COLORADO ACTION PLAN

For

Implementation of Department of the Interior Secretarial Order 3362: "Improving Habitat Quality in Western Big-Game Winter Range and Migration Corridors"

2019-2020

September 6, 2019

EXECUTIVE SUMMARY

Colorado Parks and Wildlife (CPW) has identified five *priority areas* that will guide efforts by the agency and its partners to implement Department of the Interior (DOI) Secretarial Order 3362 in 2019-2020 and conserve big game migration corridors and winter range. In addition, CPW has identified five priority *research needs* to focus our efforts to better document and understand big game use of migration corridors and winter range during the fiscal year.

Priority Areas

For Colorado's 2019-2020 Action Plan, we have retained the two priority migration corridors that were identified in the 2018 action plan. These include the areas used by the Bear's Ears/White River mule deer and elk herds in northwest Colorado, and the San Juan Basin mule deer and elk herds in southwest Colorado. Three additional priority areas have been identified in 2019, including the Uncompahgre Plateau in southwest Colorado, the Piney River/State Bridge area in north central Colorado and the Bookcliffs area in west-central Colorado.

The Bear's Ears/White River mule deer and elk herds are among the largest herds in Colorado. These herds contain about 80,000 deer and 70,000 elk. Although the elk herds are robust, the mule deer herds in the region have been in decline. Strategically placed habitat treatments, conservation easements, and highway crossing structures will help to conserve the migration corridors and winter range used by these important herds.

The San Juan Basin is home to about 27,000 mule deer and 19,000 elk, which use several migration routes as they travel across a patchwork of federal, tribal, state and privately-held lands. Some of these animals migrate south across the state boundary into New Mexico. This corridor has been identified as a focus area by the Colorado Department of Transportation for wildlife crossing structures. The region's

big game herds will benefit from strategically placed habitat treatment projects, conservation easements, and highway crossing structures.

The Uncompahgre Plateau supports about 15,000 mule deer and 9,000 elk. Both species have declined in recent years, primarily from recurring drought, poor livestock management, disease, and development (both residential and commercial), along with increasing recreational activity within big game habitat. Migration corridors and winter range can be enhanced through projects that incorporate conservation easements, wildlife friendly fencing, travel management on USFS and BLM lands, habitat improvements,and highway crossing structures.

Big game habitat for the 14,000 deer and 3,700 elk within the Piney River/State Bridge area has declined in quantity and quality due to land development, fragmentation by roads and trails, increased human activity on public lands, and suppression of large-scale wildfires. Conservation easements are also needed to protect migration corridors and winter ranges, as well as limit recreational activity on winter range. Strategically placed highway crossing structures are also needed to conserve and restore connectivity for migrating wildlife. Well-designed and strategically placed habitat treatment projects are recommended to improve the forage quality and capacity of winter range within this area.

The Bookcliffs area supports about 7,500 mule deer and 5,000 elk. Both deer and elk migrate elevationally with the seasons. Portions of each herd migrate relatively long distances west, crossing state lines to spend the winter months in Utah. BLM lands are important winter range for both species; thus CPW will collaborate with BLM to support efforts to minimize and mitigate the negative effects of developments and recreational activities on migrating big game. We will also focus on the protection of private lands within migration corridors and winter range through conservation easements, and strategically identify habitat enhancement projects to counteract the effects of livestock grazing and improve forage quality for wintering deer and elk.

Research Needs

The DOI fully funded the two research needs identified in Colorado's 2018 Action Plan. These additional GPS-based telemetry studies will gather detailed movement data on deer and elk within the North Park and the San Juan Basin herds. We have scheduled capture efforts for the 2018-2019 winter, at which time CPW will initiate monitoring of these herds over the 3-year lifespan of the transmitter collars. Appendix D contains a description of Colorado's 2018 research priorities.

In 2019, CPW has identified five new research needs relative to Secretarial Order 3362. These include: 1)Upper Purgatoire mule deer and elk herds, 2) South Park elk

herds, 3) Front Range mule deer, 4) Guanella Pass, and the 5) Dolores mule deer herd. All are areas and herds where additional data on the movements and habitat relationships of big game are needed to inform management of big game corridors and/or winter range.

The migration corridors used by the Upper Purgatoire mule deer and elk herds in southeast Colorado need to be better understood. This area borders New Mexico and a portion of this area is bisected by Interstate 25. New Mexico's Department of Transportation is in the process of installing exclusionary fencing along this highway; we expect the incidence of highway crossings to increase in Colorado as a result. Additionally, CPW has collaborated with The Nature Conservancy and Trust for Public Lands to purchase a 19,000 acre ranch that abuts Interstate 25. As development occurs for a range of recreational activities on this property, it will serve as a rare opportunity to examine the impacts of recreational development on deer and elk movements and distribution.

The South Park area in central Colorado contains critical winter range for several local elk herds. Better understanding of elk movements, migration corridors, and distribution of winter range use is needed to inform future management of these habitats.

The Front Range in northeast Colorado was considered an area where additional knowledge of mule deer movements is needed to identify migration corridors and better understand their patterns of use within a rapidly developing landscape. This knowledge will inform future efforts to manage mule deer where hunting is restricted.

Guanella Pass in northeast Colorado is an area that contains important habitat and migration corridors for elk, mule deer and moose. The U.S. Forest service manages this area, which is undergoing rapid increases in recreational activities. Detailed understanding of big game movements and habitat use patterns will help to inform future land use plans.

In southwest Colorado, mule deer and elk herds in the Dolores area near Disappointment Creek are performing poorly. Data describing specific migration corridors, stopovers, and summer and winter ranges is needed to inform plans and conservation actions to maintain habitat connectivity and protect important habitats.

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INTRODUCTION Colorado Parks and Wildlife (CPW) identified 5 priority migration corridors for the state's elk and mule deer herds in 2019. These include the Bear's Ears/White River herds in northwest Colorado, San Juan Basin herds in southwest Colorado, the Uncompahgre Plateau in southwest, Piney River/State Bridge area in north-central Colorado and the Bookcliffs area in west-central Colorado. Managers have collected mule deer and elk movement data in these areas and are working with stakeholders and agency personnel to identify related research and proactive conservation actions directed toward conserving vital habitats in these herd units.

Colorado big game populations face the same threats as many other places in the west: habitat fragmentation, degradation and loss, and increased disturbance from human activity. Projected human population growth and the geography of the state heighten the impact of these threats. The state may have some of the best habitat for elk and mule deer in the West, as it supports large populations of both species. Threats from increasing human populations include the development and fragmentation of habitat, disturbance and displacement of wildlife due to greater year-round recreational activity, increased road density and mortality from wildlife-vehicle collisions, and degradation of habitat from invasive plants. Housing development in winter range and expanding development near higher elevation ski resorts can be particularly detrimental if they occur in aspen stands (fawning/calving habitat) or migration corridors. Development of rich natural resources such as oil shale and natural gas is impacting winter ranges. Cheatgrass invasion into sagebrush habitats also threatens the quality of winter ranges.

Colorado's Wildlife Action Plan also identifies threats to big game migration. Here, the infrastructure and human activities associated with oil and gas development, including roads and railroads, fragment migration routes for elk and mule deer.

Secretarial Order 3362 directs appropriate bureaus (US Fish and Wildlife Service (USFWS), National Park Service (NPS), and Bureau of Land Management (BLM)) within the Department of the Interior (DOI) to work in close partnership with the State of Colorado to enhance and improve the quality of big-game winter range and migration corridor habitat on Federal lands under the jurisdiction of the DOI in a way that recognizes state authority to conserve and manage big-game species and respects private property rights. Through scientific endeavors and land management actions, wildlife such as Rocky Mountain elk (elk), mule deer (deer), pronghorn antelope (pronghorn), and a host of other species will benefit.

Conditions in the broader landscape may influence the function of migration corridors and sustainability of big game populations. Such conditions may include

habitat fragmentation, land use patterns, resource management, or urbanization. The United States Department of Agriculture (USDA), through the USDA Forest Service and USDA Natural Resource Conservation Service, will collaborate with DOI, the states, and other natural resource managers across the broader landscape when developing an all-lands approach to research, planning, and management for ecological resources, to include migration corridors, in a manner that promotes the welfare and populations of elk, deer, and pronghorn, as well as the ecological integrity of terrestrial ecosystems in the plan area.

Colorado has approximately 66,387,200 total acres, 23,541,190 or 35% of which are owned by the federal government. The BLM manages 8,354,660 acres, the USFS manages 14,509,180 acres and the NPS manages 596,700 acres. Other agencies manage the rest of federal ownership. The State of Colorado owns 2,917,700 acres. There are also privately owned land parcels scattered throughout big game habitats. This ownership structure requires cooperative partnerships to work effectively across all the habitat categories and ownerships for big game species (Appendix A).

CORRIDOR/WINTER RANGE

#1 Colorado Migration Corridor Priority: Bears Ears and White River Landscape Conservation of Big Game Winter Range and Migratory Routes (Northwest Colorado)

Why the area selected as a priority:

The northwest corner of Colorado is home to two of the largest migratory mule deer and elk herds in Colorado and perhaps the United States. The Bear's Ears and White River mule deer and elk herds are estimated at 75,000 – 80,000 deer and 65,000 – 70,000 elk. They are also among the most migratory of deer and elk herds in Colorado. A significant proportion of each herd migrates 60 to 70 miles in spring and fall. The migratory pattern is primarily east-west, with summer ranges in the upper reaches of the Yampa and White River drainages near the Continental Divide and winter ranges west to within about 30 miles of the Colorado-Utah state line. These herds are of high state importance, as they comprise approximately 21% of all deer on the western slope of Colorado and 25% of elk in Colorado, respectively.

Elk populations within these two herds are very robust and provide hunting opportunities for nearly 55,000 hunters annually from across the country. However, mule deer herds in these two herd units, like many other deer herds across the west, have been steadily declining over the past several decades. The White River deer herd in particular has experienced a significant decline in just the last 10-12 years.

Spatial Location:

These adjacent herd units are located within the Yampa and White River drainages between the Colorado-Wyoming state line and the White-Colorado River drainage divide (Figure WC1.1).

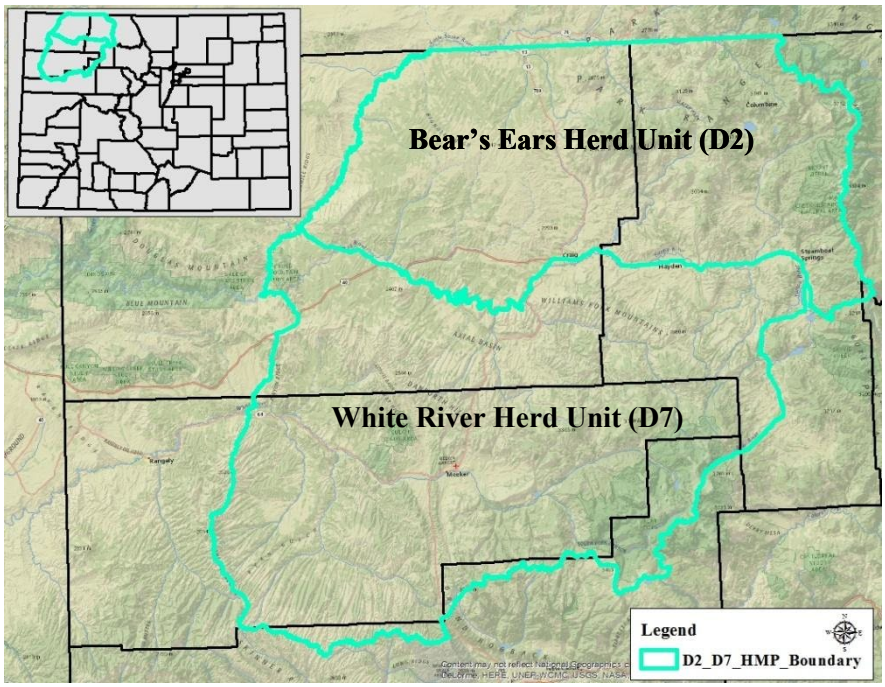

Figure WC1.1. Bear's Ears (D2) and White River (D7) Herd Management boundaries in northwest Colorado.

Mule deer winter range in this priority area is shown in Figure WC1.2, with areas of the highest density of wintering deer shown in the darkest color. Mule deer migratory patterns derived from Brownian bridge analysis of radio-marked deer are presented in Figure WC1.3. Elk winter range and migration patterns are shown in Figures WC1.4 and WC1.5, respectively.

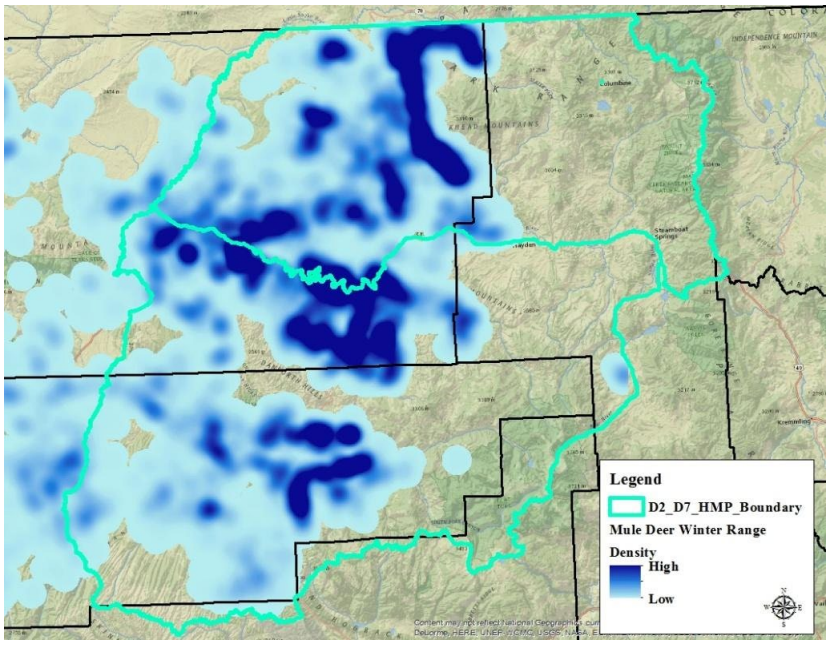

Figure WC1.2. Mule deer winter ranges in the White River and Bear's Ears herds.

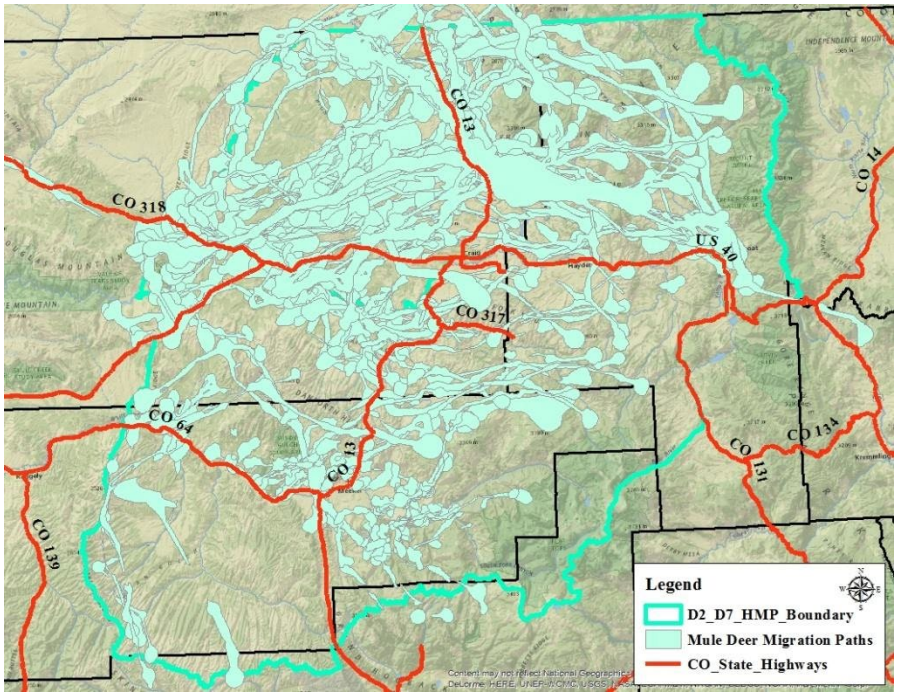

Figure WC1.3. Mule deer migratory routes based on Brownian bridge movement analysis.

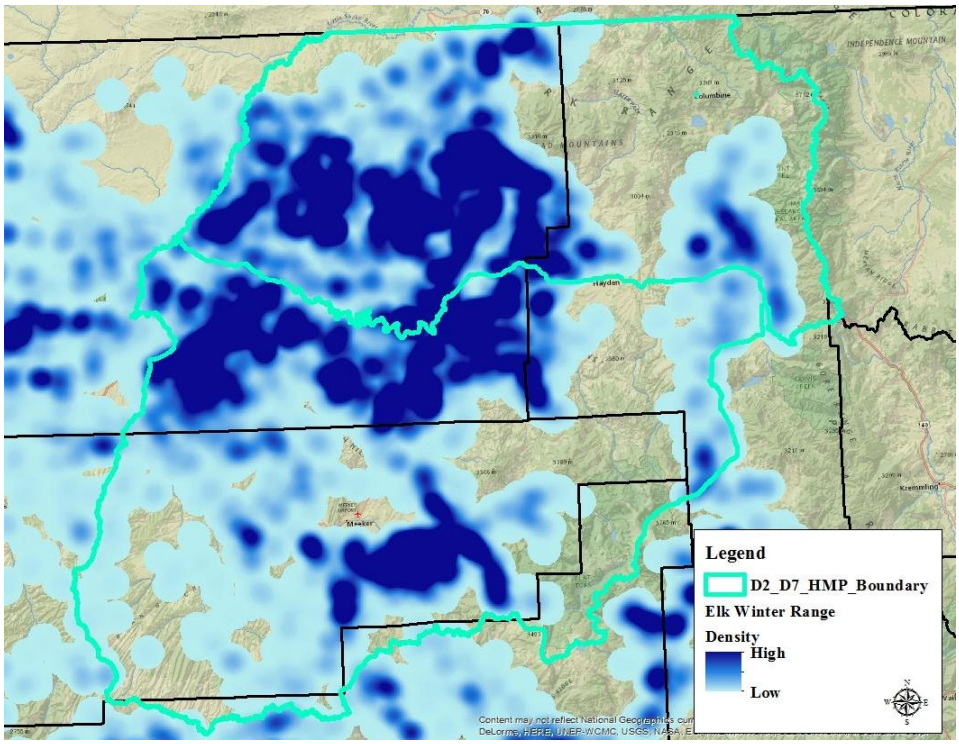

Figure WC1.4. Elk winter ranges in the Bear's Ears and White River herds.

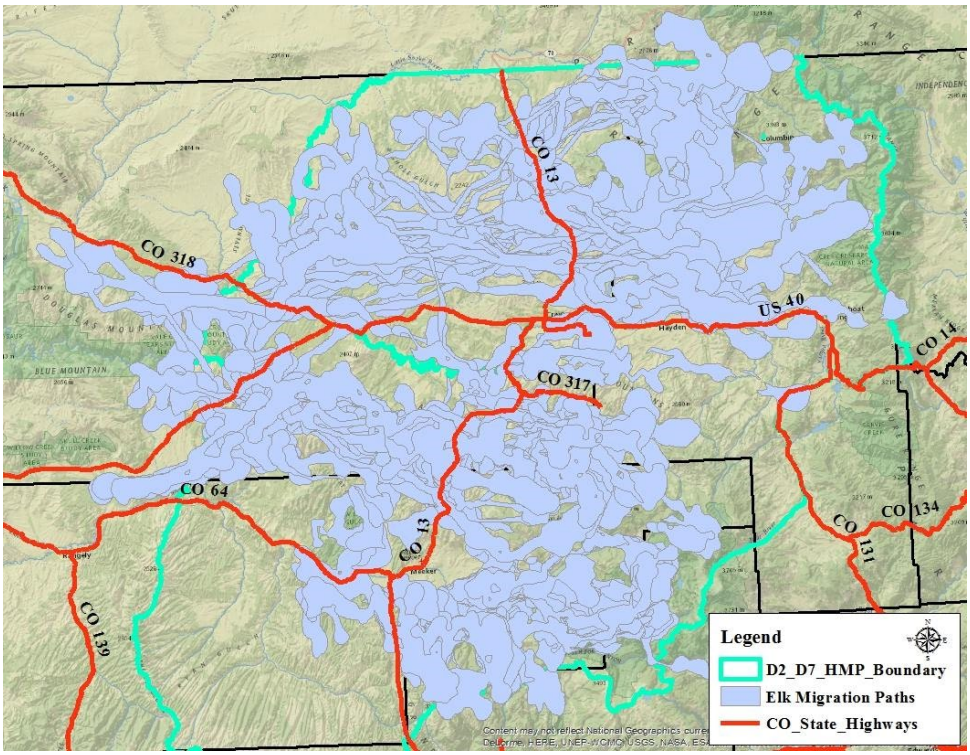

Figure WC1.5. Elk migration corridors based on Brownian bridge movement analysis.

Habitat Types:

The varied topography and elevations in the Bear's Ears and White River herd units contribute to differences in habitat across the area. Generally, vegetation types range from the montane/subalpine zone in the eastern and central areas at higher elevations to mountain shrub-dominated vegetation at middle elevations, and sagebrush shrublands and pinyon-juniper woodlands within the Great Basin zone at the lower elevations in the southern, western and northwestern portions of the herd units.

Spruce-fir and aspen stands characterize the Montane/subalpine zone. Depending on the degree of canopy closure and resultant understory of grasses and forbs, the spruce-fir areas represent moderate to good summer and fall forage for mule deer and elk. Aspen groves and associated meadows provide high quality forage from spring through fall. The Flat Tops Wilderness Area is known for its expansive meadows interspersed with spruce/fir stands. Aspen habitat is also extremely important as fawning areas for mule deer and calving areas for elk, especially when there is sufficient understory.

Mountain shrub zone vegetation consists of native grasses and Gamble's oak interspersed with mountain big sagebrush. Also common are serviceberry, mountain mahogany and chokecherry. This zone, roughly from 6,500 to 8,500 feet in elevation, is very important for both food and cover. The lower half of the zone serves as a large portion of the traditional elk winter range in all but the most extreme winters. Mule deer use the lower fringe of this zone, and the sagebrush steppe at lower elevations for winter range.

Sagebrush steppe and grasslands dominate the Great Basin Zone, occurring generally below the 6,500-foot elevation. This zone is used primarily as winter range by mule deer and elk although there are some smaller bands of both species using these areas year-round. Pinyon-juniper stands are most prevalent on north aspects of higher ridges throughout this zone. Pinyon-juniper is important winter cover and provides limited winter forage. In areas where sufficient irrigation water exists, sagebrush fields have been converted for hay production of alfalfa or grasses such as timothy or orchard grass.

During the late 80's and mid-90's large scale burns across much of the winter range have converted habitats dominated by bitterbrush, sagebrush, and pinyon-juniper to grassland habitats. These areas served as critical mule deer winter range prior to the burns, but were converted into large expanses of grasslands suitable for elk but

less attractive to mule deer. Wetland/riparian vegetation types are found along the river bottoms and associated irrigated meadows. Most notable is the Yampa River corridor running first north, then east to west across the northern portion of the priority area. The White River runs east to west through the southern portion of the area. Narrowleaf cottonwood and willow dominate most riparian areas in the Data Analysis Unit (DAU), which are extremely valuable wildlife habitats, supporting the greatest abundance and diversity of wildlife species.

Important Stopover areas within the corridor:

As demonstrated in Figures WC1.3 and WC1.5, the migratory patterns for mule deer and elk are substantial in both migratory distance and the proportion of each herd migrating seasonally. Initial findings suggest that migration tends to occur quickly and with limited use of migratory stopovers. However, further analysis is needed to identify important stopover areas within the migration corridors.

Land Ownership:

The White River and Bear's Ears herd units contain large blocks of public lands interspersed with private land holdings (Figure WC1.6). The combined area encompasses 6,992 square miles consisting of the following land ownership proportions: Private lands (45%), Forest Service (30%), BLM (20%), State Land Board (4%), and CPW State Wildlife Areas (<1%, approximately 35 mi^2).

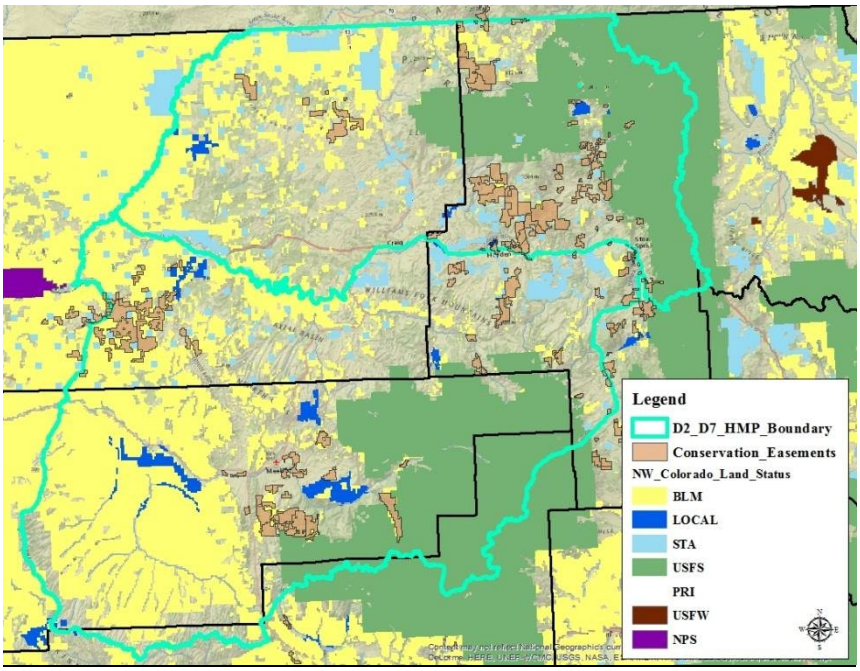

Figure WC1.6. Surface landownership and conservation easements across the Bear's Ears and White River landscapes.

Land Uses:

Those federal lands within the White River and Bear's Ears herd units not designated as Wilderness are managed under a multiple-use policy. Common uses include livestock grazing, motorized and non-motorized recreation, and extractive energy development. Mule deer and elk migrate through parcels that have been leased for oil and gas production and active open pit coal mining operations. Private lands in the herd units are primarily used for agricultural purposes and rural residential development.

Several coal mines on privately owned parcels have reached their life expectancy and are transitioning towards obtaining bond release. Some of these acreages are being sold to developers interested in rural residential development. This major change in land use for the area is starting to have a significant impact on both mule deer and elk habitat, particularly winter range in these units.

Hunting for both big and small game is a principal business in this priority area. Hunting directly contributes over $43 million annually to the economy of Moffat, Routt, Rio Blanco and Garfield counties with an additional $37 million in secondary expenditures (1990 estimates). Hunters can pursue elk, deer, pronghorn, bear, mountain lion, rabbits, three species of grouse, waterfowl and other game animals in the priority area.

Risk/Threats:

CPW developed a West Slope Mule Deer Strategy in 2014 that identified a list of issues affecting mule deer populations in Colorado. Those issues include: habitat quality, habitat quantity, predation, weather, highway mortality, disease, competition with elk, recreation, migration corridors, hunting demands, doe harvest, disease management, and population modeling/management. Habitat quality and quantity issues are further subdivided into poor forage conditions, large-scale type conversion of habitat, loss of habitat to oil and gas and other energy development, and residential expansion.

Are the Risk/Threats Immediate or Long-term:

Some of these risks are operating over the long-term; others like rural residential development are more immediate. Winter ranges in this priority area are heavily utilized by big game wildlife and domestic livestock. Severe drought conditions in 2018 decreased forage quantity and quality, exacerbating a longer term concern that key shrubs used as winter forage by big game are in relatively poor condition over significant portions of the priority area. The 2018 drought was followed by a winter of heavier than average snowfall in 2018-19, that placed additional pressure on winter range shrubs. While moisture conditions in the summer of 2019 are much improved, winter range shrubs remain in poor condition over extensive areas within the Bears Ears and White River priority area.

Northwestern Colorado contains some of the richest oil, gas, oil shale and coal reserves in the state. While current energy commodity prices and relatively high cost of production have reduced the pace of oil and gas development since 2009, it is expected to ramp up quickly when natural gas prices rise. Rural residential development is proceeding at a rapid pace in several areas within the priority area. Migrating animals in this priority area are exposed to three highways (U.S. Highway 40, Colorado State Highway 13, Colorado State Highway 64) that bisect the long migratory path. Annual mortality of mule deer from vehicle collisions in the area is estimated to be approximately 2% of the deer in each herd (equal to approximately 1600 deer annually). Elk mortality is lower but still substantial. Efforts to improve highway safety on any of the 3 highways would devastate these migratory paths if done without proper design and installation of highway crossing mitigations.

Actions necessary to reduce or eliminate risks/threats:

Continued diligence from the BLM and the Forest Service in avoiding, minimizing, and mitigating the negative effects of land use developments, including recreation, on migrating and wintering deer and elk will be critically important. Counties,

municipalities, and non-governmental organizations also have a role to play in properly designing and implementing land use practices within the priority area. Limitations on the timing and intensity of recreational activity on publicly and privately owned winter range will be especially valuable in reducing impacts on big game.

CPW has completed a comprehensive program of monitoring and research in this priority area and has made substantial steps to implement habitat enhancement and land protection measures. The greatest future need in this priority area is funding to implement additional habitat enhancement, conservation easement acquisition, and highway permeability/crossing projects. Funds allocated to this priority area would contribute to an existing landscape-scale mule deer and elk management program with a demonstrated record of success. Currently planned habitat enhancement in this priority area consists of multiple projects involving prescribed fire, mechanical treatment of pinyon-juniper woodlands and mesic mountain shrub stands through roller chopping, hydro-axe mastication, understory enhancement on rangelands and abandoned dryland agricultural fields through reseeding or interseeding with diverse seed mixes including sagebrush and other shrubs and other practices to reset succession or otherwise improve forage quality, quantity, and/or availability of forage to migrating or wintering big game. Available habitat enhancement funds will be exhausted in 2021, leaving approximately $400,000 in unmet funding need for currently planned work.

Current efforts (what is the activity; who is conducting the work; and partners involved):

In response to declining deer numbers in western Colorado, CPW implemented a mule deer strategy beginning in 2014. The goal of the mule deer strategy is to work in concert with key publics and stakeholders to stabilize, sustain, and increase mule deer populations in western Colorado, and in turn, increase hunting and wildlife-related recreational opportunities. CPW has focused considerable management efforts on the Bear's Ears and White River herds.

Since 2001, CPW has monitored mule deer survival in the White River herd. This management study has allowed managers to identify critical winter ranges and migratory routes within the herd unit. In 2012, a similar management study was initiated in the Bear's Ears herd unit. These two studies have provided managers with valuable insights to inform management decisions.

In addition to the survival studies, managers have also been very active in implementing landscape scale habitat treatments (Figure WC1.7). Significant acreage has been treated across the Bear's Ears and White River herd units to

enhance habitat quality for big game, but this acreage constitutes only a small portion of this landscape. The objective of this landscape scale work is to increase the ratio of forage to cover available for big game, primarily mule deer and elk.

CPW initiated an additional project to assess big game use and response to these landscape scale treatments. This project is ongoing and will provide managers with critical temporal and spatial data to evaluate the use of current habitat treatments and help guide future habitat improvement efforts and strategies across the landscape.

In addition to these management studies, CPW has implemented several research projects to identify potential factors limiting these herds. CPW recently completed a 10-year research project in the Piceance Basin (the southwestern portion of the White River herd unit) to assess the effects of oil and gas development on mule deer migration and to evaluate the effectiveness of industry best management practices in alleviating these effects. CPW is also concluding a research project in a portion of the same area to assess the effects of large carnivore predation on neo-natal survival of mule deer fawns.

While all of these studies have provided wildlife managers with important data for informed management decisions, they have also identified the need to secure funding to continue working at a scale that will maintain the functional integrity of the landscapes in which these large migratory big game herds operate. Radio telemetry studies conducted in these two herds to date have demonstrated that wildlife managers need to apply management actions such as habitat treatments, highway crossings, and the protection of important seasonal habitats through conservation easements at a landscape scale to adequately conserve these large and highly migratory herds.

Unlike many places in Colorado, the landscapes within these two herd units are relatively open, intact and undeveloped. This provides a unique opportunity to protect these landscapes through conservation easements if funding were available. Currently the interest from private landowners in Colorado's Wildlife Habitat Program (CWHP), exceeding funding resources available to purchase easements. Leveraging CWHP funds with additional funding sources would be ideal to fulfill the demand for conservation easements. CWHP core funding comes from habitat stamp fees, a $10 fee charged to everyone ages 18-64 that purchases Colorado hunting or fishing license. These funds are used to protect important wildlife habitat through voluntary conservation easements or fee title acquisition. Some of the easements also provide public access to private land for hunting, fishing, and other wildlife related recreation. Through 2017, a number of key areas have been protected under

conservation easement through various partnerships with land trusts, NGOs, GOCO, and CWHP funds (Figure WC1.8). There are still extensive areas worthy of additional protection.

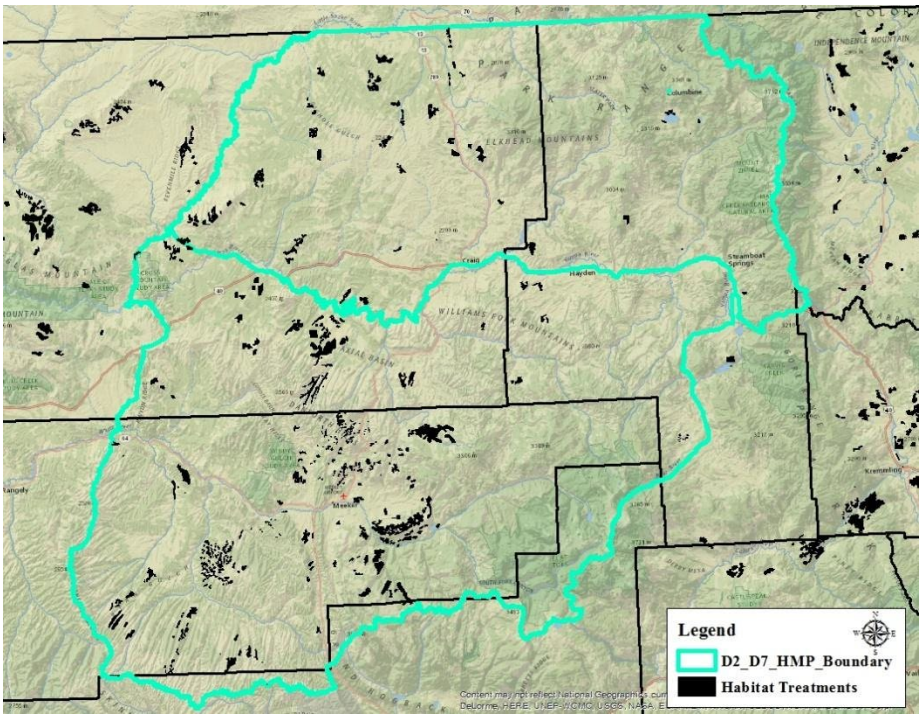

Figure WC1.7. Habitat treatments implemented across landscape in the Bear's Ears and White River herd.

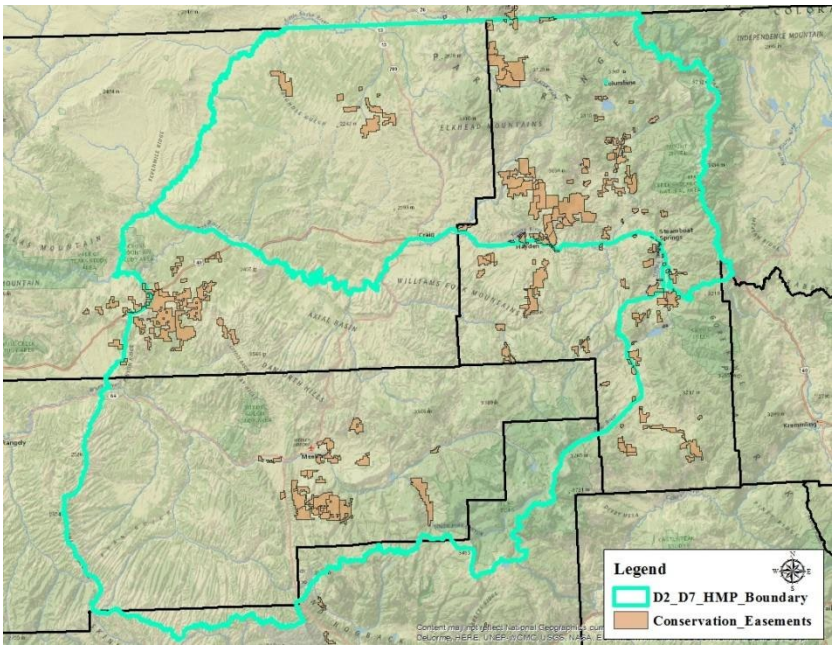

Figure WC1.8. Conservation easements protecting important wildlife habitats across the Bear's Ears and White River herds.

Cost of current or needed habitat treatments; road crossings etc.:

The landscape-scale need for habitat treatments, conservation easements, and highway crossing/fencing structures necessary to improve the Bear's Ears and White River network of migration corridors would be very costly and could reach several million dollars. CPW is conducting approximately 2000 acres of habitat enhancement with our federal and local partners annually within this priority area but there is a large backlog of identified projects for which funding has not been acquired. CPW could implement an additional 1500 to 2000 acres of habitat enhancement annually within this area, if sufficient funding was available. These enhancement projects cost approximately $250/acre, and two thousand additional acres of habitat enhancement would cost approximately $500,000 annually. CPW's Habitat Protection Program brings $11 million or more each year to the purchase of conservation easements that protect wildlife habitat values. Properties within this priority area consistently rank highly in each year's allocation. Easements are generally multi-million dollar expenditures, so the need for additional funding is essentially endless. Highway crossing structures can cost up to $1 million each. Currently, CDOT and CPW has $200,000 for the design of highway crossing structures along Highway 13. Detailed assessment of several key highway segments commenced in 2019, but neither agency has secured funds for construction of structures in key crossing areas.

Other Issues for awareness:

None

#2 Colorado Migration Corridor Priority: San Juan Basin (Southwest Colorado)

Why the area selected as a priority:

This corridor spans Game Management Units (GMUs) 75/77/78/751/771 in the San Juan Basin (elk herd E31 and deer herd D30, Figure WC2.1). Deer and elk movement patterns have been documented in the last 15 years through a combination of CPW, Southern Ute Tribe, and consultant studies (Figures WC2.2 and WC2.3). The area is home to about 27,000 deer and 19,000 elk using several significant migration routes. This area contains the second largest deer herd in Colorado, and the third largest elk herd. This area has the added benefit of being multi-jurisdictional, with the majority of lands managed by the USFS, BLM, and Southern Ute Tribe, interspersed with private lands, and it contributes to big game movements crossing into New Mexico. This corridor has been identified as a focal area for GOCO wildlife crossing structures with CDOT.

Spatial Location:

The San Juan Basin is located in southwest Colorado. The southern boundary is the New Mexico state line, and the eastern and northern boundaries are the Continental Divide, with the Animas River being the western boundary.

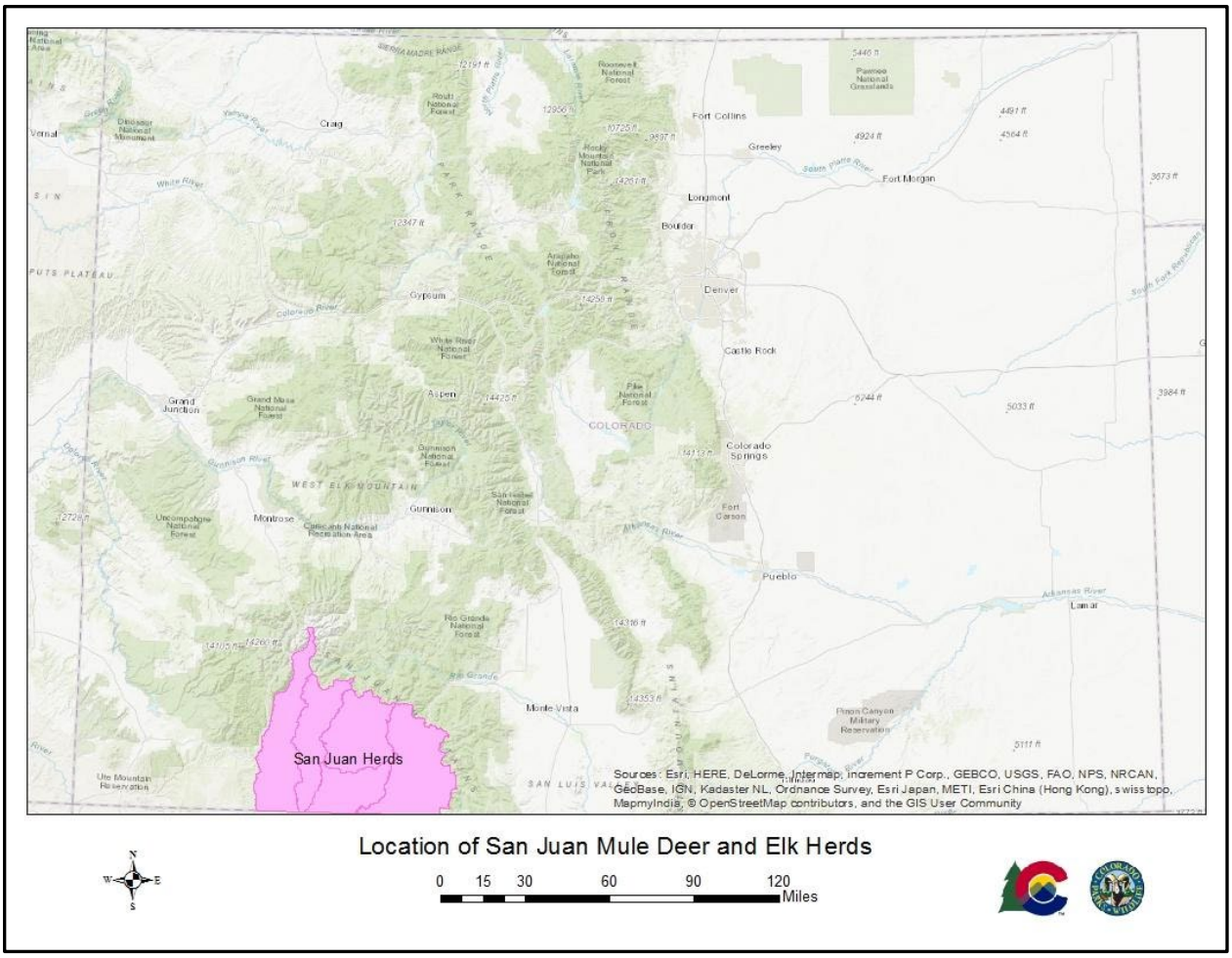

Figure WC2.1. Location of the San Juan deer and elk herds in southwest Colorado.

Habitat Types:

The climate is a highland or mountain climate, characterized by cool springs and falls, warm summers and moderately cold winters. Average precipitation and snowfall for Durango are 18 and 63 inches per year respectively. Snowfall increases dramatically moving to the east and toward the Continental Divide, approaching 250-300 inches per year. Vegetative types include: alpine over 12,000 feet elevation, spruce/fir stands down to 10,000 feet, oakbrush, serviceberry, and ponderosa pine above 7,000 feet, and pinyon/juniper/sagebrush and agricultural fields below 7,000 feet.

The amount and quality of winter range is the limiting factor for these deer and elk herds. Winter range is primarily in private ownership, with the remainder located on the Southern Ute Tribe and public lands. Available habitat on these lands is becoming more limited with human encroachment through development and expansion of recreational activities.

Important Stopover areas within the corridor:

Recent studies by CPW, the Southern Ute Tribe, and WEST,Inc utilizing GPS-collars have identified numerous discrete migration corridors, highway crossings, and stop-over areas for various segments of the San Juan deer and elk herds. Previous studies with VHF-collars demonstrate landscape scale connectivity.

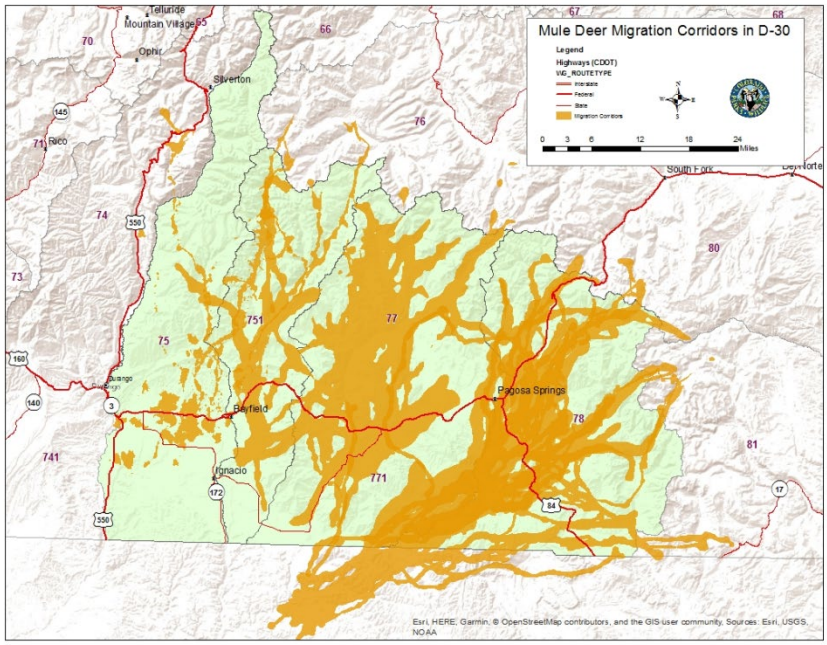

Figure WC2.2. Composite map of recent deer studies by CPW, Southern Ute Tribe, and WEST,Inc using GPS collars. Map contains data shared by Aran Johnson (Southern Ute Tribe) and Hall Sawyer (WEST,Inc).

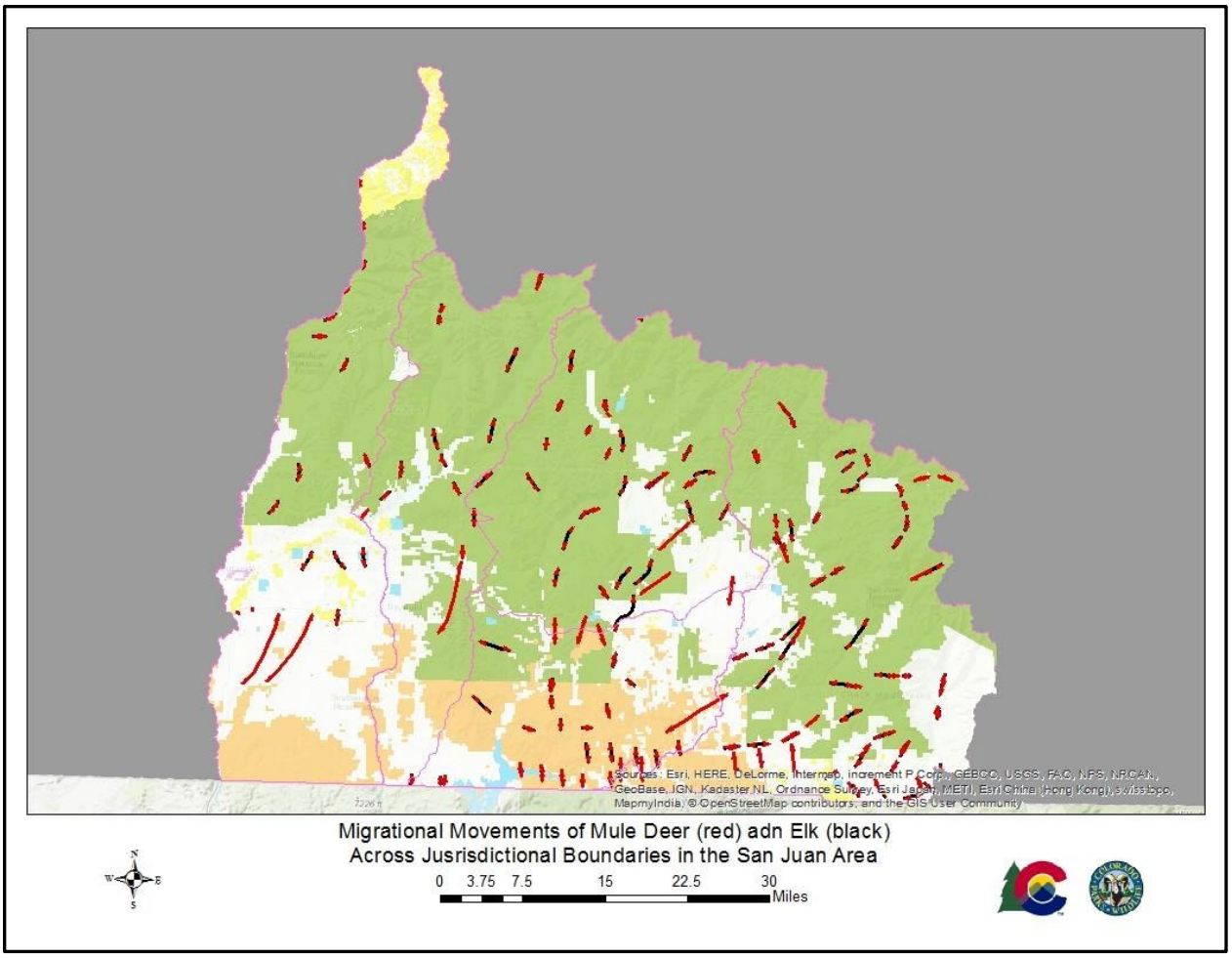

Figure WC2.3. Deer and elk movement data in the San Juan Basin, Colorado, 1998-2008.

Landownership:

Winter range is primarily privately owned (51%)(Table WC2.1). The Southern Ute Tribe owns an additional 20%, and the remaining 28% of winter range is publicly managed. Twenty-nine percent of the winter range and 15% of the severe winter range occur on public lands.

Table WC2.1. Land ownership in relation to deer and elk habitat use in the San Juan Basin, Colorado.

		Winter Range	Winter Concentration	Severe Winter Range	DAU
TOTAL	DAU Square miles	1295 (46%)	135 (5%)	779 (28%)	2795 (100%)
	BLM	26 (2%)	6 (4%)	12 (1%)	63 (2%)
	BOR	2 (<1%)	0	2 (<1%)	8 (<1%)
	CPW	1 (<1%)	0	1 (<1%)	2(<1%)
	USFS	332 (26%)	25 (19%)	98 (13%)	1545 (55%)
Public Access		361 (28%)	31 (23%)	113 (15%)	1618 (58%)
	Southern Ute	264 (20%)	7 (5%)	183 (23%)	320 (12%)
	Private	663 (51%)	94 (70%)	480 (62%)	849 (30%)
	State of CO	7 (<1%)	3 (2%)	3 (<1%)	8 (<1%)
Private Access		934 (72%)	104 (77%)	666 (85%)	1177 (42%)

.

Land Uses:

The area has seen extensive exurban development in the previous 20 years, replacing a primarily agricultural setting with rural residential developments. Few large landowners remain. In addition, extensive natural gas extraction has occurred, with associated road and pipeline corridors. The exurban development and increased human population has stressed the local highway system with a high volume of high speed traffic. Numerous wildlife crossings have been identified with previous telemetry studies, as well as through review of wildlife-vehicle collision data (Western Slope Wildlife Prioritization Study, CDOT).

Risk/Threats:

Development on Winter Range and Migration Corridors

Exurban development is occurring on much of the winter range and migration corridors in the San Juan Basin. Managers and the public are increasingly concerned over cumulative and prolonged impacts of this development disrupting big game migration and decreasing the quality and quantity of winter range. Development influences both the carrying capacity of the big game habitat and

affects harvest management programs. Although development is a widespread issue, it is a considerably larger problem in the western portions of the San Juan Basin, around Pagosa Springs and Durango.

Winter range is already limited and it is the habitat type that is most at risk from development. Deer and elk eat less and lose weight during the winter and to conserve energy they limit physical activity. Any type of disturbance will cause a deer or elk to use more energy during this critical time. Such winter-time stress can lead to a higher risk of mortality, and may also negatively influence both reproduction and the survival of fawns or calves born later that same year.

Migration corridors are needed for deer and elk to access important summer and winter ranges. The largest and most productive deer populations in the West are migratory. Development and barriers that disrupt migration can have a direct bearing on an individual animal's health, survival and reproductive success.

As the primary land use in the San Juan area continues to transition from agricultural to rural residential, maintenance of connectivity between summer ranges and winter ranges located on public and tribal lands is a critical need. Strategic placement of highway crossing structures and land protection through conservation easements will be required, and the remaining winter and transition ranges must be maintained in the best condition possible.

Are the Risk/Threats Immediate or Long-term:

Immediate: Critical parcels of land continue to be developed, creating higher traffic volumes into Durango/Bayfield and Pagosa Springs. Opportunities for land protection are being replaced by subdivisions. *Long Term:* As development continues and highways are stressed, the highway corridors will be expanded in order to accommodate the volume of traffic.

Actions necessary to reduce or eliminate risks/threats:

CPW and partner organizations need to maintain connectivity between deer/elk summer and winter ranges, creating corridors for movement and for safe passage across Highways 160 and 84. To help identify these migration corridors, GPS-quality deer and elk data is needed in the central portion of the DAU's (called the HD Mountains, primarily on publicly owned lands).

Current efforts (what is the activity; who is conducting the work; and partners involved):

CPW, CDOT, SUI Tribe, USFS, BLM are all partners in various efforts. The recently completed Western Slope Wildlife Prioritization Study (CPW, CDOT) has strategically mapped deer and elk high risk highway crossings across the western slope of Colorado, identifying significant wildlife crossing areas. This has already led to a partnership with the Southern Ute Tribe and Great Outdoors Colorado that will develop a major wildlife crossing structure on the east side of the HD Mountains.

Cost of current or needed habitat treatments; road crossings etc.:

The large scale habitat treatments and highway crossings structures and fencing necessary to maintain the San Juan Basin deer and elk herds' network of migration corridors will be very costly, and may require several million dollars to complete.

Other Issues for awareness: None known.

#3 Colorado Migration Corridor Priority: Uncompahgre (West-Central Colorado)

Why the area selected as a priority:

The Uncompahgre Plateau encompasses Colorado's D-19 and E-20 deer and elk herds. The elk herd is managed for a quality hunting experience in GMU 61 using limited allocations of licenses, and within GMU 62 the herd is managed for hunting opportunity, with more liberal license availability. Deer numbers have seen a long, steady decline from approximately 50,000 in 1980, to 15,000 in 2019. Elk numbers peaked in 2003 at just over 14,000 and have since declined to around 9,000 in 2019. These declines are the result of poor fawn/calf recruitment rates which in turn are attributed largely to recurring drought, poor livestock management, disease, development of houses and golf courses, and increasing recreational impacts.

Spatial Location:

D19 and E20 are in west-central Colorado, south of Grand Junction, west of Montrose, and north of the San Miguel River. Because of the valued wildlife resources on the Uncompahgre Plateau, the area has been the focus of multiple research projects on deer, elk, mountain lions, and bears (Fig WC3.1).

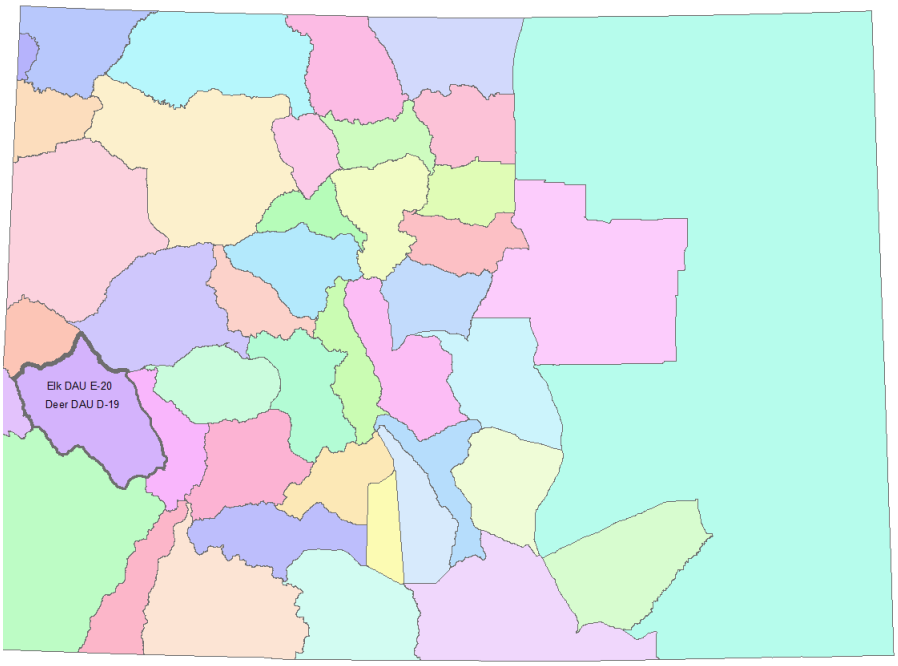

Figure WC3.1- Location of Elk DAU E-20 and Deer DAU D-19 in west-central Colorado.

Habitat Types:

At elevations below approximately 6,500 ft near the Dolores, San Miguel, Uncompahgre and Gunnison Rivers, a high desert plant community is the predominant vegetation type. Important plant species of this community include four-wing saltbush, shadscale saltbush, black sagebrush, winterfat, broom snakeweed, rabbitbrush, greasewood, and, in the Gateway area, black brush. Elevations between approximately 6,000-7,500 ft, are characterized by pinyon pine and Utah juniper woodlands and grassland/shrub (e.g., basin big sagebrush, black sagebrush, Wyoming/mountain big sagebrush, mountain mahogany, Indian ricegrass). The pinyon-juniper type covers approximately 40% of DAU D-19 and is the predominant plant community. From approximately 7,500 to 8,500 ft, ponderosa pine/mountain shrub (e.g., Gambel oak, serviceberry, mountain mahogany, mountain big sagebrush, silver sagebrush, snowberry, manzanita) is the dominant vegetation type. Elevations above 8,500 ft are generally characterized by aspen forests and a mixed spruce-fir complex (aspen, Douglas fir, sub-alpine fir and Engleman spruce). Common plant species found in lowland riparian areas on the Uncompahgre Plateau include narrowleaf cottonwood, coyote willow, chokecherry, tamarisk, and boxelder. In higher elevation riparian areas characteristic species include thinleaf alder, birches, willows, and blue spruce.

Agricultural areas and cultivated croplands within the DAU occur primarily in the Uncompahgre Valley between Montrose and Delta and in the other major river valleys surrounding the Plateau.

Important Stopover areas within the corridor:

Migration on the Uncompahgre Plateau generally takes place over a day or two for most deer and elk. Spring migration may be slower if snow is persistent at higher elevations, but fall migration is usually quick. Some deer and elk that migrate to the south off of the Uncompahgre may take longer. The horsefly peak and the area around the Cornerstone subdivision is one of the few identified stopover areas and concentrated migration corridors. Fall migration stopover may occur in the oakbrush habitat if deer slow their movements to feed on acorns.

Landownership:

Land ownership in DAU D-19 is 24% private, 38% BLM, 37% US Forest Service, and 1% state. Municipalities that border the DAU include Montrose, Delta, Olathe, Ridgway, Norwood, Nucla, Naturita, and Gateway.

Land Uses:

Agriculture is one of the primary land uses within D-19, with irrigated farmland primarily along the edges of the DAU and extensive cattle and sheep grazing across public and private lands. Recreational activities including hunting, hiking, horseback riding, fishing, wildlife viewing, photography, four-wheeling, OHV use, snowmobiling, and cross-country skiing and mountain biking have always been part of the landscape. However, over the last 15 years OHV use and mountain biking have seen the greatest growth, as local communities support the development of mountain biking and jeep/OHV trails on nearby public lands to create destinations for recreation and to increase local revenue at the expense of wildlife populations. Additional land uses include mining and timber harvest. Historically, the area supported extensive mining for uranium, vanadium and coal, but currently gravel is the primary material being mined. Timber harvest has ebbed and flowed over the years, but currently there has been more prescribed/stewardship cutting taking place to improve forest health. Montrose is home to one of the largest timber mills in Colorado taking trees from all over Colorado.

Risk/Threats:

Threats:

Habitat loss to development- golf courses and houses in migration corridors, winter range, and production areas.

Decreasing habitat quality- drought impacts, poor shrub vigor, poor aspen health, poor Douglas-fir and Spruce communities with disease and insect impacts, increasing weed issues, shifts on winter ranges from cool season to warm season grasses, and competition from livestock for forage .

Increased recreational use- increasing mountain bike use, increasing OHV use, more recreational users checked at check stations over Labor Day weekend than hunters.

Fencing- Lots of old sheep fencing remains in the region, inhibiting deer and elk movements on fawning/calving and summer range. Juvenile deer and elk can't jump sheep fences and become susceptible to predation, abandonment, and injury.

Disease- In general, diseases are a factor of mule deer juvenile survival. Recently, chronic wasting disease has been detected in the Uncompahgre Valley. Hemorrhagic diseases also occur across the Uncompahgre Plateau.

Highway Crossings- Deer and elk migrate across US Highway 550 and CO Highway 62. Exclusionary fencing has been in place on a portion of the highway for a long time and may have inhibited migration patterns. The West Slope Prioritization study has identified a segment of 550 as a top 5% project area to implement exclusionary fencing and crossing structures.

Are the Risk/Threats Immediate or Long-term:

The threats on the Uncompahgre Plateau are immediate and long-term. Habitat loss to development has been occurring and will continue to occur on private lands across and around the Uncompahgre Plateau. Conservation easements have been used to protect private property, however, land values on the southern end of the Uncompahgre are very high so cost has been prohibitive for acquisition and for compensation for the sale of development rights.

Fencing can protect drivers and deer from collision but it can become a barrier that inhibits migration. As animals cross highways, the risk of wildlife-vehicle collisions presents both an immediate and long-term threat to short term survival and long term migration patterns.

As the human population in the area has increased, mule deer migration has been inhibited by traffic along US Highway 550 and CO Highway 62. Additional fencing has been placed along the 550 corridor but there are still stretches that CDOT has

identified for more fencing. Habitat quality could improve with more consistent precipitation, however, long term trends have been much drier than in previous decades even with events like last winter's high snow pack. Additionally, while livestock numbers and big game numbers grazing and browsing across the Uncompahgre have decreased compared to historic high numbers, long term impacts on vegetation remain and are important browse plants are especially slow to respond following the drought conditions observed over the last 20 years.

Sheep fencing could be considered an immediate threat to be addressed, but some of the fences have been around for decades.

Diseases, both hemorrhagic and CWD, remain factors that suppress the growth potential of big game populations. These diseases can have lasting negative impacts on populations, and are expected to continue to be factors influencing mortality.

Recreational use within the Uncompahgre Plateau has both short term and long term impacts on the habitat and populations of wildlife as human populations continue to grow.

Actions necessary to reduce or eliminate risks/threats:

Conservation actions:

Conservation easements (~$3000/acre @ 1000 acres per year) to protect important winter ranges for connectivity and continuity are needed. Placing the Cornerstone elk ranch, located between Cornerstone golf course and subdivision and Horsefly peak, under a conservation easement would create significant protection for deer and elk migration corridors. There are many additional privately owned parcels to protect, but inflated land values make it difficult. CPW may partner with the Colorado West Land Trust to add focus to big game migration corridors and important winter ranges.

Wildlife friendly fencing program (~$7500/mile, cost share at 50%, 20 miles/year). Cooperate with landowners in summer ranges to replace or cost-share woven wire fence replacement to wildlife friendly fencing, and/or to put in gates or to drop stretches of fencing where woven wire must be used.

Travel Management ($2000/year for big game closure signs)- Assist USFS and BLM with closing roads and with developing educational materials for trail users about conflicts between wildlife and trails.

Habitat improvement ($150,000/year)- Continue to implement habitat treatments in or adjacent to key winter ranges as identified in CPW's West Slope Mule Deer

Strategy. Key outcomes from treatments will be improved sagebrush communities: decreased weeds, increased grass and forb diversity, decreased bare soils, and a possible shift warm season winter range communities back to cool season grasses. NEPA is ready to go for the Dry Mesa area up to Escalante Canyon. In addition, CPW can plan projects to implement mule deer strategy area and habitat improvement projects on winter ranges in GMU 61. Funding to assist with completion of NEPA compliance would be beneficial.

Highway crossings on Hwy 550 and 62 ($1,000,000)- The West Slope Prioritization study identified a segment of Highway 550 as a top 5% project area. CDOT is currently designing a project for fencing and an underpass near Billy Creek State Wildlife Area. The underpass would cost approximately $700,000 for the structure and another $250,000-$300,000 for construction.

Current efforts (what is the activity; who is conducting the work; and partners involved):

Research is underway to identify causes of reduced elk recruitment plaguing southern Colorado. This work is being conducted by CPW's mammals research unit with funding support from the Rocky Mountain Elk Foundation, Habitat Partnership Program, and a local landowner.

CPW's West Slope Mule Deer Strategy projects are being conducted in cooperation with the BLM, USFS, and Mule Deer Foundation to improve habitat through pinyon-juniper thinning on winter ranges, seeding a recent large wildfire area, and improving pasture fencing on winter ranges.

West Slope Prioritization Study, developed jointly between CDOT and CPW, has identified conflict areas and a priority project area along the Highway 550 corridor on the southeast edge of the Uncompahgre Plateau.

Cost of current or needed habitat treatments; road crossings etc.:

Funding to date:

CPW's West Slope Mule Deer Strategy habitat improvement projects across the Uncompahgre Plateau have been taking place over the last few years. To date approximately $375,000 has already been spent by CPW, SCTF, and GOCO to implement seeding on the Bull Draw fire and on mastication projects.

Funding needed:

Conservation easements (~$3000/acre @ 1000 acres per year) to protect important winter ranges for connectivity and continuity are needed. Placing the Cornerstone elk ranch, located between Cornerstone golf course and subdivision and Horsefly peak, under a conservation easement would create significant protection for deer and elk migration corridors. There are many additional privately owned parcels to protect, but inflated land values make it difficult. CPW may partner with the Colorado West Land Trust to add focus to big game migration corridors and important winter ranges.

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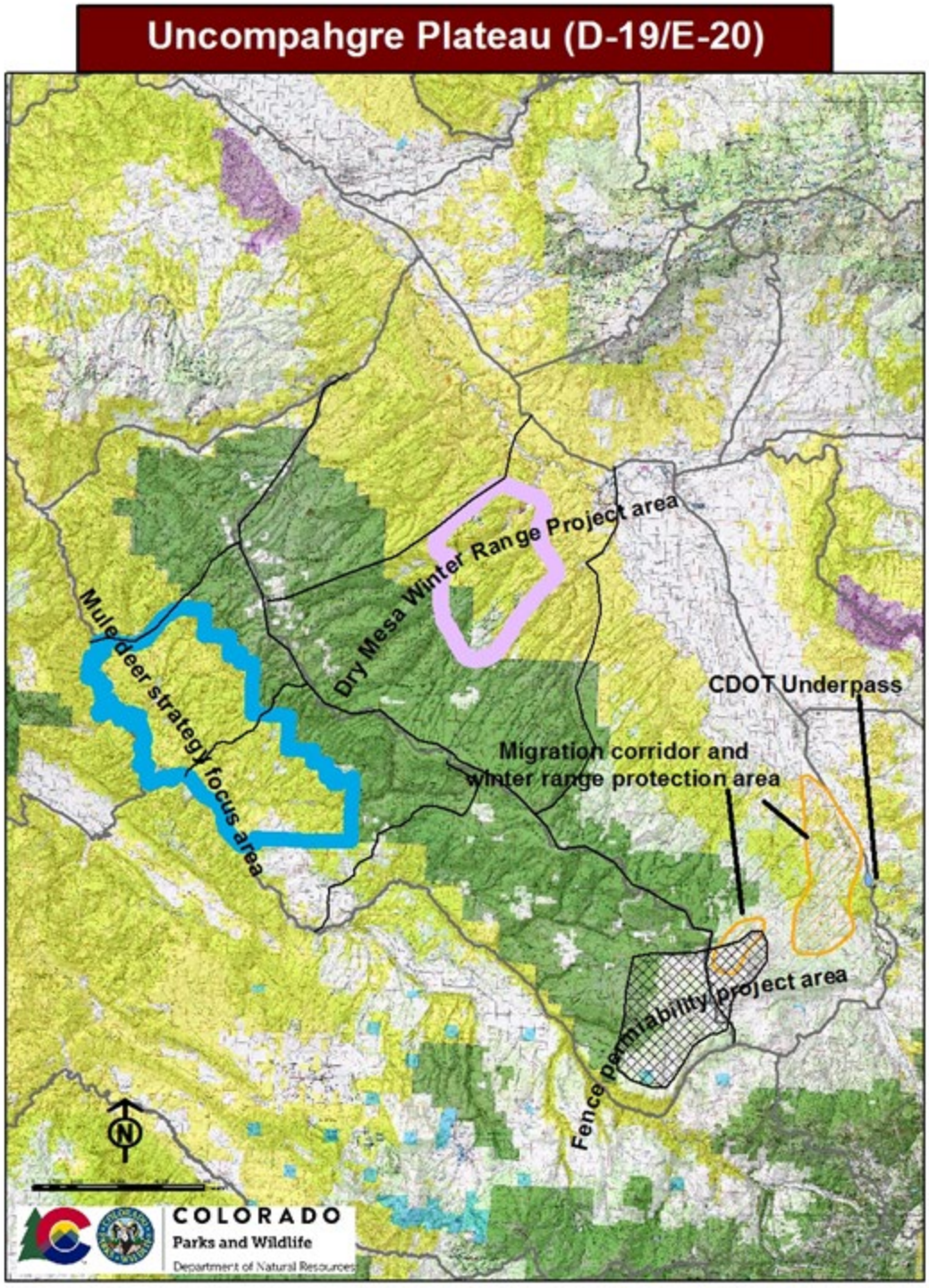


Figure WC3.2. Location of current and proposed mule deer habitat projects on Uncompahgre plateau. Projects will protect big game winter ranges and migration corridors.

Other Issues for awareness: None

#4 Colorado Migration Corridor Priority: Piney River/State Bridge (Northwest Colorado)

Why the area selected as a priority:

The Piney River/State Bridge priority area includes most of the State Bridge deer herd (DAU D-8) and all of the Piney River elk herd (DAU E-12) and provides habitat for significant populations of both mule deer and elk. Specifically, the priority area includes Game Management Units 35, 36, and 361. At approximately 14,000 deer, the State Bridge deer herd is one of the ten largest herds on the western slope of Colorado. The Piney River elk herd includes approximately 3,700 animals. While both species are within CPW's long-term population objective for the herds, habitat carrying capacity has declined over recent decades, as both the quantity and quality of habitat have diminished due to land development, fragmentation by roads and trails, increased human activity on public lands, and suppression of large-scale wildfires.

Spatial Location:

The Piney River/State Bridge priority area is located in north-central Colorado. The area occurs in Eagle and Garfield counties and lies north of the Eagle River and east of the Colorado River. It is bounded on the east by alpine habitats on the Gore Range divide. Interstate 70 runs along the southern edge of the priority area. The mountain ski town of Vail occurs in the eastern portion of the priority area, and several additional mountain towns, including Avon and Eagle, are located along the southern edge of the priority area (Figure WC4.1). The Piney River/State Bridge priority area is approximately 620 square miles in size.

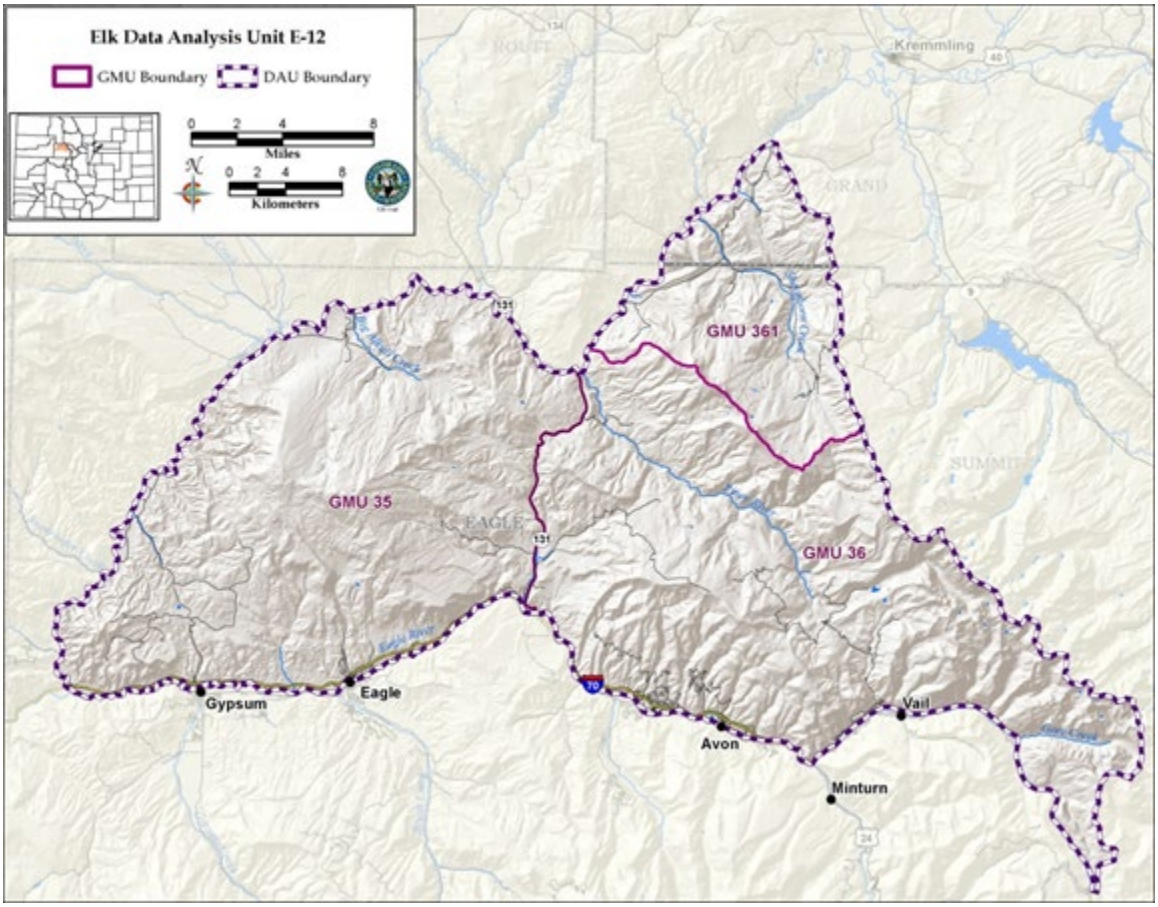


Figure WC4.1. Piney River/State Bridge Priority Area.

Mule deer and elk winter range is concentrated in the central and western portions of the priority area. The Piney River/State Bridge priority area occurs at relatively high elevation. Snowfall is heavy and persistent for many months in most years. Consequently, south facing slopes at lower elevations in the central and western portions of the area are of critical importance. Approximately one third of the area provides suitable winter range for deer, and elk winter in about half of the priority area. Two thirds of the winter range is on public land, with the remaining third in private ownership. The highest density of wintering mule deer occurs along slopes lining the north side of the I-70 corridor and along Highway 131. Elk winter use is greatest in the north-central portion of the priority area, with lower levels of use along the I-70 corridor and the Colorado River.

The majority of deer and elk in the priority area migrate from higher elevations to these winter ranges in the fall and early winter and reverse the pattern in the spring. Unfettered access to these winter range areas is of critical importance, as deer and elk seek wintering ranges where snow depths are lower and winter temperatures

are higher. Two key migration corridors are present in the unit. The first, and most significant, runs east to west along the north side of I-70. It is particularly important for deer. The second key area is associated with the Dowd Junction highway underpass at the eastern end of the priority area near Vail. Maintenance of free movement to and from this underpass is of high importance for deer that summer south of I-70, but winter in the priority area to the north of the Interstate. Mule deer and elk winter range concentrations are shown in figures WC4.2 and WC4.3, respectively.

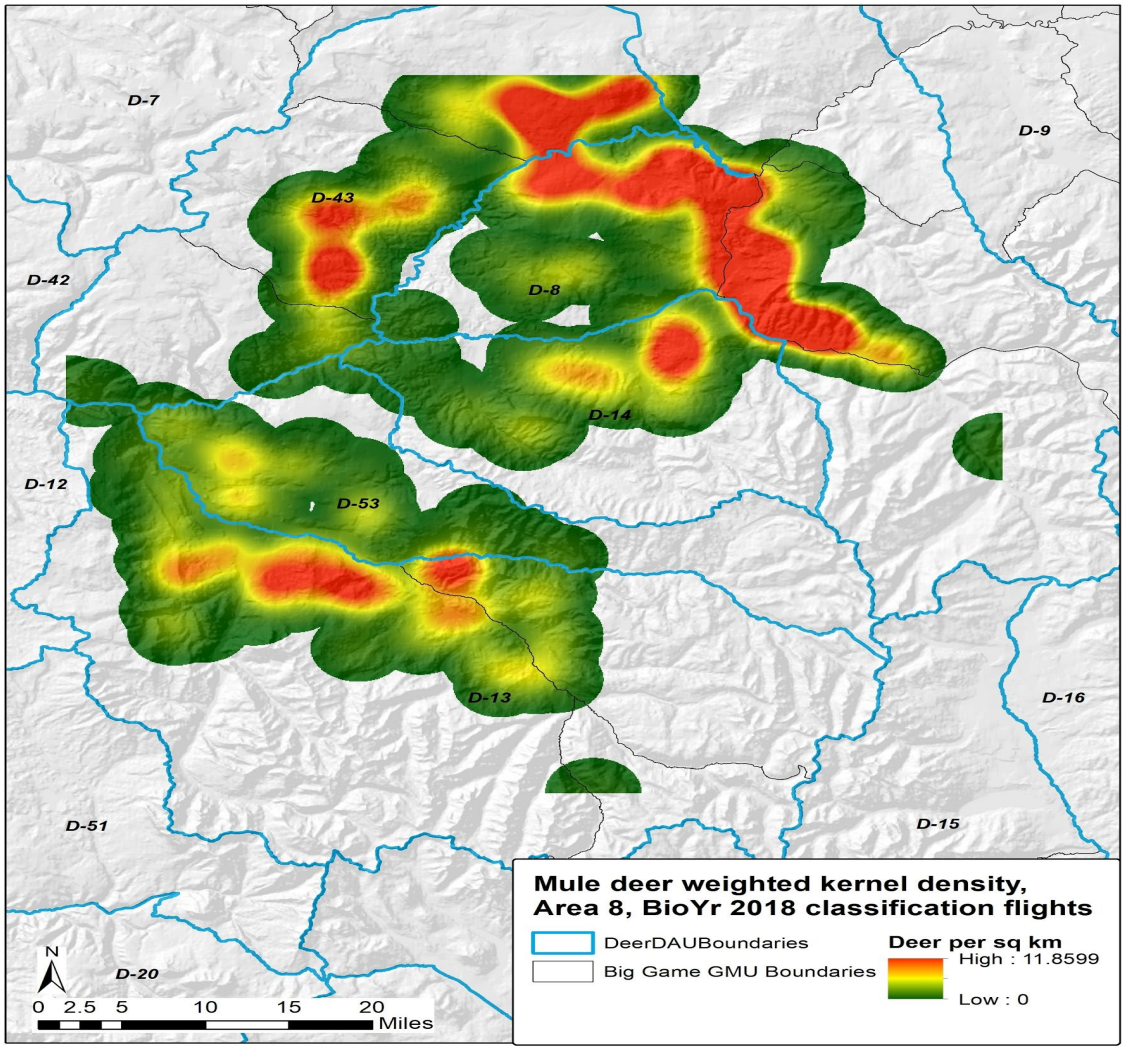


Figure WC4.2. Mule deer winter range density in the Piney River/State Bridge Priority Area.

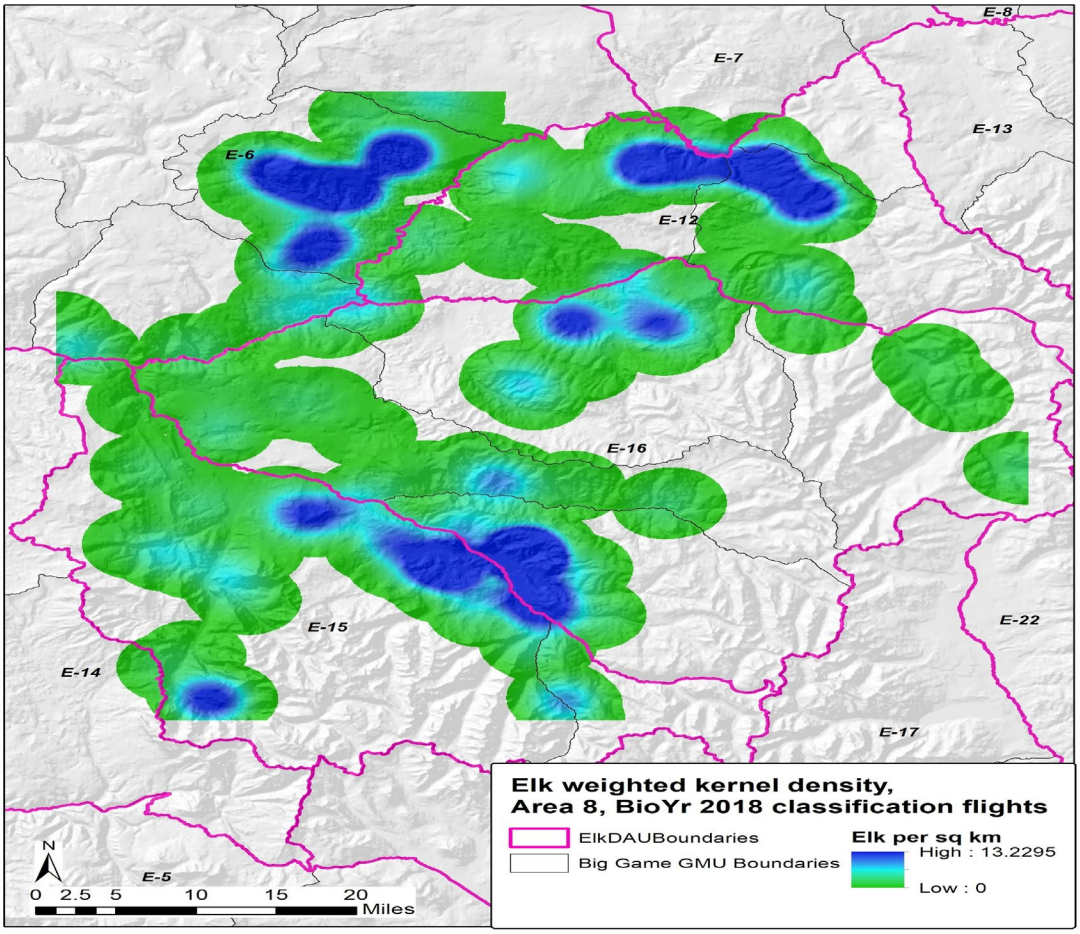


Figure WC4.3. Elk winter range density in the Piney River/State Bridge Priority Area.

Habitat Types:

Vegetation types in this unit are largely determined by elevation and aspect. Topography in the priority area is highly varied. The Gore Mountain Range, along the eastern boundary, has elevations in excess of 13,000 ft. Low-lying regions are found adjacent to the Colorado River, with an average elevation of just over 6,000 ft.

Above approximately 12,500 ft, the mountain peaks in the Gore Range are comprised mostly of bare rock or alpine communities. Spruce-fir forest occurs between the elevations of 8,000 and 12,500 ft. Aspen and aspen-conifer mixes dominate the slopes from 7,000 to 8,500 feet. Mountain shrub communities occur primarily on lower slopes near 7,000 feet. In the western two-thirds of the area, pinyon-juniper woodland covers the foothills, and sagebrush parks appear on more

level sites as elevation drops. Aspen is found mostly on sites that have been burned or disturbed within the past 150 years. Major vegetation categories are shown in Figure WC4.4.

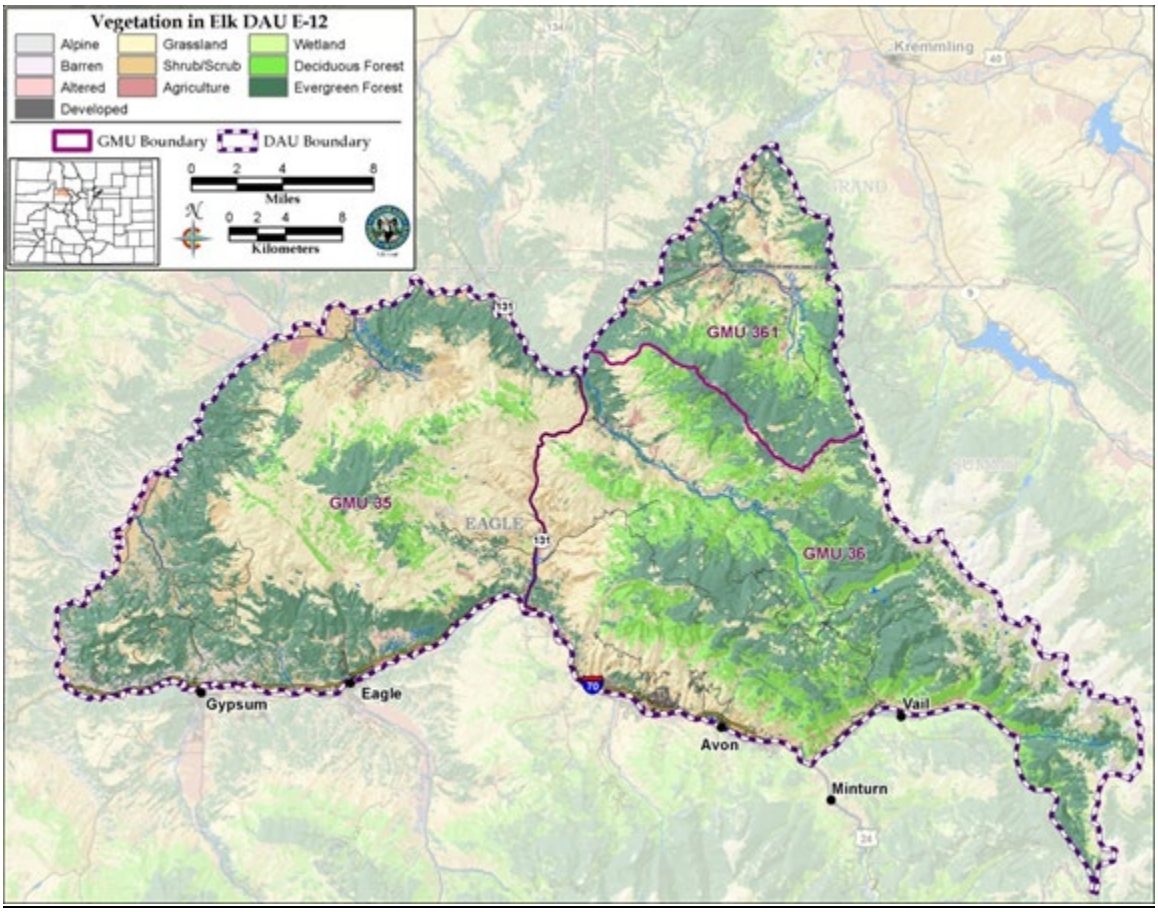


Figure WC4.4. Major vegetation communities within the Piney River/State Bridge Priority Area.

Important Stopover areas within the corridor:

Specific migration routes in the Piney River/State Bridge priority area have not been mapped to the degree of specificity necessary to identify stopover areas. As noted in the Bears Ears/White River discussion above, detailed migration route mapping in northwestern Colorado suggests that migrating deer and elk don't utilize stopover areas to the degree documented in other states.

Landownership:

The Piney River/State Bridge priority area is 75% federal land and 23% private land, with the remainder owned by the State of Colorado and other entities. The Eagle's Nest Wilderness makes up 13% of the priority area. The eastern half of the priority area is comprised of National Forest, with BLM ownership predominant in the western half (Figure WC4.5).

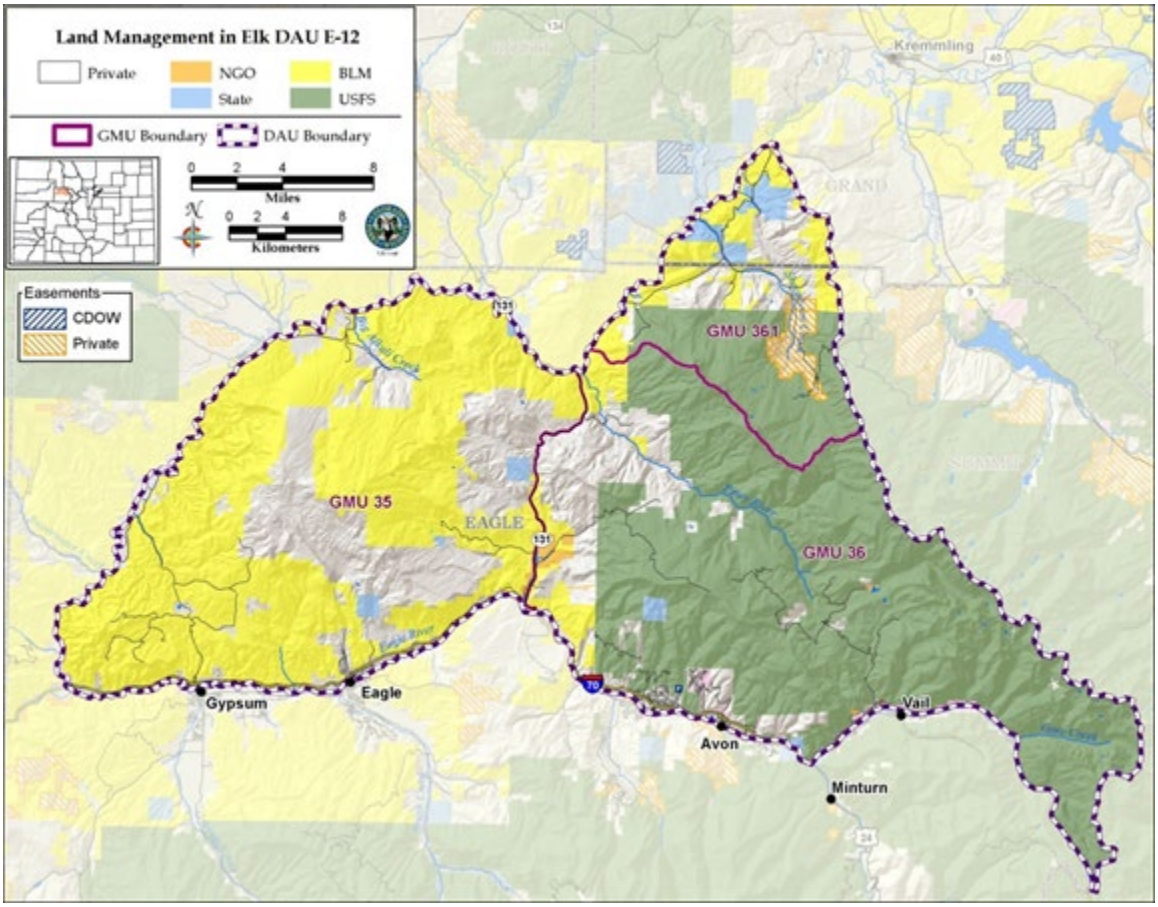


Figure WC4.5. Land ownership in the Piney River/State Bridge Priority Area.

Land Uses:

Land use is varied and diverse in the Piney River/State Bridge priority area. The main industries are tourism, outdoor recreation, ranching, construction, real estate and logging.

The local economy is strongly influenced by tourism. Interstate 70, along the southern edge of the priority area, is the major east-west artery through Colorado's Rocky Mountains. The main tourist attractions in the vicinity are the Vail and Beaver Creek Ski areas, located just south of the priority area. These resorts have shifted recreational activity in recent years from winter-only ski areas to four-season resorts

that draw visitors for a variety of outdoor recreational activities throughout the year. Increased recreational activity at these resorts has led to increasing recreation on public lands within the priority area as well. Over the past 10 years, the priority area has experienced rapid expansion of non-consumptive outdoor recreation activities, especially mountain biking and backcountry skiing, but also hiking, trail running, motorbiking, ATV/UTV riding, snowmobiling, and horseback riding. The area also supports substantial wildlife-related recreation, including hunting and fishing.

Construction and real estate development and sales are also major industries in the area, and are fueled in part by the increase in recreational activity. Unfortunately, many of the new developments are located in mule deer and elk winter range. Approximately 30% of the winter range in the priority area is privately owned, much of which has already been developed or may be subject to residential and commercial land development in the future. Over the past 30 years, this development has been focused along the I-70 and Highway 131 corridors. The density of residential development varies from suburban housing to larger exurban ranchettes.

Public land in the priority area is used for livestock grazing, although livestock grazing on private lands has declined with the general decline in agriculture as lands are converted to residential use. The BLM administers all or part of 34 active grazing allotments in the priority area. Livestock use occurs primarily in the spring, summer, and fall. The Forest Service administers 8 active grazing allotments occurring totally or partially in the priority area. The period of livestock use on the National Forest varies, but primarily occurs from late June through October. Grazing practices have changed greatly since the 1960s, such that impacts of livestock on the land are much less today than in the late 19th and early 20th centuries.

Other commercial land uses in the priority area include logging and mining. Commercial logging has occurred in several portions of the priority area in the past. The area's forests have experienced a significant bark beetle outbreak in recent years which has also contributed to a change in forest cover and has resulted in additional timber management activities. The Forest Service has several active or future timber sales planned in these areas. Cinders are mined for making blocks and for road surfacing at the Dotsero volcanic site in the western portion of the priority area. Gypsum is mined just north of the town of Gypsum for the local wallboard plant. There have been several oil and gas wells drilled in the priority area since 1940, but most of these were not productive.

Risk/Threats:

The most significant threats to deer and elk in this priority area are the rapid expansion in the intensity and duration of year-around recreational activity and the associated increase in residential and commercial development. Both lead to reduction in the amount and quality of winter range, as well as the ability of deer and elk to migrate successfully to and from these winter ranges. As noted above, the Piney River/State Bridge priority area occurs at relatively high elevation and receives considerable snowfall that persists through a long winter season. Consistent access by deer and elk to south facing slopes within the priority area, particularly the ability of deer to reach and winter on the slopes within a few miles north of I-70, is critical to the conservation of these herds.

The incidence of wildlife-vehicle collisions along I-70 has been high in the past, leading to the installation of exclusionary fence along many miles of the Interstate in this priority area. While adequate escape ramps have been constructed to allow animals to exit the fenced right of way, no wildlife crossing structures have been constructed in this area, with the exception of the Dowd Junction deer crossing under the Interstate near Vail. There are several long bridges that provide some crossing areas under the Interstate, but they are not necessarily engineered to facilitate wildlife use or located within the most important crossing sites. Highway 131 bisects high-density deer winter range north of the Interstate and also contributes to wildlife mortality. Traffic volume along this highway is relatively low, but is likely to increase as the level of recreation and residential development increases.

Are the Risk/Threats Immediate or Long-term:

There are both long-term and immediate components to the threats facing wintering and migrating deer and elk in the Piney River/State Bridge priority area. The intensity and duration of recreational activity is increasing rapidly year by year. The White River National Forest is among the most heavily visited forests in the entire National Forest system. Rapidly developing mountain bike designs and increased prevalence of off-highway vehicles are expanding the ability of people to reach formerly remote and inaccessible wildlife habitats year-round.

Residential and commercial development associated with local ski areas has been occurring for more than 40 years and has accelerated in recent decades. Much of this development has occurred on privately owned winter range. Several large ranches, particularly in the eastern portions of the priority area, have been purchased by owners who intend to maintain the properties in an undeveloped state. Few are protected by conservation easements, but they have served to conserve key habitats nonetheless. This shift of private land away from production

agriculture has moderated the effect of livestock grazing on large areas of private land, and on federal lands to a lesser degree, but winter range habitat condition in the priority area is still depressed through the persistent degradation caused by historic grazing practices and the successional effects of long-term fire suppression.

Much of the I-70 corridor has already been fenced to exclude wildlife, with some reduction in the ability of wildlife to move across the Interstate corridor. Additional areas continue to be fenced annually. No exclusionary fencing is in place along Highway 131, and there are no immediate plans to construct any. This highway represents a potential future risk to deer and elk, as it bisects important and heavily used winter range.

Actions necessary to reduce or eliminate risks/threats:

Several actions may be successful in reducing or eliminating these threats. First and foremost, continued diligence from the BLM and the Forest Service in avoiding, minimizing, and mitigating the negative effects of land use developments, including recreation, on migrating and wintering deer and elk will be critically important. Counties, municipalities, and non-governmental organizations also have a role to play in properly designing and implementing land use practices within the priority area. Limitations on the timing and intensity of recreational activity on publicly and privately owned winter range will be especially valuable in reducing impacts on big game.

Protection of privately owned migration areas and winter ranges through the implementation of conservation easements will also benefit conservation of limited winter ranges in the priority area. Unfortunately, land value in the priority area is high and rising, adding to the costs of conservation easements with each passing year.

Identification and construction of strategically designed and located highway crossing structures could conserve, and in some cases restore, permeability for migrating wildlife. This will be particularly important should the need for exclusionary fencing along Highway 131 develop at some point in the future.

Habitat enhancement to counteract the lingering effect of historic grazing practices and to reset vegetative succession to improve forage quality for wintering deer and elk would benefit both species. Potential treatment practices include prescribed fire, mechanical removal or thinning of pinyon-juniper woodland, timber and beetle-kill management, mechanical mastication or roller-chopping of mountain shrub communities, understory restoration, and management/restoration of the soil water table and wet meadow/seep areas.

Current efforts (what is the activity; who is conducting the work; and partners involved):

CPW participates with the BLM, the Forest Service, and local governments, as appropriate, to evaluate and comment on land use proposals, including the application of timing limitations, identification of best management practices, and development of mitigation proposals. CPW has also partnered with BLM and others to conduct habitat management projects in the priority area. Most of these projects have involved the mechanical removal of pinyon-juniper woodland. BLM has also begun to work on water table restoration projects in downcut ephemeral water courses. CPW and the Colorado Department of Transportation (CDOT) have established a transportation alliance to coordinate efforts to reduce wildlife-vehicle collisions and to increase permeability across state highway corridors. CPW and CDOT recently completed a western slope-wide assessment of collision risk that will be used for prioritizing and planning wildlife crossing projects. An interagency group has been established in Eagle County to assess highway safety and wildlife crossing needs in the county.

Cost of current or needed habitat treatments; road crossings etc.:

Protection of winter range and migration corridors on private lands through conservation easements would be an effective method of ensuring long-term conservation of non-federal habitat. CPW has not completed any conservation easements in the priority area to date. Due to the high cost of land in the area, purchased easements will be quite expensive. A single easement of sufficient size to be meaningful will cost several million dollars, depending on location and easement terms.

Highway crossing structures are similarly expensive. CPW experience with structures across nearby Highway 9 indicates that the per structure cost for a two-lane underpass or overpass structure is approximately $1 million. The Highway 9 project spaced structures at 1-1.5 mile intervals. Structures across I-70 would be more expensive due to their greater length to span multiple lanes of traffic.

Average cost for pinyon-juniper removal or understory restoration habitat treatments is approximately $250/acre. Habitat enhancement of 5000 acres (approximately 4% of winter range in the priority area) would cost $1,250,000.

Other Issues for awareness:

None

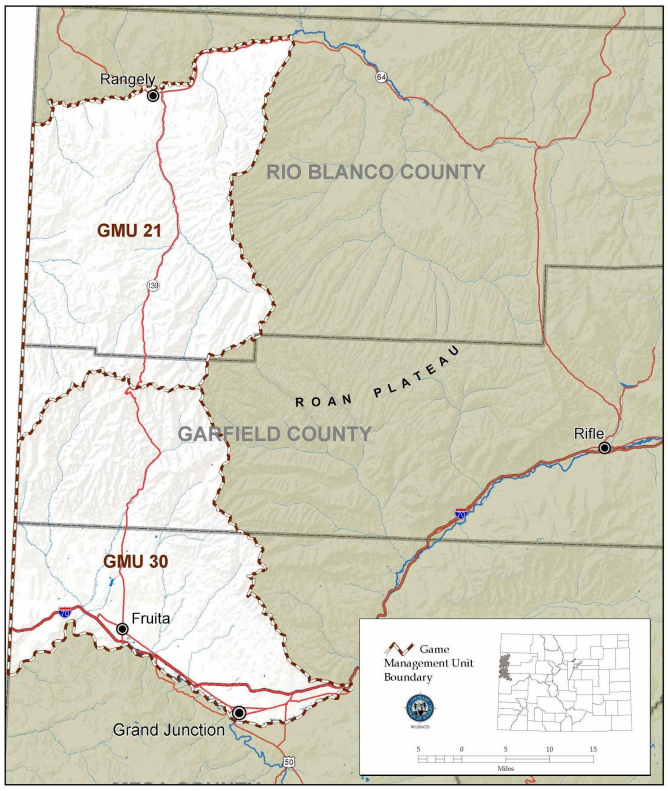
#5 Colorado Migration Corridor Priority: Bookcliffs (West-Central Colorado)

Why the area selected as a priority:

The Bookcliffs priority area includes all of the Bookcliffs deer herd (DAU D-11) and western portions of the Yellow Creek elk herd (DAU E-10) within its 1,757 square miles. The priority area provides habitat for approximately 7,500 mule deer and perhaps 5,000 elk. Specifically, the priority area includes Game Management Units (GMUs) 21 and 30. Much of GMU 21 and northern portions of GMU 30 are public land managed by the BLM. The Bookcliffs deer herd is below the long-term population objective established by CPW. The elk population is above the current long-term objective, but elk populations on public land portions of the priority area are frequently lower than desired. Both species migrate elevationally in the fall and spring. BLM lands provide important winter range for both species, and portions of each herd also migrate relatively long distances annually, including movement into the state of Utah for the winter months. Habitat carrying capacity has declined over recent decades, as both quantity and quality of habitat have diminished due to extensive oil and gas development, fragmentation by roads and trails, increased human activity on public lands, and suppression of large-scale wildfires.

Spatial Location:

The Bookcliffs priority area is located in west-central Colorado. It lies to the northwest of Grand Junction along the Colorado-Utah state line (Figure WC5.1). It is bounded on the north by the White River, on the south by the Colorado River, and on the east by the high ground of the Cathedral Rim. The priority area occurs in Mesa, Garfield, and Rio Blanco counties.

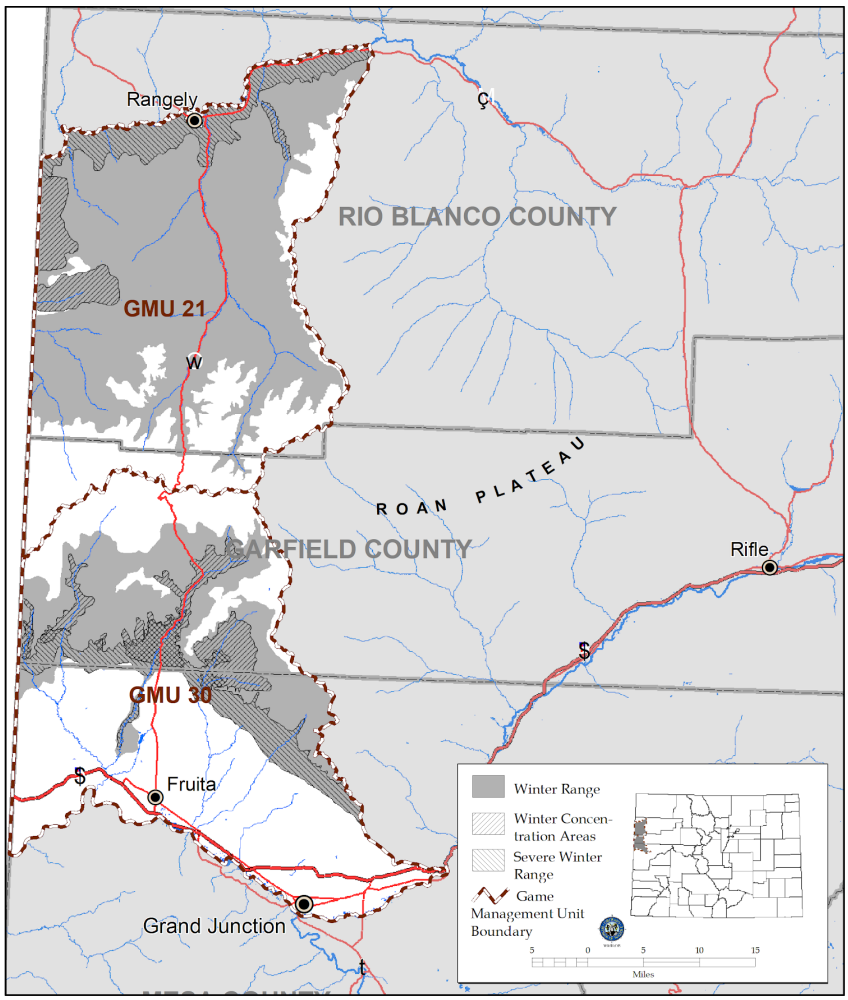


Location of Mule Deer DAU D-11 (GMUs 21, 30), West-central Colorado

Figure WC5.1. Bookcliffs Priority Area.

The Bookcliffs priority area contains approximately 1,150 square miles of suitable winter range (Figure WC5.2). Lower elevation lands across the priority area comprise the most important winter range for both deer and elk. Favorable snow depths, slope and aspect, and winter temperatures create accessible forage and make these areas suitable for wintering big game. Elk are generally found at higher elevations than deer due to their ability to forage in deeper snow conditions. However, during severe winters, both deer and elk are forced to winter at the lower elevations. The majority of deer and elk in the priority area winter on public lands, as approximately 91% of the winter range occurs on public land. The remaining 9%

of the winter range is held by private landowners. Important private land wintering areas are found within the lower drainages.



Location of Mule Deer DAU D-11 (GMUs 21, 30), West-central Colorado showing Deer Winter Range, Severe Winter Range, and Winter Concentration Areas.

Figure WC5.2. Winter range in the Bookcliffs Priority Area.

Two principal migration patterns occur in the priority area. A portion of deer and elk move to the south side of the priority area and winter on the Bookcliff slopes above the valley floor, or drop into the valley, depending on winter conditions. This tends to be a relatively short-distance, elevational movement pattern. On the north side of the priority area, similar elevational movements between summer and winter range occur, but a portion of the deer and elk demonstrate longer-distance, directional seasonal migration. This movement pattern is to the west and northwest, with a significant proportion of both deer and elk wintering on adjacent areas in Utah.

Habitat Types:

Topography varies greatly in the Bookcliffs priority area. The highest elevations are at the center of the area at the top of the Bookcliffs. Elevations decrease to the north and south from there. The highest elevation in the priority area is approximately 9,300 ft. The lowest elevation is approximately 4,600 ft and occurs in the southwestern corner of the priority area, where the Colorado River meets the Utah state line. The Bookcliffs area is noted for canyon country in the south and rolling pinyon-juniper/sagebrush/mountain shrub steppe in the north.

Steep-sided sandstone and shale canyons are dominant geographic features of this priority area. The Bookcliffs are a generally continuous, uniformly high cliff formation with canyons and washes running north to south toward the Colorado River. In the upper reaches of GMU 30, large canyons bisect the topography at frequent intervals. The interior portions of the priority area are composed of mesas and rolling sagebrush hills. Terrain is less fragmented and more open in these interior areas.

Vegetation within the Bookcliff priority area varies across the wide range of elevations and aspects that occur. At lower elevations along drainages, irrigated lands composed primarily of grass/alfalfa meadows are common. At lower elevations away from the drainages, vegetation is typical of most semi-arid regions in western Colorado. Saltbush, sagebrush, and greasewood are common shrub species found in these open desert areas. Cheatgrass dominates the understory in many areas in the desert. Pinyon-juniper woodlands are common on the lower and intermediate slopes throughout the priority area. Oakbrush (Gambel's oak) is found mixed with pinyon-juniper woodland at higher elevations. A combination of sagebrush and snowberry are commonly found in open areas in the oakbrush zone at intermediate and higher elevations. Higher elevations, which receive considerably more moisture, are dominated by stands of aspen and Douglas fir, sagebrush steppe, and serviceberry-dominated shrublands. Often, the aspen and

fir are found in pockets, rather than in large, continuous forested areas. Vegetative communities grade into each other in response to slope, aspect, and moisture, forming a mosaic pattern across the landscape. Extensive crop production of corn, wheat, alfalfa, beans, and onions occurs in the Grand Valley. These crop fields are used by deer and elk principally during the winter months, although some deer use the fields throughout the year.

Important Stopover areas within the corridor:

Specific migration routes in the Bookcliffs priority area have not been mapped to the degree of specificity necessary to identify stopover areas. As noted in the Bears Ears/White River discussion above, detailed migration route mapping in northwestern Colorado suggests that migrating deer and elk don't utilize stopover areas to the degree documented in other states.

Landownership:

The Bookcliffs priority area contains a mixture of public and private lands. Approximately 81% of the priority area is in public ownership. The vast majority of the priority area (80%) is managed by the BLM, 0.4% is managed by CPW, 0.2% is managed by the Colorado State Land Board and 19% is privately owned. BLM lands in the priority area are managed by the Grand Junction and White River Field Offices, located in Grand Junction and Meeker, respectively. The land managed by CPW falls within the Square S Summer Range tract of the Piceance State Wildlife Area.

Land Uses:

Livestock production is a predominant land use throughout the priority area. Much of the private land is used to graze livestock throughout the year. Cattle and sheep ranchers graze livestock on BLM lands during various seasons of the year. Livestock are generally grazed on allotments during the summer and then moved to home ranches for the winter, but some grazing also occurs on BLM lands during the winter months. Most domestic grazing is by cattle. Historically, domestic sheep were grazed in significant numbers, but are now limited to a few small flocks.

Crop production is limited to specific regions within southern portions of the priority area, but plays a significant role in wildlife management. The Grand Valley area around Grand Junction and Fruita is extensively irrigated and farmed.

Significant oil and natural gas resources underlie portions of the Bookcliffs priority area, particularly in the northern half of the area. Extensive development has occurred in the Douglas Creek drainage basin. While the field remains in

production, the pace of development has fallen sharply since 2009. An increase in the price of natural gas could accelerate these activities.

The Bookcliffs priority area experienced a great deal of human population growth over the past 20 years, primarily in the Grand Valley and along Interstate 70. The majority of new housing developments built outside city limits have occurred in deer winter range, fragmenting former sagebrush and agricultural lands. The area north of Grand Junction is undergoing rapid conversion of agricultural lands to exurban and suburban housing developments.

Outdoor recreation is extensive across the priority area, which provides excellent backcountry hiking, biking, and off highway vehicle (OHV) opportunities. Vehicular access varies across private and public lands. A network of roads provides ample access to many areas that are open to multi-purpose land uses. Big game hunting is a major recreational activity in the priority area in the fall. Fishing is limited to some of the larger perennial streams and to several public and private reservoirs.

Commercial timber harvest is limited to small blocks and occurs primarily on private land. Some Douglas fir has been harvested in recent years. Most of this harvest occurs in rugged canyon areas in the northern part of the priority area. Aspen has also been harvested, sometimes as part of other land management practices including habitat management for big game wildlife. Some firewood is harvested, both commercially and privately.

Risk/Threats:

Livestock grazing is extensive across the Bookcliffs priority area. The arid nature of the priority area requires careful management to ensure that livestock grazing is done in a manner consistent with maintaining land health standards. Vegetation in the priority area, particularly within deer range, has been intensively managed to produce livestock forage, often to the detriment of shrubs important as deer winter forage. Natural fire has been suppressed in the priority area for many decades, and pinyon-juniper encroachment into sagebrush communities is a significant concern in some areas. Pinyon-juniper encroachment may be impacting wildlife populations by reducing palatable forage suitable for deer.

Intensity of outdoor recreation activity is increasing in the priority area. Fruita has become a destination mountain biking area where new trail complexes have been pioneered in recent years. Off road vehicle activity on federal lands has also increased substantially.

Oil and gas production is currently at a relatively low level but could increase quickly with a change in the market price of natural gas. Oil and gas developments can affect big game wildlife in several ways. One is the direct disturbance on and immediately surrounding drill pads due to development and production activities on the drill pad, increased human activity, and habitat displacement. Indirect disturbance effects also extend into adjacent undeveloped areas and can alter deer use patterns in these habitats. Additionally, the necessary infrastructure to support oil and gas production, including roads and pipelines, fragment the landscape and contribute to an overall decline in habitat quality. Elk and deer tend to avoid areas of higher human activity, and thus can lose access to affected habitat. Both summer and winter ranges have been affected by past and present oil and gas development and production. Planned developments will likely be concentrated more heavily on winter ranges, increasing the impact of each development on wintering deer and elk.

Increasing suburban and exurban residential development has occurred in some of the most productive habitat (irrigated agricultural fields) in the priority area. The resulting loss of deer and elk winter range is a significant and increasing concern.

Highway 139 bisects the priority area, but has not been identified as a major risk factor for wildlife-vehicle collisions.

Are the Risk/Threats Immediate or Long-term:

Increased recreation activities and suburban/exurban development are immediate threats in the Bookcliffs priority area. Vegetative effects of livestock grazing and effects of oil and gas development and production are long-term threats, so long as current energy market conditions prevail.

Actions necessary to reduce or eliminate risks/threats:

Several actions may be successful in reducing or eliminating these threats. First and foremost, continued diligence from the BLM in avoiding, minimizing, and mitigating the negative effects of land use developments, including recreation, on migrating and wintering deer and elk will be of critical importance. Counties, municipalities, and non-governmental organizations also have a role to play in properly designing and implementing land use practices within the priority area. Limitation of the timing and intensity of recreational activity on publicly and privately owned winter range will be especially valuable.

Although private lands make up a small portion of the Bookcliffs priority area, they constitute some of the most productive habitat. Protection of privately owned

migration areas and winter ranges through conservation easements could benefit conservation of deer and elk in the priority area. Land value in the priority area is lower than in some of the mountain communities, and may help in leveraging conservation easement efforts.

Habitat enhancement to counteract the vegetative effects of domestic livestock grazing practices and to reset vegetative succession to improve forage quality for wintering deer and elk would benefit both species. Potential treatment practices include prescribed fire, mechanical removal or thinning of pinyon-juniper woodland, mechanical mastication or roller-chopping of mountain shrub communities, understory restoration, and management/restoration of the soil water table and wet meadow/seep areas.

Current efforts (what is the activity; who is conducting the work; and partners involved):

CPW participates with the BLM and local governments, as appropriate, to evaluate and comment on land use proposals, including the application of timing limitations, identification of best management practices and development of mitigation proposals. CPW has also partnered with BLM and others to conduct habitat management projects in the priority area, particularly in the higher elevations along the eastern edge of the area. Most of these projects have involved the mechanical removal of pinyon-juniper woodland. CPW and CDOT have established a transportation alliance to coordinate efforts to reduce wildlife-vehicle collisions and to increase permeability across state highway corridors. CPW and CDOT recently completed a western slope-wide assessment of collision risk that will be used for prioritizing and planning wildlife crossing projects.

Cost of current or needed habitat treatments; road crossings etc.:

Protection of winter range and migration corridors on private lands through conservation easements would be an effective method of ensuring long-term conservation of non-federal habitat. CPW has not completed any conservation easements in the priority area to date. Even with the relatively moderate cost of land in the area, purchased easements will be quite expensive. A single easement of sufficient size to be meaningful will cost several million dollars, depending on location and easement terms.

Average cost for pinyon-juniper removal or understory restoration habitat treatments is approximately $250/acre. Habitat enhancement of 5000 acres (approximately 0.7% of winter range in the priority area) would cost $1,250,000.

Other Issues for awareness:

None

RESEARCH

#1 Colorado Research Priority: Upper Purgatoire Mule Deer and Elk Herds

Why the area selected as a priority: The Upper Purgatoire watershed (GMUs 85, 851 and 140; DAUs E-33 and D-32) provides some of the most critical mule deer and elk winter habitat in the SE Region of Colorado and contains one of the top 5 elk herds in the state. Three primary opportunities exist in this area to better understand how deer and elk use this important landscape. First, a better understanding of elk and deer movements in the northern portion (GMU 85) would help us better identify the migration corridors in this area. Second, this area is bisected by Interstate 25 from the town of Trinidad to the Colorado State line at the top of Raton pass. The importance of understanding how deer and elk interchange across Interstate 25 recently intensified with our recent knowledge that the New Mexico Department of Transportation is installing exclusionary fencing along Interstate 25 from the city of Raton to the top of Raton pass. In this project, New Mexico has limited funds to provide crossing structures. Therefore, with limited crossing structures and lack of fencing on the Colorado side of the pass, the incidence of vehicle collisions with bear, lion, deer and elk may intensify. Lastly, CPW, The Nature Conservancy (TNC), and Trust for Public Lands (TPL) recently purchased a 19,000 acre ranch to the south of Trinidad; this property's western boundary is Interstate 25. The property known as the Fishers Peak Ranch will be open to the public for a variety of uses, which could include, hunting, camping, hiking, mountain biking, rock climbing, and wildlife watching. The development of recreation on this property provides a rare opportunity for CPW to examine impacts of recreation on deer and elk movements and distribution, in addition to investigating concerns about wildlife crossing Interstate 25.

Spatial Location:

This watershed includes GMUs 85, 851 and 140, which overlap with deer DAU D-32 (Figure R1.1). The watershed is bounded on the north by US highway 69, Interstate 25 and Colorado 160; on the east by Colorado 389; the south by the New Mexico

and Colorado State line; and on the west by the Sangre de Cristo and Culebra Mountain Ranges (Figure R1.1).

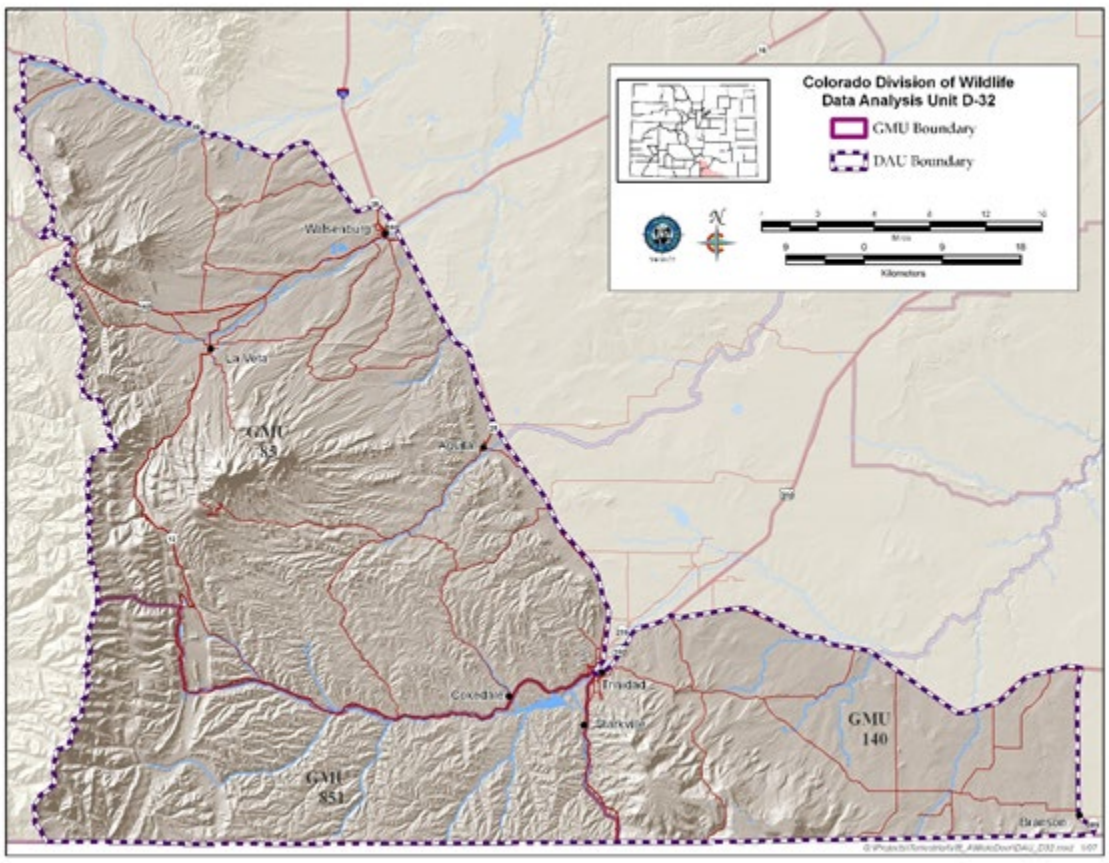


Figure R1.1. Upper Purgatoire watershed including GMUs 85, 851 and 140.

Habitat Types: This area covers 2,044 square miles ranging in elevation from 14,047 feet at the summit of Culebra Peak to about 5,364 feet where San Francisco Creek flows under Colorado 160. The range in elevation leads to diverse habitat types that includes; alpine tundra, subalpine conifer, montane mixed conifer, montane shrub, pinyon/juniper woodlands, oak brush, mountain meadow and plains grassland.

Important Stopover areas within the corridor:

These are unknown at this time due to the lack of telemetry data within this area.

Landownership: The size of the watershed is 2,070 square miles. Of that area, 71 mi^2 is owned by CPW (Spanish Peaks, Lake Dorothey, Bosque del Oso and James M. John State Wildlife Areas) which is approximately 3.4% of the watershed, the U. S. Forest Service controls 109 mi^2 (5.2%), the BLM 46 mi^2 (2.2%), the State Land Board

66 mi^2 (3.1%), and 1,772 mi^2 is in private ownership (85.6%).

Land Uses: Agriculture is the predominant land use in the watershed with livestock grazing, primarily cattle and horses, occurring throughout the area on native rangeland. Irrigated hay and alfalfa occurs along many rivers with the majority of row crops confined to small farms. In addition, the Raton basin has been extensively developed for coalbed methane, with roads and well pads found throughout large portions of the watershed. Lastly, large ranches have been developed into 40 acre or smaller "ranchettes", which has fragmented portions of the watershed.

Risk/Threats: First, the extensive development of coalbed methane in the Raton Basin has fragmented this watershed in some of the key winter ranges for both deer and elk. Much of the development has already occurred in the southern portion of the watershed. However, development of gas resources to the northern portion of the watershed could further fragment this landscape. Second, over the last 30 years, a number of large ranches have been developed into 40 acre or smaller "ranchettes". These developments have fragmented the landscape through both the development of homes and also the proliferation of fences. Many of these developments are located in deer and elk winter range, which likely affects both distribution and movements of deer and elk in the watershed. Third, as described above, we are concerned about the fencing of Interstate 25 on Raton Pass in New Mexico and the potential impact that the lack of fencing and key crossing structure may have on the Colorado side. Lastly, the future impact of trail-based recreation on the movement of deer and elk on Fishers Peak Ranch is unknown at this time, but presents a a rare opportunity to be studied.

Are the Risk/Threats Immediate or Long-term: The risk of oil and gas development and ranchette development are long term. The risk of wildlife-vehicle collisions on Interstate 25 between Trinidad and Raton Pass is more immediate. New Mexico Department of Transportation plans to complete a fencing project from Raton to the top of Raton Pass in the summer of 2020. It is expected that trail-based recreation on the Fishers Peak property will be developed within the next few years. This presents a rare opportunity to study the impacts and make contributions to other managers addressing the impacts of increased trail-based recreation on deer and elk movements and distribution.

Actions necessary to reduce or eliminate risks/threats: First, protection and enhancement of winter range in this watershed is needed to reduce the threat of oil and gas development and housing development. Additional information on deer and elk movements in this watershed could help define the best locations for these actions. Another need is development and execution of a strategy to facilitate

wildlife crossing Interstate 25 between Trinidad and Raton pass. Lastly, thoughtful and well planned recreation development on the Fishers Peak Ranch is needed to reduce this threat.

Current efforts (what is the activity; who is conducting the work; and partners involved): In partnership with several large ranches, CPW researchers have been collaring and monitoring approximately 30 cow elk in the southwest portion of this watershed. The study was initiated to examine the cause of low calf:cow ratios in this herd. In addition to the cow capture, 60 neonate calves are captured each spring to monitor calf survival. This information has provided information on elk movements in this area. However, it only represents a small portion of the watershed. CPW has been communicating with CDOT staff to make them aware of the fencing project in New Mexico and the need to consider action to mitigate wildlife-vehicle collisions on the Colorado side. CPW and TNC have been conducting a biological inventory of the wildlife on the Fishers Peak Ranch. In the summer of 2019, 45 remote cameras were deployed to estimate population abundance and distribution of deer and elk on the property. This information will be utilized in developing a master plan for the property, which identifies areas for both protection and recreational development.

Cost of current or needed habitat treatments; road crossings etc.: Application of satellite transmitters to a minimum of 40 doe deer and 30 cow elk in the areas not included in the current elk study would provide a better assessment of habitat use and timing/pattern of migration. This information would improve understanding of seasonal habitat use and migration patterns in these herds. In particular, fine scale (i.e., GPS/satellite) telemetry information would allow greater understanding of the changes that have occurred in wintering distributions of deer and elk, the specific corridors used by deer and elk during seasonal migrations, the timing of migration relative to hunting seasons, and the out-of-area winter ranges used by both big game species. Costs to implement this action include $106,000 for capture efforts, satellite transmitter collars, and initial year of airtime for monitoring, followed by $15,000/year for an additional 2-3 years of monitoring and maintaining the samples of 40 transmitter-equipped deer and 30 transmitter-equipped elk. This information would support a refined management approach to both the deer and elk herds.

A rare opportunity exists for CPW to examine the impacts of trail-based recreation on the movements of deer and elk on the Fishers Peak Ranch. Due to the connectivity of the Ranch to Interstate 25, collared animals could be used to examine crossing locations. Application of satellite transmitters to a minimum of 40 doe deer and 40 cow elk would be needed to assess impacts of recreation on deer and elk movements. Costs to implement this action include $121,000 for capture efforts, satellite transmitter collars, and initial year of airtime for monitoring, followed by

$20,000/year for an additional 2-3 years of monitoring and maintaining the samples of 40 transmitter-equipped deer and 40 transmitter-equipped elk. This information will support a better understanding of the impacts of recreation on deer and elk movements and distribution and also examine the potential interchange of animals across Interstate 25.

The highway crossing structures and fencing necessary to facilitate wildlife passage across Interstate 25 from Trinidad south to the New Mexico State line would be very costly and could reach several million dollars.

Other Issues for awareness: None

#2 Colorado Research Priority: South Park Elk Herds

Why the area selected as a priority:

The area referred to as South Park is located in Central Colorado and includes critical winter range habitat and important migration corridors for several elk herds. The largest elk herd within South Park is E-18, the Kenosha Pass Elk Herd, occupying GMUs 50, 500, and 501. All seasonal movements of this elk herd occur within the geographic area of South Park. The southern portion of South Park, GMU 50, contains critical winter range for E-18 elk and 3 adjacent elk herds. Nearly all elk from E-18, an estimated population of 1,900 elk, winter in a just a few areas of South Park. Additionally, another 500-1,000 elk from elk herds that summer in GMUs 37, 46, 49, 57, 58, and 581 migrate to the same areas of GMU 50 each winter. In the winter of 2018, nearly 2,000 elk were counted in a single group on one property, the James Mark Jones State Wildlife Area. The severity of the winter influences the timing and number of elk that migrate to South Park. During winters with average to above average snowfall, elk winter survival depends on their ability to access wintering areas in South park. Therefore, protection of wintering habitats and migration corridors in South Park is critical to the performance and viability of 4 different elk populations.

Spatial Location:

South Park is a grassland basin formed by the Mosquito and Park Mountain Ranges. It encompasses the South Platte River headwaters in Park County; the town of Fairplay is the largest population center. South Park is located approximately 60 miles southwest of Denver.

Elk migrate in the winter to South Park from adjacent herds located near the towns of Breckenridge, Bailey, Lake George, Hartsel, Leadville and Salida (Figure R2.1). Elk migrate long distances to areas in South Park that are free of snow and provide necessary winter forage.

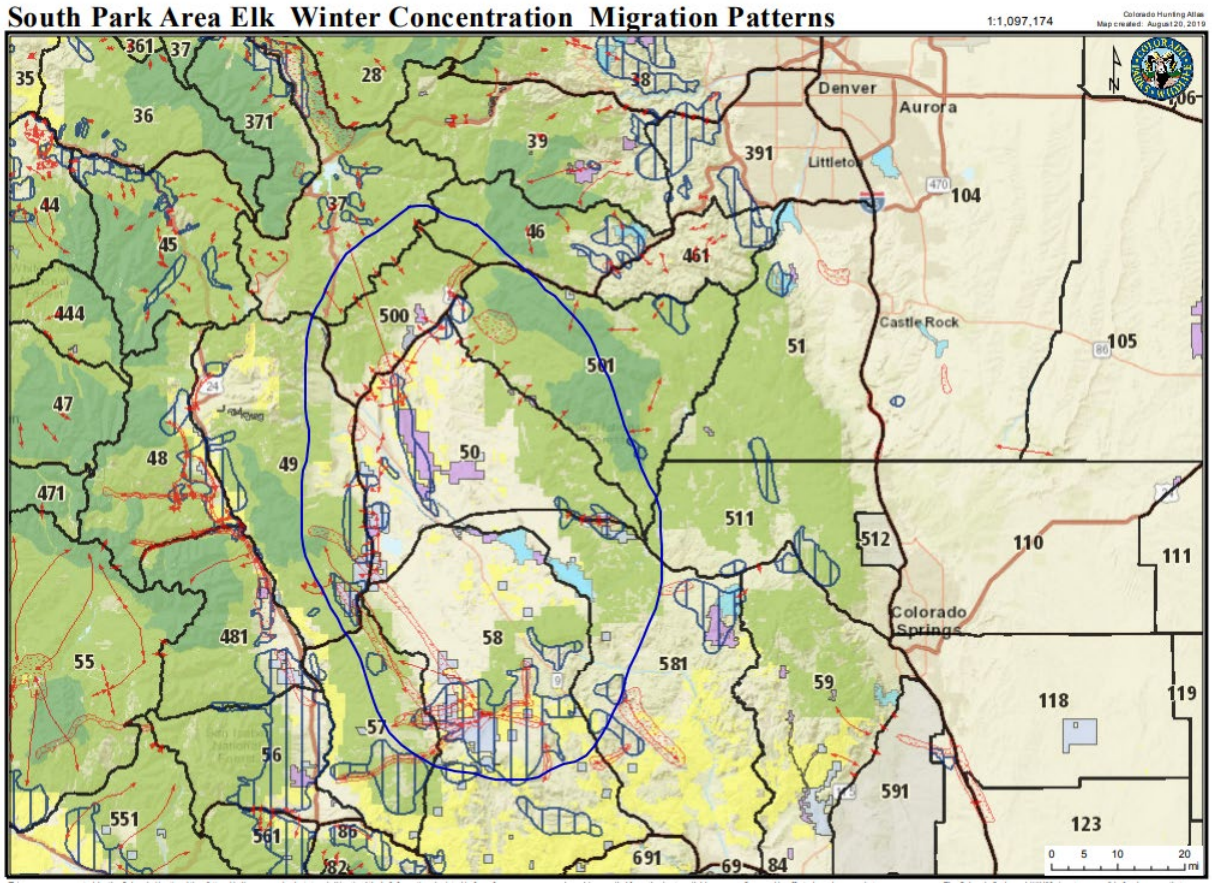


Figure R2.1: South Park Areas Elk Winter Concentration and Migration Patterns which is composed of part or all of GMUs 37, 46, 49, 50, 57, 58, 500, 501, and 581.

Habitat Types:

Vegetative types vary across South Park depending on elevation, climate, and aspect. For elevations over 11,500 feet, vegetation is alpine tundra which mainly consists of willows, grasses, forbs and sedges. As elevation drops (9,000-11,500), the ecosystem shifts to subalpine forest which consists of densely forested areas of lodgepole, bristlecone and limber pine, spruce/fir, rocky outcroppings, aspens and grass dominated meadows. The dominant life zone (6,500-9,000 feet) within South Park consists of ponderosa pine forest, Douglas-fir, and foothill shrub and grass species. Shrub species include mountain mahogany, chokecherries, currant, and shrubby cinquefoil. Elk are dependent on each of these various habitat types during

different times of the year. Elk winter in the lower elevations of South Park with habitat composed of foothills shrub and grass species. Agricultural croplands occur along tributaries up to elevations of 9,500 feet and consist of native grass hay species.

Important Stopover areas within the corridor:

Stopover areas within the corridor are unknown, but investigation and identification of potential stopover areas will be a research objective.

Landownership:

Approximately half of South Park is in public, federal ownership and the other half is privately owned or in non-federal ownerships.

Land Uses:

Land use in South Park has changed significantly in the last 25 years. Private lands have been converted from ranch lands to residential uses. Significant portions of the most critical winter range for elk were impacted and private lands have been subdivided into residential properties. Much of the lower elevation, non-subdivided private land consists of large acreage ranches managed for cattle and hay production.

Recreational activity is high from hiking, fishing, hunting, off road vehicle use, and mountain biking. The proximity to Denver and Colorado Springs, along with access to public land, makes this area popular for recreationalists year round. The headwaters to the South Platte River basin and its associated tributaries support a major tourism industry and generate significant revenue for Park County. Recreational activities have increased significantly over the last 10 years and are expected to continue to increase.

Several high speed and high volume highways bisect or border South Park. Highway 285 bisects the northern portion of South Park and Highway 9 borders the west side. Both highways contribute to elk mortality and have become a barrier to elk movement as traffic has increased over the last 10 years.

Risk/Threats:

Recreation is the dominant use on public lands and has increased commensurately with the population growth in the Denver metro area. Land conversion from agriculture to exurban/suburban housing has been and continues to degrade elk

habitat. Recreation and human development displace elk, fragment habitat, and create barriers to movement.

Are the Risk/Threats Immediate or Long-term:

Threats to South Park winter range and migration corridors from recreational impacts are both immediate and long term. Conversion of agricultural lands to residential use is a long term threat.

Actions necessary to reduce or eliminate risks/threats:

Protection of winter range and migration corridors in South Park is needed to reduce the threat of recreational impacts and housing development. Additional information on elk movements in South Park will help define the best locations to facilitate wildlife movements through habitat protections and enhancements. Management strategies should be developed and prioritized to protect critical areas and manage important habitats. Location data from radio collars would inform land use, development proposals, recreational proposals, and other land management agency resource management plans.

Current efforts (what is the activity; who is conducting the work; and partners involved):

Over the last 10 years, CPW staff has worked with the South Park Habitat Partnership Program (HPP) Committee to implement elk winter range improvement projects. Local CPW staff has collaborated with CDOT to install elk crossing signage where elk mortality has occurred along Highway 285.

Cost of current or needed habitat treatments; road crossings etc.:

A research project to monitor elk movements in the South Park area will initially require one-time funding of approximately $115,000 to deploy 40 GPS radio collars on elk. This will include costs of capture efforts, satellite transmitter collars, a temporary employee, field equipment, and 3 years of airtime/subscription fees (Figure R2.2).

Table R2.2: South Park area elk study budget for years 1-3.

South Park Area Elk Study Budget (Year 1)			
Description	**Cost ($)**	**Quantity**	**Total ($)**
Personnel			
Intern/Temporary	$15.00-$16.00/hr pay	1, 4-6 month term	18600.12
Equipment and Supplies			
GPS Collars	800	40	32000.00
Activation Fees	45	40	1800.00
Subscription Fees/annual	200	40	8000.00
Helicopter Capture	900	40	36000.00
Field Supplies	1000		1000.00
			$97,400.12
South Park Area Elk Study Budget (Year 2 &Year 3)			
Description	**Cost**	**Quantity**	**Total**
Personnel			
Intern/Temporary	$15.00-$16.00/hr pay	1, 4-6 month term	0.00
Equipment and Supplies			
Subscription Fees	200	40	8000.00
Year 2 Total			$8,000.00
Year 3 Total			$8,000.00
TOTAL			**$16,000.00**

Multiple habitat treatments have occurred on winter range in South Park on the James Mark Jones State Wildlife Area (JMJ SWA)and over $250,000 has been spent on these projects. These treatments have included clearing decadent overstory to stimulate grass growth on winter range. Over 2,000 acres of winter range have been treated over the last 10 years. Additional habitat treatment project sites have been

identified on winter range in South Park. The cost to complete this winter range habitat work includes $350/acre to treat 1,500 acres for a broadcast burns, $400/acre to treat 750 acres for conifer reduction, and $450/acre to treat 150 acres for aspen enhancement. Funding for habitat treatments in South Park could improve another approximately 2,000 acres of winter range in South Park.

Other Issues for awareness:

A telemetry project in South Park, conducted in the 1990s to better understand elk movements, identified several winter migration corridors in South Park. Initiating another telemetry project on elk in South Park offers an opportunity to compare current location and movement data to previous data. We also have the opportunity to interpret the impacts of land use change over the past 20 years on elk migration and habitat quality.

#3 Colorado Research Priority: Front Range Mule Deer

Why the area selected as a priority:

Mule deer are a valued resource on the Front Range and provide watchable and hunting opportunities for the public along with economic benefits to local communities. Mule deer hunting is the most significant big game hunting opportunity on the Front Range.

Management of mule deer on the Front Range is challenging because of the mixture of land ownership on the landscape, restricting traditional management tools and data collection. Many properties that provide deer habitat are small in size and within municipal boundaries, resulting in prohibitions on traditional hunting methods. The Front Range is also experiencing rapid land use changes from human developments and demands for data to inform management actions is growing. Most of CPW's mule deer research and management projects have been conducted in west slope deer herds. CPW's understanding of mule deer movements along the Front Range is limited. Specific corridors and priority habitats used by mule deer still need to be identified. Telemetry data from mule deer, gathered with GPS radio collars, would identify specific migration corridors, stopovers, summer and winter

ranges, highway crossing locations, and other critical habitats. This data will be useful for siting wildlife crossing structures in cooperation with CDOT. The project would involve capture and radio-collaring a sample of doe mule deer on winter range and then monitoring their movements over the 3-year lifetime of the transmitters.

Spatial Location:

Colorado's Front Range runs north and south on the east side of the Continental Divide in Northeastern Colorado and encompasses the foothills. Major population areas include Denver, Fort Collins and Castle Rock. Major rivers include the Cache La Poudre, Big and Little Thompson, and the South Platte River. Mule deer range in habitat from an elevation of 5,000 feet up to 13,000 feet. Mule deer occupy all areas and for all seasons along the Front Range. In general mule deer summer at higher elevations and shift to lower elevations in the winter along the foothills of the Front Range (Figure R3.1).

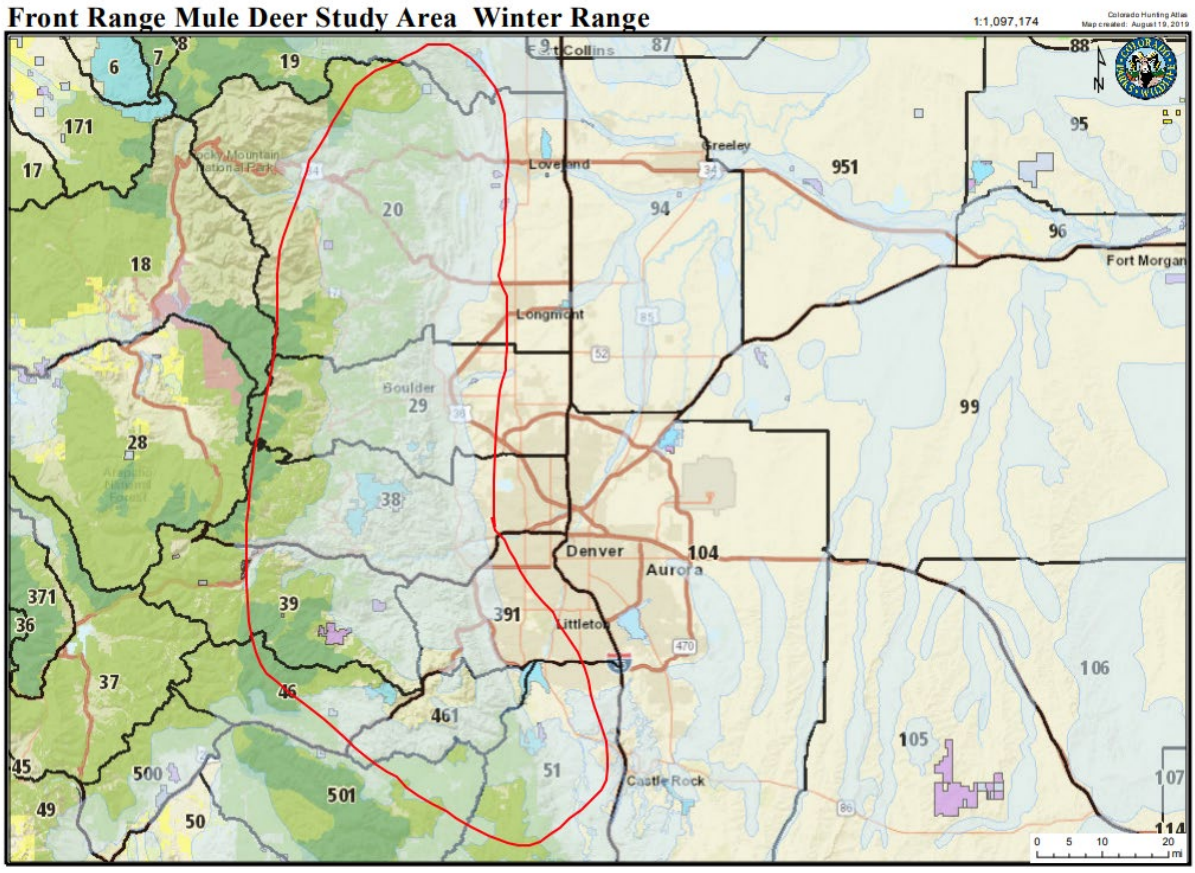


Figure R3.1: Front Range Study Area with mule deer winter range identified in blue.

Habitat Types:

Vegetation along the Front Range is diverse, varying with elevation and climate. The lowest elevation is comprised of short grass prairie. Shrubs, including mountain mahogany, juniper and currants, range from approximately 5,500 to 7,500 feet in elevation. Mountain riparian communities dominated by willows, chokecherries, alders and narrowleaf cottonwoods are found along various creeks. Ponderosa pine dominated communities are found up to 8,500 feet with Douglas fir covering many north facing slopes in the foothills. The Front Range contains subalpine forests from 8,500 feet up to timberline at approximately 11,600 feet. The subalpine forest zone is dominated by lodgepole pine intermixed with aspen up through 10,500 feet in elevation. Spruce/fir subalpine forest interspersed with meadows is the dominant vegetation up to timberline. Stands of limber and bristlecone pine also occur at higher elevations. Alpine tundra, alpine willows and rock dominate above timberline on the Front Range.

Important Stopover areas within the corridor:

Stopover areas along the Front Range have not been identified and determining these areas is a priority. Radio collar locations would identify these areas along with other important habitat. Migration patterns have been coarsely identified based upon field staff observations, but the extent of migration is largely unknown (Figure R3.2).

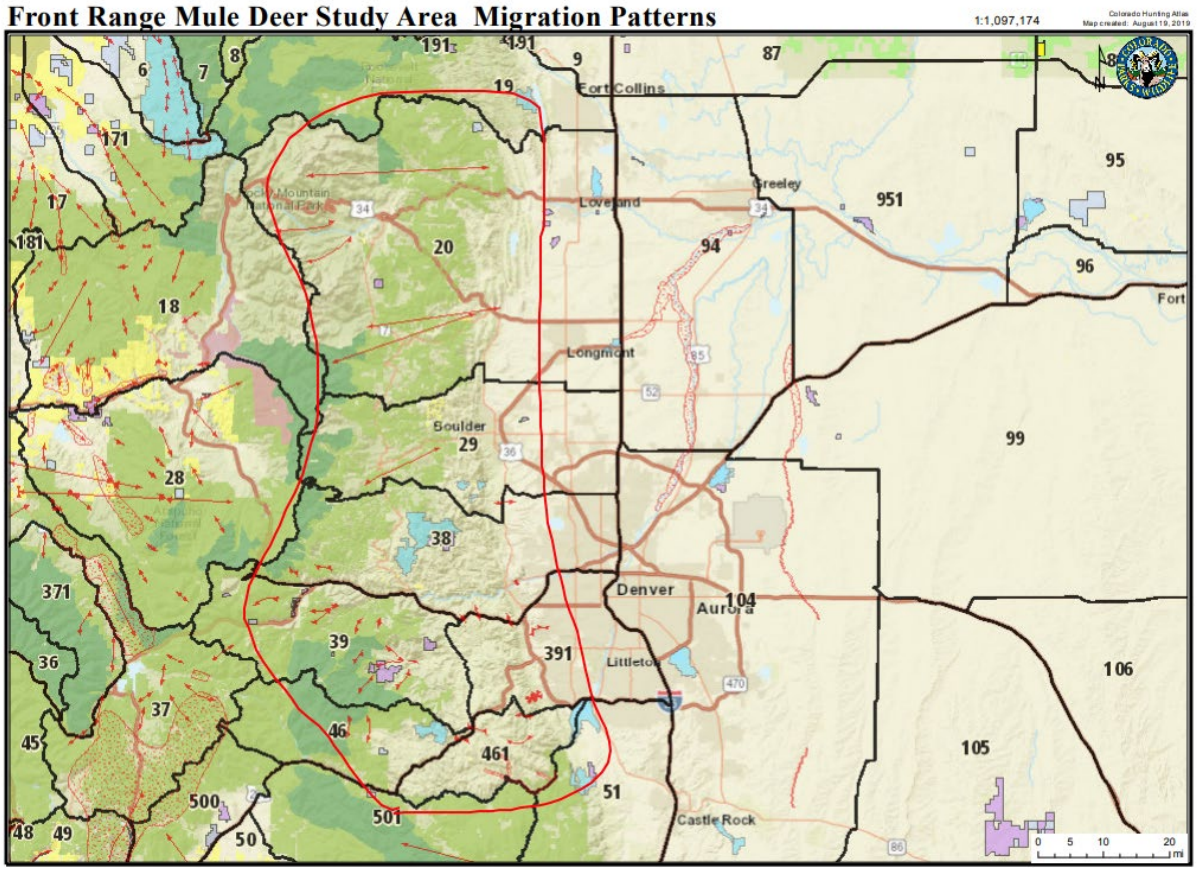


Figure R3.2: Migration patterns (red arrows) of Front Range mule deer.

Landownership:

Within the foothills and lower elevations of the Front Range, lands are mostly privately owned; the U.S. Forest Service owns most land at higher elevations.

Land Uses:

Outdoor recreation on public lands is substantial along the Front Range. Hiking, four wheeling, horseback riding, motorcycle riding, mountain bike riding, angling, hunting and wildlife viewing are primary uses. Hunting is not currently allowed on any city or county open space lands or parks, with the exception of a few county properties. Much of the private lands have the potential to be developed into residential subdivisions. Agriculture activities on private land consist of hay production and cattle and horse grazing. Grazing allotments do occur on federal lands in several areas along the Front Range, but this is not a significant land use.

Risk/Threats:

The Front Range contains Colorado's largest and densest human population centers and continues to experience annual population growth. Land conversion from agriculture/undeveloped lands to exurban/suburban housing continues to be significant. Recreation is the dominant use on public lands and has increased commensurately with human population growth. Recreation and human development displace mule deer and fragment habitat. Human development also creates management issues by restricting harvest and creating refuge areas.

Are the Risk/Threats Immediate or Long-term:

The rate of change on the landscape due to development, coupled with limited data on mule deer movements and habitat use, create immediate and long term threats.

Actions necessary to reduce or eliminate risks/threats:

A better understanding of critical mule deer habitats and migration corridors is needed to inform management strategies that focus on the protection of critical areas and management of important habitats. Location data from radio collars would inform land use, development proposals, recreational proposals, and other agency resource management plans.

Current efforts (what is the activity; who is conducting the work; and partners involved):

CPW staff currently map mule activity and priority habitats based upon field observations. This data is used to guide CPW recommendations on land use and development proposals. CPW partners with federal, county and city agencies on mule deer management along the Front Range.

Cost of current or needed habitat treatments; road crossings etc.:

No specific habitat treatments or road crossings have been identified to date. A research project for Front Range mule deer will initially require one-time funding of approximately $150,000 to deploy 40 GPS radio collars on mule deer. This will include costs of capture efforts, satellite transmitter collars, a temporary employee, field equipment, and 3 years of airtime/subscription fees (Table 3.2).

Table R3.2. Front Range mule deer study budget for years 1-3.

Front Range Mule Deer Study Budget (Year 1)			
Description	**Cost ($)**	**Quantity**	**Total ($)**
Personnel			
Intern/Temporary	$15.00-$16.00/hr pay	1, 4-6 month term	18600.12
Equipment and Supplies			
GPS Collars	1500	40	60000.00
Activation Fees	45	0	0.00
Subscription Fees	300	0	0.00
Helicopter Capture	800	40	32000.00
Field Supplies	1000		1000.00
			$111,600.12
Front Range Mule Deer Study Budget (Year 2 & Year 3)			
Description	**Cost**	**Quantity**	**Total**
Personnel			
Intern/Temporary	$15.00-$16.00/hr pay	1, 4-6 month term	0.00
Equipment and Supplies			
Subscription Fees	300	40	12000.00
Year 2 Total			$12,000.00
Year 3 Total			$12,000.00
TOTAL			**$24,000.00**

Other Issues for awareness:

None.

#4 Colorado Research Priority: Guanella Pass

Why the area selected as a priority:

Guanella Pass is composed of important wildlife habitats and movement corridors for many species including elk, mule deer, and moose. This area is heavily impacted by recreation due to the close proximity to the Denver metro area. There is a lack of data to inform management strategies to conserve and manage wildlife habitat and migration corridors. The U.S. Forest Service partnered with multiple stakeholders to develop the Guanella Pass Scenic and Historic Byway Corridor Management Strategy which outlines a vision for resource management in the Guanella Pass area.

Spatial Location:

Guanella Pass is located 40 miles southwest of Denver and is accessed by Interstate 70 at Georgetown and US Highway 285 at Grant (Figure R4.1). The Guanella Pass Byway runs north/south and traverses about 24 miles of forest, shrubland, and alpine tundra of the Rocky Mountains in north central Colorado. The northern portion of Guanella Pass lies in Clear Creek County within the Arapaho National Forest. The southern portion of the pass lies in Park County within the Pike National Forest. Mount Evans Wilderness is situated just east of Guanella Pass, and Square Top Mountain Inventoried Roadless Area can be found just west of the Guanella Pass Road summit. Wildlife migration occurs on both sides and over the top of Guanella Pass.

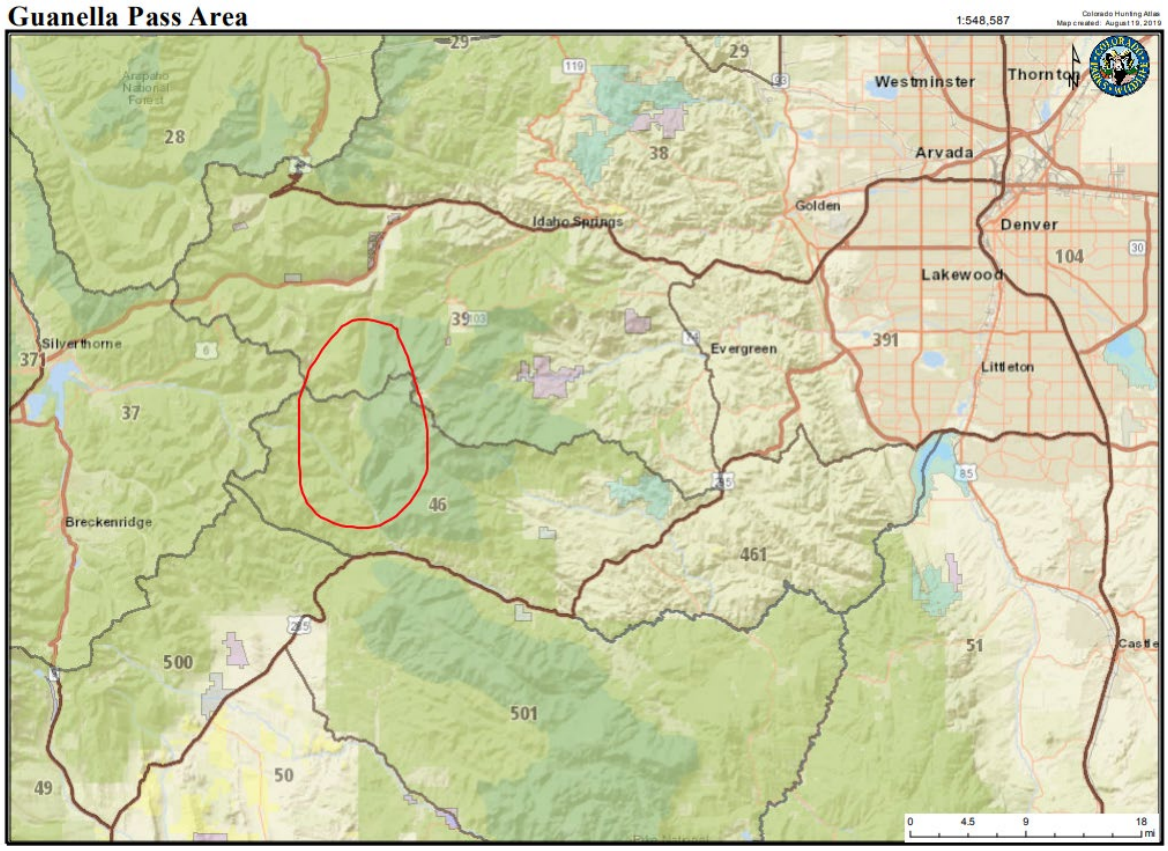


Figure R4.1. Guanella Pass Area.

Habitat Types:

Elevation, temperature gradients, and precipitation patterns create diverse flora and fauna in the Guanella Pass area. The lower elevations, starting at 9,500 feet, contain ponderosa pine and Douglas-fir tree species, with patches of aspen interspersed.

Broad willow flats with sedges and riparian grasses dominate the moist meadows, while mountain mahogany shrublands can be found on drier slopes.

Subalpine habitat occurs at 11,500 feet dominated by engelmann spruce and subalpine fir along with some limber pine and bristlecone pine. The area ranges up to 14,000 feet with higher elevations characterized by vegetation that includes elk sedge, low willow, hairgrass meadow, and contains many small fens and ponds, including one of the largest alpine willow carrs in Colorado.

Important Stopover areas within the corridor:

Important stopover areas within the corridor have not been investigated to date. Therefore, developing a greater understanding of the movements of deer and elk, and their potential use of and location of stopover areas will be a priority.

Landownership:

Land ownership is nearly all U.S. Forest Service lands.

Land Uses:

Recreation is the main land use in the Guanella Pass area. Recreational opportunities including backpacking, bicycling, wildlife watching, hiking, camping, fishing, four-wheeling, horseback riding, hunting, mountaineering, orienteering, picnicking, photography, rock hounding, sightseeing, nordic skiing, snowshoeing, snowmobiling, ATV riding, and auto touring.

Risk/Threats:

Recreational use has increased significantly over the last 10 years, but management actions and strategies to address the increased activity have not kept pace. Data is needed to inform management actions to manage and protect wildlife habitats and corridors.

Are the Risk/Threats Immediate or Long-term:

Threats are immediate and long term. The Denver metro area population is projected to increase in the near future and likely recreation will increase in the Guanella Pass area. Social capacity concerns currently exist regarding the amount of recreation in the area for both USFS and CPW.

Actions necessary to reduce or eliminate risks/threats:

Identifying wildlife movement corridors and habitat use with radio collar locations is the first priority. The second priority is using that data to inform management actions to conserve critical area and manage recreational use.

Current efforts (what is the activity; who is conducting the work; and partners involved):

The U.S. Forest Service has partnered with numerous stakeholders to develop a plan to define a vision and management strategies for the Guanella Pass area. CPW collaborates with the U.S. Forest Service on land use management recommendations and strategies.

Cost of current or needed habitat treatments; road crossings etc.:

This research proposal is for on-going (up to 10 years) funding to deploy approximately 10-15 GPS radio collars on mule deer and 10-15 radio collars on elk. Initially (the first 3 years), location data will be used to identify critical habitats and migration corridors to inform future study design objectives, the number/species of radio collared animals, and the study area for years 3-10. The first 3 years of this project is estimated at approximately $88,000. This project funding will include costs of capture efforts, satellite transmitter collars, a temporary employee, field equipment, and 3 years of airtime/subscription fees (Table R4.1).

Table R4.1: Guanella Pass area study budget for years 1-3.

Guanella Pass Area Study Budget (Year 1)			
Description	**Cost ($)**	**Quantity**	**Total ($)**
Personnel			
Intern/Temporary	$15.00-$16.00/hr pay	1, 4-6 month term	0.00
Equipment and Supplies			
GPS Collars	1500	30	45000.00
Activation Fees	45	0	0.00
Subscription Fees	300	0	0.00
Helicopter Capture	800	30	24000.00
Field Supplies	1000		1000.00
			$70,000.00
Guanella Pass Area Study Budget (Year 2 & Year 3)			
Description	**Cost**	**Quantity**	**Total**
Personnel			
Intern/Temporary	$15.00-$16.00/hr pay	1, 4-6 month term	0.00
Equipment and Supplies			
Subscription Fees	300	30	9000.00
Total Year 2			**$9,000.00**
Total Year 3			**$9,000.00**
TOTAL			**$18,000.00**

Other Issues for awareness:

None.

#5 Colorado Research Priority: Dolores Mule Deer and Elk Herds

Why the area selected as a priority:

Mule deer and elk have long been an important resource to the local communities and economy. The population of deer and elk in Disappointment Creek area have been performing poorly for several years.

CPW's understanding of big game movements in this area is limited. Specific corridors used by mule deer and elk have not been clearly identified. Telemetry

data from deer and elk, gathered with GPS radio collars, would identify specific migration corridors, stopovers, summer and winter ranges, and other critical habitat. Highway crossings would also be identified and these locations used in cooperation with CDOT in identifying areas for wildlife crossing structures. The project would capture doe deer and cow elk on winter range and fit them with radio collars. Capture would be spread out in an attempt to get the best representation of deer and elk distribution on the landscape.

Spatial Location: Disappointment Creek is located in Southwest Colorado (Figure R5.1) with major population centers of Dolores, Dove Creek, Norwood, Telluride, and Mancos. The main rivers in the area are the Mancos River, the Dolores River, San Miguel River and Disappointment Creek. Mule deer and elk are found in a variety of habitats ranging from 4,700 ft elevation to above 13,000 ft elevation. Deer and elk make long distance seasonal migration movements from lower elevation habitats in the winter to high elevation habitats in the summer (Figure R5.2).

These movements also take animals across several jurisdictional boundaries including private, State, BLM, US Forest Service (FS), National Park, and Tribal (Figure R5.3). Several highways and major roads, including Hwy 62, Hwy 84, Hwy 141, Hwy 145, and Hwy 491, intersect deer and elk movement corridors and habitat causing conflicts between big game and motorists.

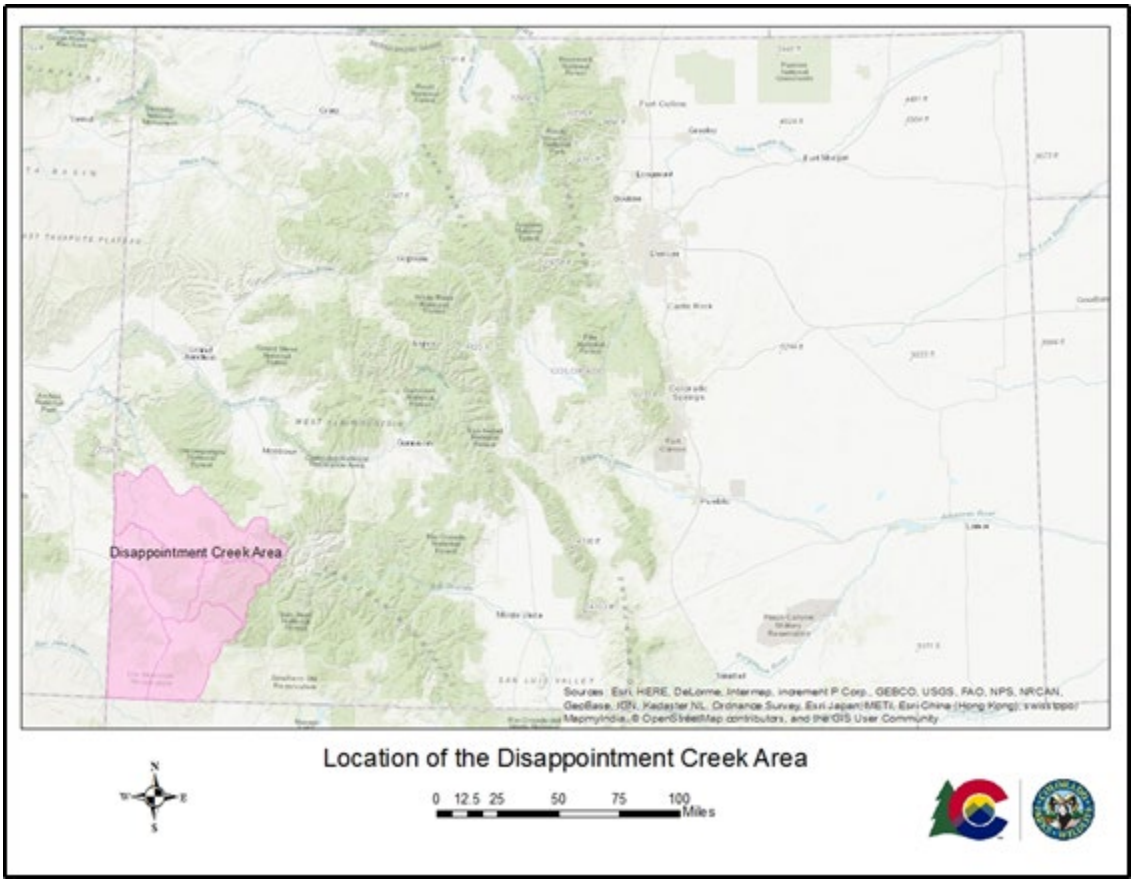


Figure R5.1: Location of the Disappointment Creek Area in southwest Colorado.

Habitat Types:

The lower elevations along the Dolores, San Juan, and San Miguel Rivers are high desert vegetation types and have dominant canyon-mesa geographic features, with some agricultural areas in the river flood-plain areas. As elevations increase, the vegetation changes to grassland/shrub, pinyon-juniper, ponderosa pine often with an oak understory, mountain shrub, aspen, and Douglas-fir. At the highest elevations, subalpine spruce fir and Engelmann spruce lead into alpine areas of willow or grass/sedge/forb communities above 12,000 feet. Deer and elk depend on these habitat types at various times of the year and through different life phases.

Important Stopover areas within the corridor:

Stopover areas within the corridor have yet to be identified. Determining where these are, along with other important habitat, is a priority.

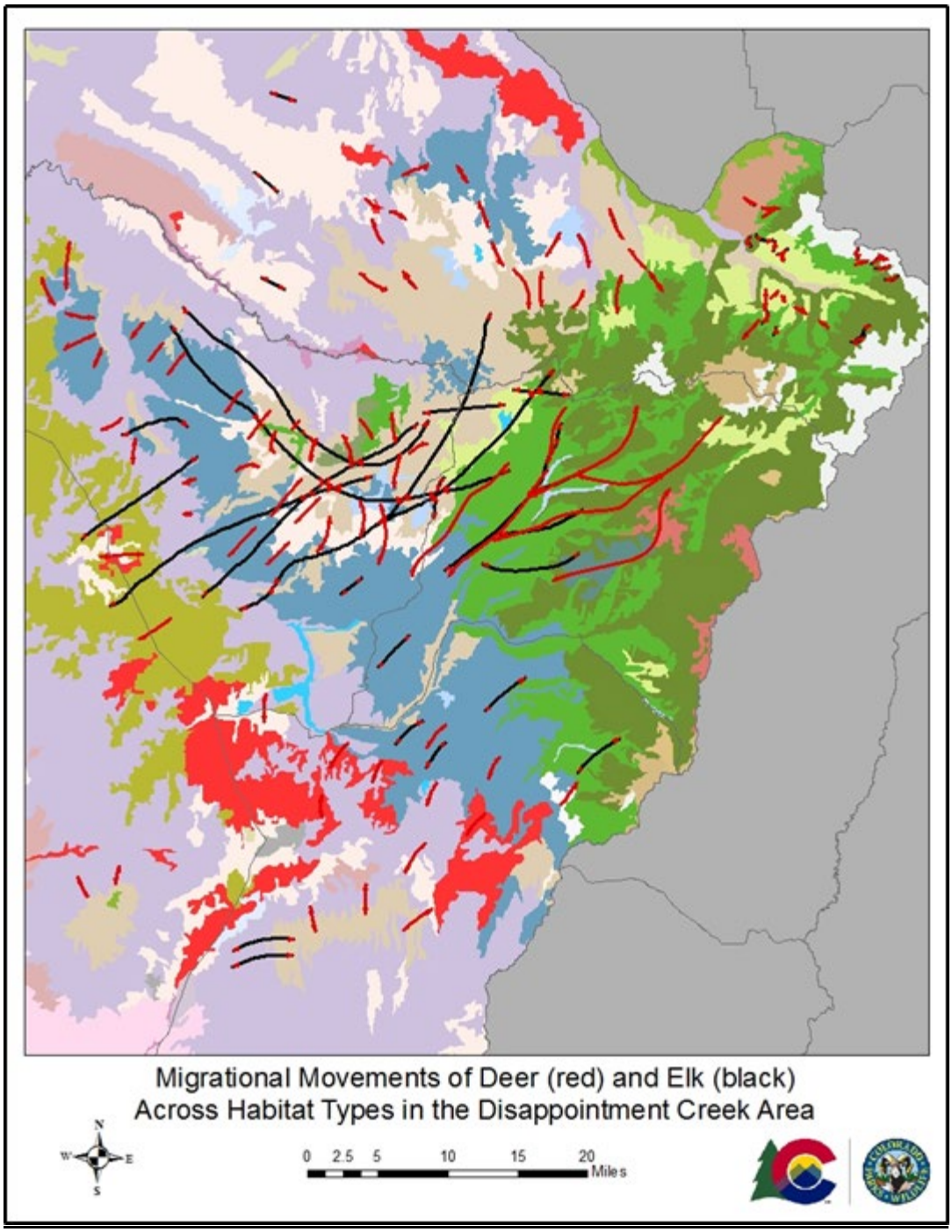


Figure R5.2: Rough migration patterns of deer and elk across vegetation types (lower elevation habitat in the southwest to higher elevation habitat to the northeast) in the Disappointment Creek Area.

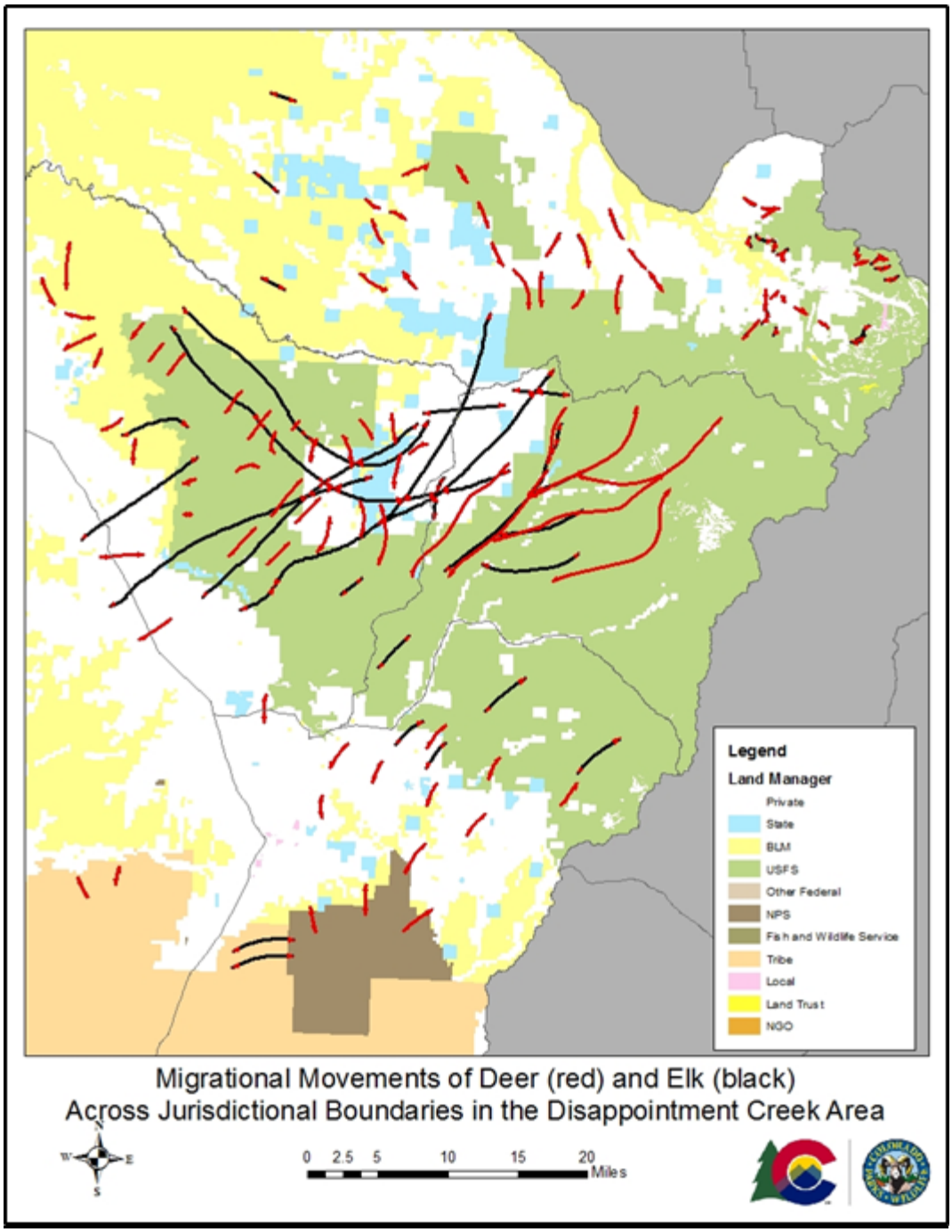


Figure R5.3: Rough migration patterns of deer and elk across jurisdictional boundaries in the Disappointment Creek Area.

Landownership:

Land ownership in the DAU is 34% U.S. Forest Service, 32% BLM, 30% private, and 2% CPW and State Land Board each

Land Uses:

The southwest portion of the area, south of the Dolores River and Hwy 85, dryland and irrigated farming is still prevalent. The fields are bisected with canyons hosting native pinyon/juniper forest habitats. Recreation use, specifically hiking and single track biking, is steadily growing. Trails to support these activities are expanding into the native habitats found in the canyons and other undisturbed habitats. Residential growth is also occurring in this area, with large acre properties being subdivided into residential lots. Road densities are increasing to access these new homes. There is also some energy development.

The central and western edge of the area is predominantly US Forest Service (FS) lands. Motorized recreation is very popular with high density of roads and trails. Non-motorized recreation is also a favorite pastime and growing in popularity on FS lands. The Telluride area attracts recreational users throughout the year resulting in extensive development of housing and lodging primarily in summer habitat deer and elk range. Cattle grazing occurs on portions of the federal lands which are shared by deer and elk throughout the year. Logging has occurred with a desire by the Dolores Ranger District to increase intensities in an attempt to minimize tree mortality caused by beetles.

The northern and western portion of the unit historically has been associated with livestock grazing across public and private lands. The area around Norwood north to Naturita and west into Dry Creek Basin supports considerable irrigated agricultural hay production. Subdividing and development occurs in the Norwood area, but not to the extent of the Telluride area. Historically uranium mining occurred primarily across lower elevation winter ranges and hard rock precious mineral mining occurred at the higher elevations. Many of these patented claims are now being developed for recreational houses. Recreational activities are focused around skiing and snowmobiling in the high country with hiking and OHV use occuring in the summer months. Single track trails are being developed more in the high country as well as on winter ranges around Norwood and Naturita.

Risk/Threats:

The area has historically been agricultural based, with farming and ranching the primary land uses on private lands, and grazing/forest products the primary uses on public lands. In the last 20 years, significant portions of agricultural land has been converted to exurban/suburban housing, and public lands are increasingly used for recreation in addition to livestock grazing. These changes have shifted the seasonal use patterns of deer and elk and have altered their migration corridors. Increased recreational activity within critical habitats also present a threat by displacing deer and elk and decreasing the functionality of habitat.

Are the Risk/Threats Immediate or Long-term:

Threats are both immediate and long-term, as crucial habitat has been and continues to be lost to development and expanding recreational activity. Once development occurs, whether ex-urban or recreational, it is essentially permanent, with cumulative losses of crucial habitat.

Actions necessary to reduce or eliminate risks/threats:

To maintain robust mule deer and elk populations in the Disappointment Creek area, the following actions are necessary:

1) Identify migration corridors and critical habitat used by these animals,

2) Ensure that there is unobstructed connectivity between seasonal habitat and other critical habitats, and

3) Augment the amount and quality of critical habitat.

Identifying deer and elk migration corridors and use of habitat is the first priority in reducing threats in this area. With this information, resources can be prioritized where these crucial habitats are found.

The area around McPhee Reservoir northwest towards Dove Creek provides important migration corridors and winter range for mule deer and elk. Most of this is private ownership and converted to agriculture. Conservation easements would be valuable in protecting large tracts of property from future development. Restoration of native habitat, primarily sagebrush systems, would be valuable to big game during the winter when resources are limited.

In addition, there are key corridors and critical winter habitat located on US Forest Service lands in the McPhee Reservoir area. Notably the Sage Hen (west side of McPhee) and House Creek (northeast of McPhee) areas support high densities of wintering deer and elk (Figure R5.4). Deer and elk concentrate here in part due to the loss of winter habitat from construction of the McPhee Reservoir in the 1980's. There are opportunities for habitat improvement, protection from recreation development and use, and reduction of domestic grazing with FS cooperation. These actions would all have positive impacts on mule deer and elk populations. Habitat work may include controlled burns, chemical treatment of noxious weeks, thinning of shrubs and/or trees by hand crews, and hydro-axing. Other areas to use these management actions to improve habitat on FS land would be identified through deer and elk telemetry data.

Opportunity is also available on Lone Mesa State Park. The 11,000 acre park (currently closed to the public) offers transitional range for migrating deer and elk.

The habitat improvement actions identified above would also be beneficial to deer and elk in the park.

In the northern portion of the area, deer and elk typically migrate from the northern and western low elevation sagebrush and pinyon-juniper shrublands to the higher elevation areas to the south and east through the mountain shrub communities up to the aspen, coniferous, and alpine habitats. The transition habitat in this area is primarily privately owned and if developed could hinder migration for large numbers of animals. These migration corridors are not clearly mapped, and the routes and potential stopover areas are not known. Telemetry studies using collared animals will help to identify sites for conservation easements and potentially for habitat improvement projects to maintain migration corridors for deer and elk across GMU 70.

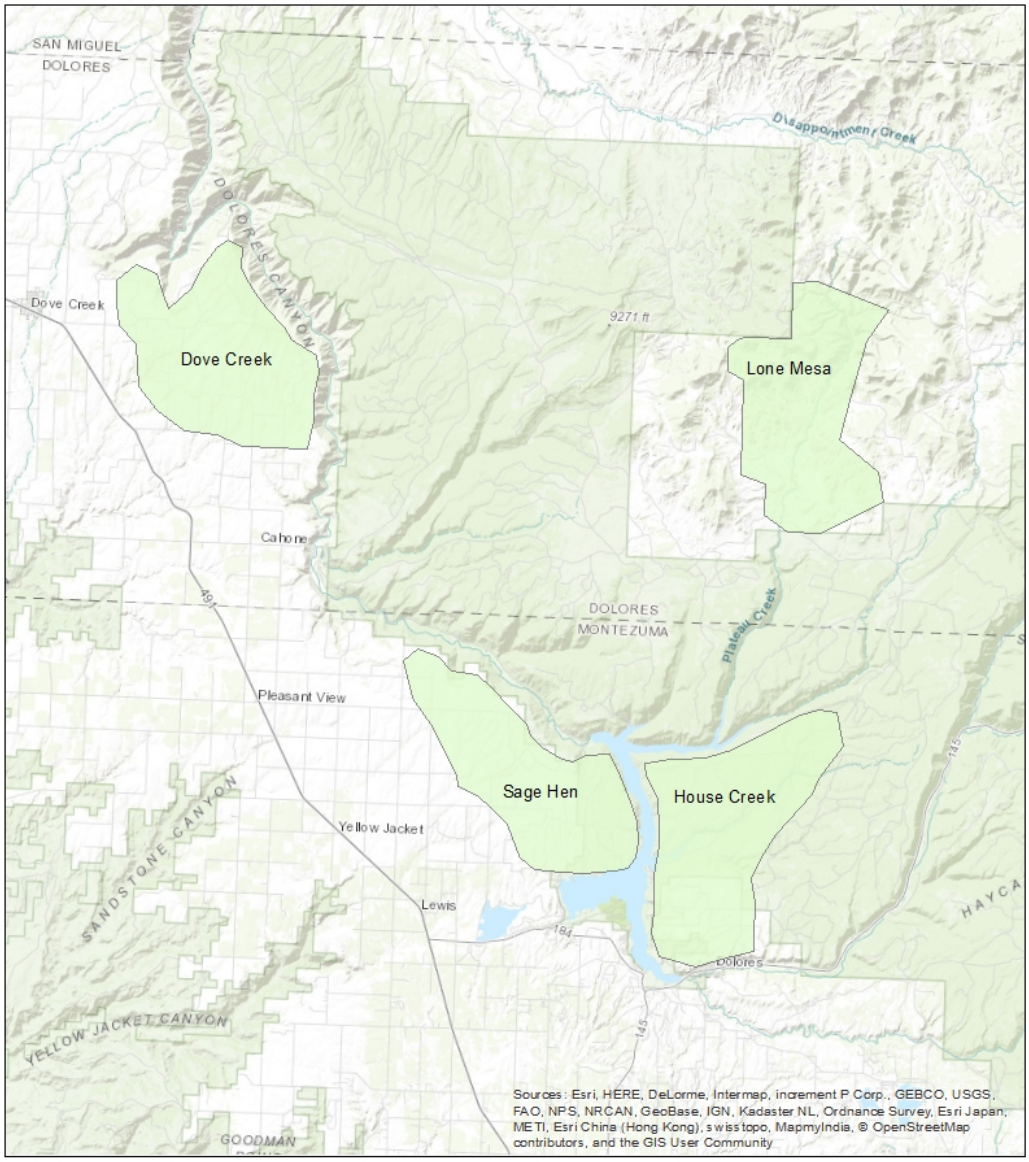


Figure R5.4. Habitat Enhancement and Protection Areas Identified in the Dolores River Area.

Current efforts (what is the activity; who is conducting the work; and partners involved): The Western Slope Wildlife Prioritization Study (CPW, CDOT) was recently completed and assists in identifying sections of high risk highway crossings.

Cost of current or needed habitat treatments; road crossings etc.:

This research proposal is for one-time funding of $166,000 to deploy approximately 40 GPS collars on deer and elk each, that will acquire data for 3+ years (multiple seasons and annual intervals for each deer or elk). Costs to implement this action include $121,000 for capture efforts, satellite transmitter collars, and initial year of airtime for monitoring, followed by $15,000/year for an additional 3 years of monitoring and maintaining the samples of 40 transmitter-equipped deer and 40 transmitter-equipped elk. This information would support a refined management approach to both the deer and elk herds.

Other Issues for awareness:

None

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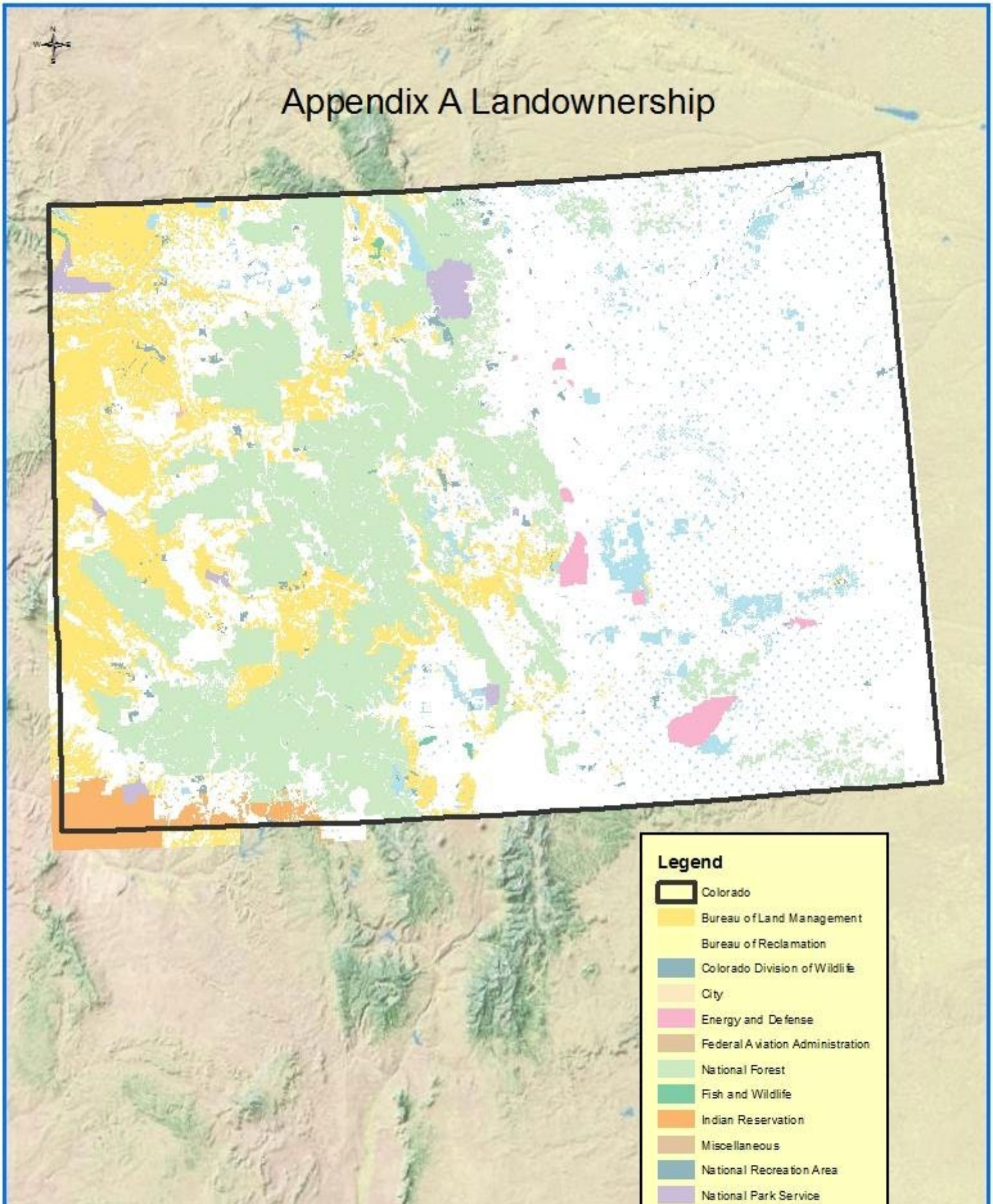
LITERATURE CITED

Horne, J.S., E.O. Garton, S.M.Krone, and J.S. Lewis. 2007. Analyzing animal movements using Brownian bridges. Ecology 88(9):2354-2363.

APPENDICES

Appendix A Landownership



APPENDIX B: Department of the Interior Secretarial Order 3362: Improving Habitat Quality in Western Big-Game Winter Range and Migration Corridors

ORDER NO. 3362
Subject: Improving Habitat Quality in Western Big-Game Winter Range and Migration Corridors

Sec. 1 **Purpose**. This Order directs appropriate bureaus within the Department of the Interior (Department) to work in close partnership with the states of Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming to enhance and improve the quality of big-game winter range and migration corridor habitat on Federal lands under the management jurisdiction of this Department in a way that recognizes state authority to conserve and manage big-game species and respects private property rights. Through scientific endeavors and land management actions, wildlife such as Rocky Mountain Elk (elk), Mule Deer (deer), Pronghorn Antelope (pronghorn), and a host of other species will benefit. Additionally, this Order seeks to expand opportunities for big-game hunting by improving priority habitats to assist states in their efforts to increase and maintain sustainable big game populations across western states.

Sec. 2 **Authorities**. This Order is issued under the authority of section 2 of Reorganization Plan No. 3 of 1950 (64 Stat. 1262), as amended, as well as the Department's land and resource management authorities, including the following:

a. Federal Land Policy and Management Act of 1976, as amended, 43 U.S.C. 1701, *et seq*.;
b. U.S. Geological Survey Organic Act, as amended, 43 U.S.C. 31, *et seq*.;
c. National Wildlife Refuge System Improvement Act of 1997, as amended, 16 U.S.C. 668dd *et seq*.; and
d. National Park Service Organic Act of 1916, as amended, 54 U.S.C. 100101, *et seq*.

Sec. 3 **Background**. The West was officially "settled" long ago, but land use changes continue to occur throughout the western landscape today. Human populations grow at increasing rates with population movements from east and west coast states into the interior West. In many areas, development to accommodate the expanding population has occurred in important winter habitat and migration corridors for elk, deer, and pronghorn. Additionally, changes have occurred across large swaths of land not impacted by residential development. The habitat quality and value of these areas crucial to western big-game populations are often degraded or declining.

The Bureau of Land Management (BLM) is the largest land manager in the United States (U.S.) with more than 245 million acres of public land under its purview, much of which is found in Western States. The U.S. Fish and Wildlife Service (FWS) and National Park Service (NPS) also manage a considerable amount of public land on behalf of the American people in the West. Beyond land management responsibilities, the Department has strong scientific capabilities in the U.S. Geological Survey (USGS) that can be deployed to assist State wildlife agencies and Federal land managers. Collectively, the appropriate bureaus within the Department have an opportunity to serve in a leadership role and take the initiative to work closely with Western States on their priorities and objectives as they relate to big-game winter range and migration corridors on lands managed by the Department.
Consistent with the American conservation ethic, ultimately it is crucial that the Department take action to harmonize State fish and game management and Federal land management of big-game winter range and corridors. On lands within these important areas, if landowners are interested and willing, conservation may occur through voluntary agreements.

Robust and sustainable elk, deer, and pronghorn populations contribute greatly to the economy and well-being of communities across the West. In fact, hunters and tourists travel to Western States from across our Nation and beyond to pursue and enjoy this wildlife. In doing so, they spend billions of dollars at large and small businesses that are crucial to State and local economies. We have a responsibility as a Department with large landholdings to be a collaborative neighbor and steward of the resources held in trust.

Accordingly, the Department will work with our State partners and others to conserve and/or improve priority western big-game winter range and migration corridors in sagebrush ecosystems and in other ecotypes as necessary. This Order focuses on the Western States of: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. These States generally have expansive public lands with established sagebrush landscapes along with robust big-game herds that are highly valued by hunters and tourists throughout the Nation.

The Department has broad responsibilities to manage Federal lands, waters, and resources for public benefit, including managing habitat to support fish, wildlife, and other resources.
Secretary's Order 3356, "Hunting, Fishing, Recreational Shooting, and Wildlife Conservation Opportunities and Coordination with States, Tribes, and Territories," (SO 3356) was issued on September 15, 2017. SO 3356 primarily focused on physical access to lands for recreational activities, particularly hunting and fishing. This Order is focused on providing access to big game animals by providing direction regarding land management actions to improve habitat quality for big-game populations that could help ensure robust big-game populations continue to exist.

Further, SO 3356 includes a number of directives related to working with States and using the best available science to inform development of guidelines, including directing relevant bureaus to:

a. Collaborate with State, tribal, and territorial fish and wildlife agencies to attain or sustain State, tribal, and territorial wildlife population goals during the Department's land management planning and implementation, including prioritizing active habitat management projects and funding that contributes to achieving wildlife population objectives, particularly for wildlife that is hunted or fished, and identifying additional ways to include or delegate to States habitat management work on Federal lands;
b. Work cooperatively with State, tribal, and territorial wildlife agencies to enhance State, tribe, and territorial access to the Department's lands for wildlife management actions;
c. Within 180 days, develop a proposed categorical exclusion for proposed projects that utilize common practices solely intended to enhance or restore habitat for species such as sage grouse and/or mule deer; and
d. Review and use the best available science to inform development of specific guidelines for the Department's lands and waters related to planning and developing energy, transmission, or other relevant projects to avoid or minimize potential negative impacts on wildlife.

This Order follows the intent and purpose of SO 3356 and expands and enhances the specific directives therein.

Sec. 4 **Implementation**. Consistent with governing laws, regulations, and principles of responsible public stewardship, I direct the following actions:

a. With respect to activities at the national level, I hereby direct the BLM, FWS, and NPS to:

(1) Within 30 days, identify an individual to serve as the "Coordinator" for the Department. The Coordinator will work closely with appropriate States, Federal agencies, nongovernmental organizations, and/or associations to identify active programs focused on big- game winter range and/or migration corridors. The programs are to be organized and cataloged by region and other geographic features (such as watersheds and principles of wildlife management) as determined by the Deputy Secretary, including those principles identified in the Department's reorganization plan.

(2) Within 45 days, provide the Coordinator information regarding:
(i) Past and current bureau conservation/restoration efforts on winter range and migration corridors;
(ii) Whether consideration of winter range and corridors is included in appropriate bureau land (or site) management plans;
(iii) Bureau management actions used to accomplish habitat objectives in these areas;

(iv) The location of areas that have been identified as a priority for conservation and habitat treatments; and (v) Funding sources previously used and/or currently available to the bureau for winter range and migration corridor conservation/restoration efforts.

(3) Within 60 days, if sufficient land use plans are already established that are consistent with this Order, work with the Coordinator and each regional Liaison (see section 4b) to discuss implementation of the plans. If land use plans are not already established, work with the Coordinator and each regional Liaison to develop an Action Plan that summarizes information collected in section 4 (a) (1) and (2), establishes a clear direction forward with each State, and includes:

(i) Habitat management goals and associated actions as they are associated with big game winter range and migration corridors;
(ii) Measurable outcomes; and
(iii) Budgets necessary to complete respective action(s).

b. With respect to activities at the State level, I hereby direct the BLM, FWS, and NPS to:

(1) Within 60 days, identify one person in each appropriate unified region (see section 4a) to serve as the Liaison for the Department for that unified region. The Liaison will coordinate at the State level with each State in their region, as well as with the Liaison for any other regions within the State. The Liaison will schedule a meeting with the respective State fish and wildlife agency to assess where and how the Department can work in close partnership with the State on priority winter range and migration corridor conservation.

(2) Within 60 days, if this focus is not already included in respective land management plans, evaluate how land under each bureau's management responsibility can contribute to State or other efforts to improve the quality and condition of priority big-game winter and migration corridor habitat.

(3) Provide a report on October 1, 2018, and at the end of each fiscal year thereafter, that details how respective bureau field offices, refuges, or parks cooperated and collaborated with the appropriate State wildlife agencies to further winter range and migration corridor habitat conservation.

(4) Assess State wildlife agency data regarding wildlife migrations early in the planning process for land use plans and significant project-level actions that bureaus develop; and

(5) Evaluate and appropriately apply site-specific management activities, as identified in State land use plans, site-specific plans, or the Action Plan (described above), that conserve or restore habitat necessary to sustain local and regional big-game populations through measures that may include one or more of the following: (i) restoring degraded winter range and migration corridors by removing encroaching trees from sagebrush ecosystems, rehabilitating areas damaged by fire, or treating exotic/invasive vegetation to improve the quality and value of these areas to big game and other wildlife;

(ii) revising wild horse and burro-appropriate management levels (AML) or removing horses and burros exceeding established AML from winter range or migration corridors if habitat is degraded as a result of their presence;

(iii) working cooperatively with private landowners and State highway departments to achieve permissive fencing measures, including potentially modifying (via smooth wire), removing (if no longer necessary), or seasonally adapting (seasonal lay down) fencing if proven to impede movement of big game through migration corridors;

(iv) avoiding development in the most crucial winter range or migration corridors during sensitive seasons;

(v) minimizing development that would fragment winter range and primary migration corridors;

(vi) limiting disturbance of big game on winter range; and

(vii) utilizing other proven actions necessary to conserve and/or restore the vital big-game winter range and migration corridors across the West.

c. With respect to science, I hereby direct the USGS to:

(1) Proceed in close cooperation with the States, in particular the Western Association of Fish and Wildlife Agencies and its program manager for the Crucial Habitat Assessment Tool, prior to developing maps or mapping tools related to elk, deer, or pronghorn movement or land use; and

(2) Prioritize evaluations of the effectiveness of habitat treatments in sagebrush communities, as requested by States or land management bureaus, and identified needs related to developing a greater understanding of locations used as winter range or migration corridors.

d. I further hereby direct the responsible bureaus and offices within the Department to:

(1) Within 180 days, to update all existing regulations, orders, guidance documents, policies, instructions, manuals, directives, notices,

implementing actions, and any other similar actions to be consistent with the requirements in this Order;

(2) Within 30 days, provide direction at the state or other appropriate level to revise existing Federal-State memorandums of agreement to incorporate consultation with State agencies on the location and conservation needs of winter range and migration routes; and (3) Consult with State wildlife agencies and bureaus to ensure land use plans are consistent and complementary to one another along the entire wildlife corridor in common instances where winter range or migration corridors span jurisdictional boundaries.

e. Heads of relevant bureaus will ensure that appropriate members of the Senior Executive Service under their purview include a performance standard in their respective current or future performance plan that specifically implements the applicable actions identified in this Order.

Sec. 5 **Management**. I hereby direct the Deputy Secretary to take is responsible for taking all reasonably necessary steps to implement this Order.

Sec. 6 **Effect of Order**. This Order is intended to improve the internal management of the Department. This Order and any resulting reports or recommendations are not intended to, and do not create any right or benefit, substantive or procedural, enforceable at law or equity by a party against the United States, its departments, agencies, instrumentalities or entities, its officers or employees, or any other person. To the extent there is any inconsistency between the provision of this Order and any Federal laws or regulations, the laws or regulations will control.

Sec. 7 **Expiration Date**. This Order is effective immediately. It will remain in effect until its provisions are implemented and completed, or until it is amended, superseded, or revoked.
Secretary of the Interior
Date:

Appendix C. Funded Research Priorities from 2018-2019 Action Plan – implementation will occur during 2019-2020

RESEARCH NEEDS

Colorado #1 Research Priority North Park Mule Deer Herd

Why the area selected as a priority:

The number of winter-resident deer in the North Park herd has declined in recent years. Preliminary radio-telemetry information from Wyoming to the north and the Middle Park herd to the south suggest that a large number of the mule deer present in North Park in the summer months migrate to either Wyoming or Middle Park and spend much of the fall hunting season and all winter in these areas outside North Park. Additional radio-telemetry data on mule deer would be of great value in understanding seasonal habitat use and migration patterns of this deer herd. In particular, fine scale (i.e., GPS/satellite) telemetry information would allow greater understanding of the changes that have occurred in mule deer wintering distribution, the proportion of mule deer migrating out of the herd unit to Wyoming and Middle Park, the specific corridors used by mule deer during these migrations, the timing of the migration relative to hunting seasons, and the out-of-area winter ranges used by these deer. This information would support a better-tuned management approach to this deer herd.

Spatial Location:

The North Park mule deer herd is located in the headwaters basin of the North Platte River in north-central Colorado. The northern boundary of the herd unit is the Wyoming-Colorado state line. The Continental Divide lies along the western boundary of the herd unit, with Rocky Mountain National Park to the southeast. The Middle Park Basin lies to the south of the North Park herd unit.

Habitat Types:

The North Park herd occupies a high-mountain park that is surrounded on the east, south and west by mountain ranges. The periphery of the Park is comprised of mountains ranging from alpine habitats at the highest elevations to coniferous timber with interspersed aspen stands. Significant areas of coniferous timber have experienced heavy pine beetle mortality over the past decade. The base of North Park is at approximately 8000 feet in elevation. It is characterized by extensive areas of sagebrush steppe uplands, separated by large willow-dominated riparian areas and extensive irrigated hay meadows.

Important Stopover areas within the corridor:

Unknown-only limited telemetry information is available for this herd unit.

Landownership:

Land ownership in the North Park herd unit is 36% private land, 12% state land and 52% federal land. The Routt National Forest covers 32% of the herd unit and most of the mountainous areas that surround the park. The Bureau of Land Management (BLM) property, 18.2%, is primarily sagebrush habitat in the center of the park where a majority of the private land is also located. The Colorado State Forest, 6.8%, is found on the east side of the park. The Arapaho National Wildlife Refuge, 1.7%, manages important waterfowl and big game habitat in the center of the park. State Trust Lands, 4.9%, are primarily sagebrush habitat with some aspen and mixed conifer.

Land Uses:

North Park is one of the more remote and least developed areas in northwestern Colorado. The principal land use in North Park is agriculture, principally irrigated hay production on private lands and domestic livestock grazing on all land ownerships. The area receives significant recreational activity (fishing, hunting, off-highway vehicle use). Oil and gas development has ramped up over the past five years, and shows the potentially to expand in the future. The rate of residential development is relatively low.

Risk/Threats:

Anthropogenic threats to wildlife are relatively low in North Park. Most current land uses appear to be consistent with long-term wildlife conservation. The area of greatest concern is the increasing pace of oil and gas development on the valley floor. Severe winter conditions are the greatest annual risk to big game in North Park.

Are the Risk/Threats Immediate or Long-term:

North Park is known for its winters-severe winter conditions are an every year possibility in North Park. Oil and gas development is increasing year-by-year, but still remains relatively low compared to other areas within northwestern Colorado.

Actions necessary to reduce or eliminate risks/threats:

Few risks/threats are amenable to intervention (e.g., severe winter conditions) or are of a sufficient degree to require intervention at present. The principal current

need in this population is better knowledge of how deer use North Park and surrounding areas through the year.

Current efforts (what is the activity; who is conducting the work; and partners involved):

Some radio-telemetered deer from Wyoming and Middle Park have been observed using North Park in the summer. No Colorado-specific telemetry data is available for this herd.

Cost of current or needed habitat treatments; road crossings etc.:

Application of satellite transmitters to a minimum of 40 doe deer would provide a better assessment of habitat use and timing/pattern of migration. This information would improve understanding of seasonal habitat use and migration patterns in this deer herd. In particular, fine scale (i.e., GPS/satellite) telemetry information would allow greater understanding of the changes that have occurred in mule deer wintering distribution, the proportion of mule deer migrating out of the herd unit to Wyoming and Middle Park, the specific corridors used by mule deer during these migrations, the timing of the migration relative to hunting seasons, and the out-of-area winter ranges used by these deer. Costs to inplement this action include $60,500 for capture efforts, satellite transmitter collars, and initial year of airtime for monitoring, followed by $10,00/year for an additional 2-3 years of monitoring and maintaining the sample of 40 transmittered deer. This information would support a better-tuned management approach to this deer herd.

Other Issues for awareness:

None

Colorado #2 Research Priority San Juan Basin (Southwest Colorado)

Why the area selected as a priority:

Deer and elk movement patterns in the San Juan Basin have been documented in the last 15 years through a combination of CPW, Southern Ute Tribe, and consultant studies. However, our understanding of the movements of big game in this area remains limited to several significant migration routes. Specific corridors used by deer and elk have not been clearly identified. This area has the added benefit of being multi-jurisdictional- USFS, BLM, and Southern Ute Tribe, as well as private, as

well as interstate movements into New Mexico. This corridor has been identified as a focal area for GOCO wildlife crossing structure with CDOT. In particular, fine scale (i.e., GPS/satellite) telemetry information would allow greater understanding of the changes that have occurred in wintering distribution of mule deer and elk, the proportion of both species migrating out of the herd unit to New Mexico, the specific corridors used by big game during these migrations, the timing of the migration relative to hunting seasons, and the out-of-area winter ranges used. This information would support a better-tuned management approach to both deer and elk herds.

Spatial Location:

The San Juan Basin is located in the southwest part of Colorado. The southern boundary is the New Mexico state line, and the eastern and northern boundaries are the Continental Divide, with the Animas River being the western boundary.

Habitat Types:

The climate is a highland or mountain climate, characterized by cool springs and falls, warm summers and moderately cold winters. Average precipitation and snowfall for Durango are 18 and 63 inches per year respectively. Snowfall increases dramatically moving to the east and toward the Continental Divide, approaching 250-300 inches per year. Vegetative types include: alpine over 12,000 feet elevation, spruce/fir stands down to 10,000 feet, oakbrush, serviceberry, and ponderosa pine above 7,000 feet, and pinyon/juniper/sagebrush and agricultural fields below 7,000 feet.

The amount and quality of winter range is the limiting factor for this deer and elk herd. Winter range is primarily on private land, with the remainder located on the Southern Ute Tribe and public lands. These lands are becoming more limited with human encroachment.

Important Stopover areas within the corridor:

Recent studies by CPW, the Southern Ute Tribe, and WEST,Inc utilizing GPS-collars have identified numerous discrete migration corridors, highway crossings, and stop-over areas for various segments of the San Juan deer and elk herds. Previous studies with VHF-collars demonstrate landscape scale connectivity.

Landownership:

Winter range is primarily privately owned (51%), the Southern Ute Tribe owns 20%, and the remaining 28% of winter range is publicly managed. Twenty-nine percent of the winter range and 15% of the severe winter range occur on public lands.

Land Uses:

The area has seen extensive exurban development in the previous 20 years, replacing a primarily agricultural setting with rural residential. Few large landowners remain. In addition, extensive natural gas extraction has occurred, with associated road and pipeline corridors. In order to accommodate the exurban development, the highway system is stressed with high volume and high speed traffic. Numerous wildlife crossings have been identified with previous radio collar studies, as well as wildlife collisions (Western Slope Wildlife Prioritization Study, CDOT).

Risk/Threats:

Development on Winter Range and Migration Corridors

Exurban development is occurring on much of the winter range and migration corridors in the San Juan Basin. Managers and the public are increasingly concerned over cumulative and prolonged impacts disrupting migration and decreasing quality and quantity of winter range. Development influences both carrying capacity and harvest management. Development is a wide spread issue, but it is a considerably larger problem in the western portions of the San Juan Basin and around Pagosa Springs.

Winter range is already limited and the habitat type that is most at risk by development. Deer and elk eat less and lose weight during the winter and to conserve energy they limit physical activity. Any type of disturbance will cause a deer or elk to use more energy during this critical time and lead to a higher chance of that animal dying. It can also influence reproduction success and survival of fawns or calves born later that same year.

Migration corridors are needed for deer and elk to access important summer and winter ranges. The largest and most productive deer populations in the West are migratory. Development and barriers that disrupt migration can have a direct bearing on an individual animal's health, survival and reproductive success.

As the primary land use continues to transition from agricultural to rural residential, it is imperative to maintain connectivity between summer ranges and winter ranges located on public and tribal lands. This will involve strategic placement of highway crossing structures and land protection through conservation easements. Secondly,

the remaining winter and transition ranges must be maintained in the best condition possible.

Are the Risk/Threats Immediate or Long-term:

Immediate: Critical parcels of land continue to be developed, creating higher traffic volumes into Durango/Bayfield and Pagosa Springs. Opportunities for land protection are being replaced by subdivisions. *Long Term:* As development continues and highways are stressed, the highway corridors will be expanded in order to accommodate the volume of traffic.

Actions necessary to reduce or eliminate risks/threats:

Primarily, the need is to maintain connectivity between deer/elk summer and winter ranges, creating corridors for movement and for safe passage across Highways 160 and 84. To help identify these migration corridors, GPS-quality deer and elk data is needed in the central portion of the DAU's (called the HD Mountains, primarily publicly owned).

Current efforts (what is the activity; who is conducting the work; and partners involved):

CPW, CDOT, SUI Tribe, USFS, BLM are all partners in various efforts. The Western Slope Wildlife Prioritization Study (CPW, CDOT) is nearing completion in strategically mapping deer and elk corridors across the western slope of Colorado in relation to highways, and will result in identifying significant wildlife crossing areas. This has already led to a partnership with the Southern Ute Tribe and Great Outdoors Colorado that will develop a major wildlife crossing structure on the east side of the HD Mountains.

Cost of current or needed habitat treatments; road crossings etc.:

Application of satellite transmitters to a minimum of 40 doe deer and 40 cow elk would provide a better assessment of habitat use and timing/pattern of migration. This information would improve understanding of seasonal habitat use and migration patterns in this deer herd. In particular, fine scale (i.e., GPS/satellite) telemetry information would allow greater understanding of the changes that have occurred in wintering distributions of deer and elk, the proportion of these populations that migrate out of the herd unit to New Mexico, the specific corridors used by deer and elk during these migrations, the timing of the migration relative to hunting seasons, and the out-of-area winter ranges used by both big game species. Costs to inplement this action include $121,000 for capture efforts, satellite transmitter collars, and initial year of airtime for monitoring, followed by $20,00/year for an

additional 2-3 years of monitoring and maintaining the samples of 40 transmittered deer and 40 transmittered. This information would support a better-tuned management approach to both the deer and elk herds.

The large scale habitat treatments and highway crossings structures and fencing necessary to maintain the San Juan Basin deer and elk herds' network of migration corridors would be very costly and could reach several million dollars.

Other Issues for awareness:

None

CURRENT ACTIVITIES - catalog on-going corridor/winter range projects and/or research projects.

Colorado West Slope Mule Deer Strategy 2014 (link to web page: http://cpw.state.co.us/learn/Pages/CO-WestSlopeMuleDeerStrategySummit.aspx) includes seven primary strategic priorities, of which 4 are directly linked to this SO:

1) Landscape-scale habitat management to improve habitat quality,
2) Predator management where predation may be limiting deer survival,
3) Protect habitat and mitigate development impacts to lesson rates of habitat loss,
4) Reduce the impacts of highways on mule deer survival, movements and migration,
5) Reduce the impacts of human recreation on mule deer,
6) Regulate doe harvest and provide youth opportunity,
7) Maintain a strong ungulate population and disease monitoring program and conduct applied research to improve management of deer populations

The Western Slope Wildlife Prioritization Study (CPW, CDOT) is nearing completion in strategically mapping deer and elk corridors across the western slope of Colorado in relation to highways, and will result in identifying significant wildlife crossing areas.

SAM species activity mapping which provides information on wildlife distributions to public and private agencies and individuals, for environmental assessment, land management resource planning and general scientific reference.

CPW has identified threats in their Wildlife Action Plan (SWAP) that pertain to big game migration. Oil and Gas, roads and railroads, habitat fragmentation specifically mentions elk and mule deer. (link to SWAP: http://cpw.state.co.us/aboutus/Pages/StateWildlifeActionPlan.aspx)