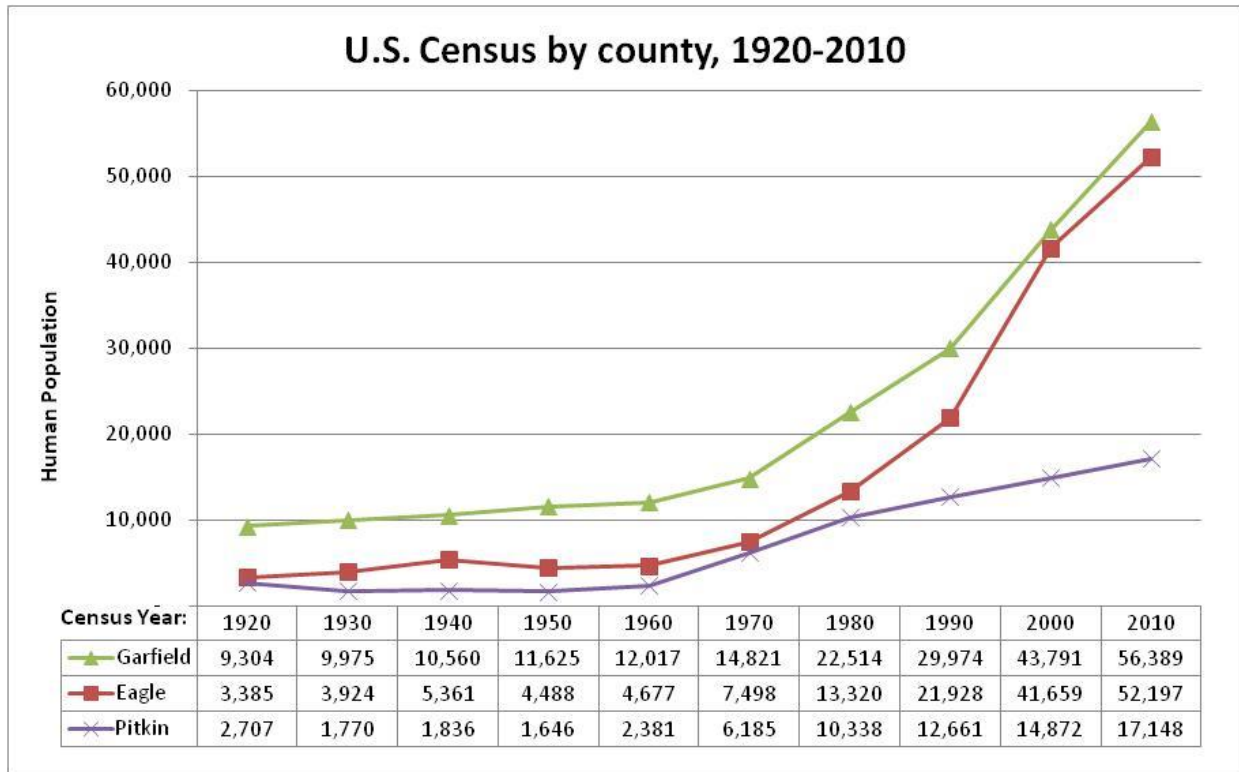
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Draft

APPENDICES

Appendix A. Human population in counties overlapping mule deer DAU D-53, 1920-2010.

Source: U.S. Census Bureau



Appendix B. Results of online hunter questionnaire, Oct-Nov 2017.

To view the complete results of the D53 hunter survey, go to the following website link:

<https://drive.google.com/file/d/1uKBBloJMqbkvjnt8dSa8tYjP17C3ORfa/view?usp=sharing>

or <https://tinyurl.com/y9w7ho6s>

To view the results of the hunter crowding question and comments based on geographic area, please see:

<https://drive.google.com/file/d/1Z744fl16e6yWPUviaKle68HbPgan5PyL/view?usp=sharing>

or <https://tinyurl.com/y96z8oo2>

Appendix C. Results of public comment period questionnaire, Oct 2018.

To view the complete results of the D53 public comment period questionnaire, go to either of the following links:

<https://drive.google.com/file/d/1MiqcPPshT3x00gAwgH8RuKMIFy2seOWq/view?usp=sharing>

or <https://tinyurl.com/y96z8oo2>

Appendix D. Comment letters from other agencies and committees.

Tom Jankovsky
District 1

John Martin, Chair
District 2

Mike Samson, Chair Pro Tem
District 3



October 1, 2018

Julie Mao, Wildlife Biologist
Colorado Parks and Wildlife
0088 Wildlife Way
Glenwood Springs, CO 81601

RE: *Garfield County comments in Support of the Draft Mule Deer Herd Management Plan for the Basalt (DAU-53)*

Dear Ms. Mao,

The Garfield County Board of County Commissioners would like to offer our support of the Draft Mule Deer Herd Management Plan currently proposed by the Colorado Department of Parks and Wildlife (CPW) for the Basalt (Data Analysis Unit - 53) also known as Game Management Unit 444. We wish to thank you for the informative and thoughtful presentation you gave to our Board on October 1, 2018 where you explained the purpose of the Herd Management Plan to set population objectives and sex ratio objectives for the Mule Deer herd in DAU-53 for the next 10 years.

As you know, the Garfield County Commissioners continue to support CPW's efforts to maintain and strengthen Mule Deer herds not only in Garfield County but in the State as well. We recognize the importance of maintaining healthy Mule Deer herds not only from a natural, biological and scenic standpoint but also from a long-time hunter harvest tradition. We applaud CPWS's work to address the many impacts to the herd's overall health with a 'management by objective' approach that strives to balance the biological capabilities of the herd and its habitat with the public's demand for wildlife recreational opportunities which is important to our community.

Garfield County supports the preferred alternatives as you outlined them in your presentation and draft Herd Management Plan specifically regarding population objectives and sex ratio objectives in DAU-53 for the next 10 years. Please do not hesitate to contact me if you have any questions regarding our support.

Very truly yours,



John Martin, Chairman
Garfield County Board of County Commissioners



October 25, 2018

Julie Mao
Colorado Parks and Wildlife
0088 Wildlife Way
Glenwood Springs, CO 81601

RE: Lower Colorado River Habitat Partnership Program Comments - Deer DAU D-53

Dear Julie:

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

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

The LCRHPP committee supports the draft alternative 2, to maintain or slightly increase the range of animals within this DAU and within our committee area. If achieved, the LCRHPP committee does not believe this increase would create more conflicts and we also believe we have the resources necessary to address conflicts should they occur. Increasing the population objective will ultimately lead to more hunting licenses and sportsmen opportunities.

HPP is also directed by statute to assist the Division to meet game management objectives. The LCRHPP committee has worked with both public land managers and private landowners to improve the quality and quantity of the habitat in D-53 and we remain committed to this.

As with most people in Colorado, our committee also desires to have more deer in this area. However, residential growth has occurred in winter range resulting not only in a loss of critical habitat but also habitat fragmentation and increased disturbance on the remaining landscape, affecting both wintering and reproducing deer. Additionally, public land recreation demands in DAU-53 continue to increase for both motorized and non-motorized users with similar effects. Given the increased demand to live and recreate in this area, we believe these trends will continue and will eventually affect CPW's ability to achieve their management objectives.

The LCRHPP committee also discussed the proposed sex ratio alternative. We support alternative 3; lowering the current sex ratio objective to a range that, while still maintaining larger bucks, would ultimately increase the opportunity for more hunters in the field.

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

Sincerely,

A handwritten signature in black ink, consisting of a large, stylized 'D' followed by a horizontal line that extends to the right and then curves slightly upwards at the end.

Darren Chacon, Co-Chair
Lower Colorado River HPP Committee