# UTAH MULE DEER
# STATEWIDE MANAGEMENT PLAN

UTAH DIVISION OF WILDLIFE RESOURCES

DEPARTMENT OF NATURAL RESOURCES

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## I. PURPOSE OF THE PLAN

### A. General

This document provides overall guidance and direction for managing Utah's mule deer populations. This plan provides general information on natural history, management, population status, habitat, and issues of concern for mule deer in Utah. This plan also outlines the goals, objectives, and strategies for managing mule deer populations and their habitats. The plan will be used to help set priorities for statewide mule deer management programs and provide guidance for individual unit management plans.

### B. Dates Covered

The mule deer management plan will be presented to the Utah Wildlife Board on December 12, 2024 and, if approved, will be in effect for a period of 6 years (Dates covered: December 2024 – December 2030).

## II. SPECIES ASSESSMENT

### A. Natural History

Mule deer (*Odocoileus hemionus*) are part of the deer or cervid family which includes moose (*Alces alces*), elk (*Cervus canadensis*), and caribou (*Rangifer tarandus*) among many other species. A unique feature of the cervid family is that males grow bony antlers that are shed each year. The name "mule deer" comes from their large ears, which resemble those of mules. The specific epithet *hemionus* means half mule. Mule deer occur throughout the western U.S. with as many as 11 subspecies described (deVos, 2003).

Mule deer males, females, and young are known as bucks, does, and fawns, respectively. Fawns are born as singles or more commonly as twins after a gestation period of approximately 7 months. Fawns are normally born in June with the mean fawning date in Utah ranging from June 7–20 (Robinette et al. 1977, Freeman et al. 2014, Hughes et al. 2024). Fawns born too early may have a higher likelihood of encountering late winter storms, which could decrease survival. Conversely, fawns born too late may not have time to grow large enough and build up sufficient fat reserves to withstand Utah's winters.
The antlers of bucks begin to grow as soon as the old antlers are shed in late winter. Bucks will generally live apart from does and fawns through the summer antler growing period (Geist 1998). The velvet, which covers and provides nourishment to the growing antlers, begins to shed in early September. In Utah, the rut or breeding period for mule deer peaks in mid-November. During the rut, bucks seek out and "tend" several does, waiting for them to come into estrus. Pregnancy rates in Utah are high averaging 85% for yearlings and 95% for adults ≥2 years old (Freeman et al. 2014, UDWR, unpublished data).

After the rut, bucks become reclusive again until they shed their antlers in late winter and join herds of does and fawns, blending in with the rest of the antlerless population. In late spring, does seek solitude for fawning. At this time, yearlings from the previous year can be aggressively driven away by the does.

Once new fawns are several months old, adult females form family groups for the remainder of the summer that often include yearlings born the previous year.

B. Management

1. UDWR Regulatory Authority

The Utah Division of Wildlife Resources (hereafter the Division) operates under the authority granted by the Utah Legislature in Title 23 of the Utah Code. The Division was created and established as the wildlife authority for the state under section *23-14-1*. This Code also vests the Division with necessary functions, powers, duties, rights, and responsibilities associated with wildlife management within the state. Division duties are to protect, propagate, manage, conserve, and distribute protected wildlife throughout the state.

2. Past and Current Management

*History of Mule Deer Management*

Mule deer were common in Utah at the time of settlement, although not as abundant as today (Rawley 1985). Mule deer harvest was unrestricted until after the turn of the twentieth century. In 1908 the hunting season on deer was closed to help protect Utah's dwindling deer herd (Rawley 1980). In 1913 deer hunting resumed when the legislature enacted a buck-only law. However, as the deer herd increased game managers realized the need for antlerless harvest in order to keep the deer herds in balance with their habitat. The first limited harvest of does began in 1934 on 4 separate herd units. Multiple permits, multiple seasons, and extra permits for antlerless deer were common in the 1950s and early 1960s. Total deer harvest (bucks and does) peaked in Utah in 1961 when over 132,000 deer were harvested (Figure 1). As the number of hunters and permits increased, deer populations were gradually reduced and brought more in balance with available forage and habitat. Extra permits and antlerless harvest were gradually reduced through the mid-1960s and early-1970s.

By the mid 1970s it was apparent that deer populations were in decline. In 1975, Utah again adopted a statewide buck-only hunting strategy and a symposium was held in 1976 to discuss the decline of mule deer in the west (Workman and Low 1976). Under buck-only hunting deer populations went through a series of boom and bust cycles. The peak harvest of buck deer in the state occurred in 1983 when 82,552 bucks were harvested during the general season hunts. Buck hunter numbers also peaked in 1983 with 228,907 hunters participating in the general season deer hunt, whereas the total number of hunters peaked in 1988 with nearly 250,000 total hunters afield (Figure 1).

*Mule Deer Management Plans*

Management plans provide guidance and direction for deer populations in Utah. The statewide plan is developed jointly by the Division and a statewide plan advisory committee composed of representatives from different stakeholder groups including: hunters, agriculture, local government, conservation organizations, land management agencies, indigenous peoples, etc. The Division also convenes an external advisory committee when revising unit deer plans with major changes including any changes to unit boundaries or unit population objectives. These revised plans are taken through a public process to gather input from a wide body of interested constituents and finally presented to the Utah Wildlife Board for approval. The first statewide deer management plan was approved in 1995 and called for managing public land general season units to a minimum regional average of 15 bucks per 100 does. Individual management plans were then developed for 53 deer management units and approved by the Wildlife Board in 1996. This plan remained in effect until 2003 when it was updated and approved by the Wildlife Board. Unit management plans were revised in 1998 following a reduction in the number of deer management units from 53 to 30, and revised again in 2001 to incorporate new population objectives and habitat information. In 2008, the statewide plan was again revised and approved by the Wildlife Board. In 2011, the statewide plan was amended with the general season buck-to-doe objectives being raised from 15–25 to 18–25 bucks per 100 does as an average in each of the 5 regions.

Due to concerns over chronically low buck-to-doe ratios on specific management units within the regional hunt boundaries, the Wildlife Board amended the statewide plan again in 2012 and approved a general season unit-by-unit hunt structure. Under this management system, the state was divided into 30 general-season hunting units with 14 units managed at 15–17 bucks per 100 does and 16 units managed for 18–20 bucks per 100 does. The lower buck-to-doe ratio objective was designed to provide for increased hunting opportunity whereas the higher objective was intended to provide opportunity for hunters to harvest older and larger bucks. The statewide management plan was revised again in December 2014 and in 2019. After the 2019 revision there was a change in unit plans that resulted in 31 general-season hunting units. There were 10 general deer units managed at 15–17 bucks per 100 does and 21 of general season units managed at 18–20 bucks per 100 does during the 2019-2024 plan cycle.

Unit plans are currently revised on a five-year rotation with each unit plan being revised the year following collection of range trend data (https://wildlife.utah.gov/range-trends.html). By doing so, the latest and most accurate habitat assessment can be incorporated into each unit plan. On some units, local working groups have been used to help with the development and implementation of unit plans. Those groups have been instrumental in garnering local support for mule deer management and providing local knowledge on factors limiting population growth and locations where habitat projects may be beneficial. Local working groups will continue to be used on an as-needed basis to assist in achieving the population and habitat management goals and objectives.

*Recent Mule Deer Harvest Management*

Following several years of drought and an unusually hard winter in 1992–1993, buck deer permits were capped for the first time in 1994. That year, 97,000 general-season buck permits were issued across 5 hunting regions. The 97,000 permit cap remained in place through 2005, but due to difficulties in monitoring over-the-counter permit sales, buck hunter numbers exceeded 97,000 permits in some years. Permit sales were closer to the 97,000 cap after implementation of a drawing system in 2000. Because of severe drought during the early 2000s, the permit cap was temporarily reduced to 95,000 in 2005 with 1,000 permits removed from both the Central and Northeastern regions. Due to continued drought concerns and, in some areas, severe winter weather, permits were held below the 97,000 cap through 2012, at which time unit-by-unit hunting was implemented and the statewide permit cap was removed and permit numbers were set on a unit by unit basis based on buck-to-doe ratios on individual units. The total number of general-season deer permits available in 2024 was 71,525.

Prior to 1994, data on buck-to-doe ratios were collected by wildlife biologists, but not used to determine permit numbers. The 1995 statewide mule deer management plan changed this management practice and set postseason buck-to-doe objectives for general season units at 15 bucks per 100 does for the 5 regions. The regions, and later individual units, have been managed for a set range of bucks per 100 does since that time. In 2023, all general-season units either met or exceeded their buck-to-doe ratio objective (Table 1).

Over the past 10 years, an average of 25,062 bucks has been harvested in Utah each year. The harvest level varies depending on population size and permit numbers with a low of 17,042 in 2023 and a high of 31,987 in 2016. During the past 20 years, buck-to-doe ratios have shown an increasing trend in Utah with average ratios on public lands across the state rising from 13 bucks per 100 does in 1998 to 21 bucks per 100 does in 2023 (Figure 2). With fewer hunters and higher buck-to-doe ratios, hunter success has increased on general-season units. Statewide average hunter success during the general-season any weapon hunt in 2023 was 35.0% compared to 31.1% during the 1998 any weapon hunt.

In addition to general season hunting opportunities, Utah also manages for “premium limited-entry” and “limited-entry” buck deer hunts which provide a high quality hunting experience, high hunter success, and low numbers of permits. There are two premium limited-entry hunting units in Utah: the Henry Mountains and the Paunsaugunt. From 2019 to 2024, these units were managed for a 3-yr average of 40–55 bucks per 100 does (Table 2 ) and >40% of the harvested bucks being 5 years of age or older. The Division, in cooperation with Utah State Parks, also offers one public-drawing premium limited entry deer permit available annually to hunt on Antelope Island State Park. The Division's premium limited entry buck deer management strategy was updated in 2015 and set the public draw permits at 49 for the Henry Mountains and 135 on the Paunsaugunt, as long as the 3-yr average of >40% of the bucks harvested were ≥5 years of age. In 2008, management buck hunts (3 points or less on 1 antler) were added to these units to help reduce their buck-to-doe ratios and provide additional hunting opportunity while not reducing the top-end quality. In 2018 cactus buck hunts were implemented on the Paunsaugunt unit to allow for some additional harvest of bucks with antler abnormalities resulting in 50% or more of the antlers still covered in velvet in late October. These cactus bucks are present in higher concentrations on the Paunsaugunt unit, are often sterile and can provide a unique and additional opportunity for hunters. In 2024, 243 premium limited-entry permits were issued- 1 for Antelope Island, 135 for the Paunsaugunt, 49 in the Henry Mtns. as well as 28 management buck permits and 30 cactus buck permits on the Paunsaugunt unit.

There are 7 limited-entry units in the state that are managed for a postseason buck-to-doe ratio of 25–35 bucks per 100 does. In 2023, all 7 units met or exceeded their management objectives (Table 3). In addition to managing limited-entry units based on buck-to-doe ratios, the Division also provides limited-entry hunts on general-season units based on the timing of the hunting season through muzzleloader hunts in early November. There are also three limited entry deer hunts that use shorter range weapons designated as HAMSS (handgun, archery, muzzleloader, shotgun, straight-walled rifle cartridge) hunts with season dates in November to coincide with rutting behavior. In 2023, the Division issued 1,299 limited-entry permits and 1,052 bucks were harvested.

In addition to hunting bucks, doe hunting has been used to address habitat concerns on rangelands and alleviate depredation on private lands. In 1995, the Utah Legislature passed a law that required the establishment of population objectives on each mule deer unit. In some instances, doe hunts have been used to meet population objectives, although the current approach is to evaluate range trends, annual winter browse utilization, and deer densities to determine if population objectives need to be adjusted before recommending doe permits.

*Changes to Buck-to-Doe Ratio Objectives in This Plan*

In the interest of long-term herd health, disease resilience and sustainability - this plan makes several changes to buck-to-doe ratio objectives. Recent data suggests that managing at higher buck-to-doe ratios may be detrimental to deer populations for several reasons. While some deer hunters prefer higher buck-to-doe ratios because they are typically associated with older/larger bucks, higher success rates and less hunter crowding, higher buck-to-doe ratios also limit hunter participation, increase the risk of increased CWD prevalence and spread of CWD (Jennelle *et al.* 2014, Potapov *et al.* 2016, Conner *et al*, 2021). In addition, a recent observational analysis of robust, long term data sets in Utah which looked at a variety of factors influencing deer population size strongly suggests that managing herds for higher buck-to-doe ratios decreases herd productivity. It appears that deer populations managed in excess of 20 bucks per 100 does only show positive growth during the optimal weather and precipitation patterns (Pal et al. 2024, in review). Conversely, herds with lower buck-to-doe ratios were more likely to experience population growth, even during less-than-ideal conditions making deer populations more resilient and adapted to hard winters, drought and other challenges regularly faced by deer populations in Utah. Managing to lower buck-to-doe ratios allows for increased herd productivity, reduction to disease risks as well as increased hunter participation and opportunity.

In the interest of long term-herd health as well as optimizing hunter participation and engagement, this plan sets buck-to-doe ratio objectives for all units in the state and directs us to manage more general season deer units to a buck-to-doe ratio objective of 15-17 with fewer units managed at 18-20 (see Table 1). In addition, this plan truncates the premium limited entry and limited entry unit buck-to-doe ratio objectives at 40-45 and 25-30 respectively (see Tables 2 and 3).

C. Population Status

The 2023 postseason population estimate for mule deer in Utah was approximately 279,000 deer; 69% of the long-term management objective of 404,900 deer. Since the large decline during winter 1992–1993, the statewide deer population has shown periods of growth and decline (Figure 3). The population had good growth during the mid-late 1990s, but then declined during the severe drought years from 2000 to 2003 when fawn production decreased (Figure 4). The harsh winters in northern Utah in 2007–2008 and in southern Utah in 2009–2010 negatively impacted adult and fawn survival, resulting in population declines. Weather conditions from 2011–2015 were very favorable for mule deer resulting in an increase of nearly 100,000 deer. Impacts from a hard winter in Northern Utah in 2017 followed by several consecutive years of extreme drought led to a declining trend 2017-2021. Favorable winter and summer weather allowed for growth during 2022, but the record-setting severe winter conditions of 2022-2023 led to another decline.

D. Herd Monitoring

Population sex and age composition for mule deer is determined through the use of postseason ground classification counts. On each unit, annual ground classification counts are conducted shortly after the general-season hunts (typically between November 15 and January 15) when mule deer are concentrated on winter range and bucks are in peak rut. Data are collected on representative areas throughout each unit, and biologists attempt to classify a minimum of 400 does on each unit. Classification data are used to determine annual production and survival of neonate fawns to 6-months old (fawn-to-doe ratios), to assess if herds are meeting their buck-to-doe objectives, and as input data for population models.

In addition to classification data, the Division also monitors survival and cause-specific mortality on 8 representative units across the state. Adult female survival has been shown to have the most influence on population growth, whereas fawn survival, although less influential, shows considerable temporal variation (White and Bartmann 1998, Gaillard et al. 2000). Beginning in 2009, survival data were collected using VHF radio collars on a sample of adult does and female fawns. This provided good estimates of overwinter and annual survival, but little information on timing and cause of mortality. In 2014, the Division switched from using VHF collars to satellite-GPS collars, which greatly improved the quantity and quality of data collected. The GPS collars send an email when they switch to mortality mode, enabling biologists to determine the timing and likely cause of mortality for each deer. Over the 10-year survival monitoring period, statewide adult female survival has averaged 79.8% (range 72-87%), whereas fawn survival has averaged 52.1% (range 30-82%, Table 4). During the 10 years of monitoring cause-specific mortality, 46% died due to predation, 13% due to malnutrition, 7% from vehicle collisions, 7% other causes, and 27% to unknown causes (Table 5). By understanding the extent and main sources of mortality, we are able to determine the likely limiting factors for each population and develop management actions to address those factors.

In 2014 the Division also began monitoring nutritional condition of mule deer entering winter using a combination of ultrasonography and palpation (Cook et al. 2010, Table 6). Nutrition and the resultant nutritional condition can have substantial effects on virtually every aspect of physiology and productivity of animals (Cook 2002). Nutritional condition can affect survival including the types of mortality animals may be susceptible to, reproduction (including pregnancy, twinning rates, offspring weight, and birth-timing), as well as growth and development (Gaillard et al. 2000, Cook et al. 2004, Parker et al. 2009, Lamb et al 2023, Hersey 2024). In addition to impacts on demography, deer in good body condition produce fawns that have the potential to grow larger antlers than females in poor body condition (Freeman et al. 2013). By knowing when and where nutrition is limiting mule deer populations, habitat treatment projects and other management actions can be implemented to improve population performance.

E. Habitat

Mule deer are adaptable to a wide variety of habitats throughout their range (Wallmo 1981). In North America, they live from the northern boreal forests to the hot deserts of the southwest and from the coastal rain forests to the Great Plains. In Utah, mule deer are found across the state, although they are less abundant in desert areas (Figure 5).

Although mule deer occur in a wide variety of habitat types, there are many similarities in diet and habitat composition. Deer eat a wide variety of plants including browse, forbs and grasses. Deer are especially reliant on shrubs for forage during winter months. Similarly, fawn production is closely tied to the abundance of succulent, green forage during the spring and summer months. Even though vegetative communities vary throughout the range of mule deer, habitat is nearly always characterized by areas of thick brush or trees interspersed with small openings. The thick brush and trees are used for escape and thermal cover, whereas the small openings provide forage and feeding areas.

Mule deer do best in habitats that are in the early stages of plant succession. This relationship is described in the Western Association of Fish and Wildlife Agencies (WAFWA) publication on mule deer, which states: “Mule deer thrive in early successional habitats, where forbs, grassy plants and shrubs dominate. These environments are not as stable as forest habitats, and they rely on fire or some other type of disturbance to return them to an early successional stage. If they are not disturbed, they become more stable plant communities dominated by large trees and large shrubs. Tree-dominated habitats offer mule deer a place to retreat from severe weather, but these areas offer little in the way of food. That is why it is important to provide a mosaic or pattern of habitats that can provide food, cover and water." (WAFWA 2003)

One of the major problems facing mule deer populations in Utah is many of the crucial deer ranges are in late successional plant community stages dominated by mature stands of pinyon-juniper or other conifer trees, and old even-aged stands of shrubs such as sagebrush. Many crucial deer winter ranges are covered with older shrubs with little or no recruitment of young plants, or are being replaced by annual grasses like cheatgrass (*Bromus tectorum*), which increase fire cycles. Additionally, many forest aspen habitats are being replaced by conifers that provide little forage for mule deer. In order for mule deer populations to thrive in Utah, it is essential that extensive habitat treatments be completed to revert sagebrush habitats back to young, vigorous, shrub-dominated communities, and restore aspen communities to early seral stages. Habitat treatments vary by site but generally include chaining, bullhog, and pinyon-juniper lop and scatter on winter range and prescribed fire and logging on summer range (Larsen et al. 2023). Figure 6 shows the habitat restoration priority areas for mule deer in Utah.

## III. ISSUES AND CONCERNS

### A. Habitat

Deer habitats are classified into three main categories based on season of use: winter, summer and transitional. Deer use high quality forage during the spring and early summer to aid in fat and protein deposition (Cook et al. 2013). The higher the quality of spring and summer forage, the better the antler growth in bucks, the better does are prepared for lactation, and the more fat reserves deer can build up for use during winter (Tollefson et al. 2010, Monteith et al. 2013, Hersey 2024), and the amount of fat deer have entering into winter is an important predictor of over winter survival LaSharr et al. 2023, Hersey 2024). Additionally, high quality forage on winter range helps slow the rate of decline of accumulated fat reserves (Hersey 2024), helping deer survive. The size and condition of mule deer populations are primarily determined by the quantity and quality of these habitats as they provide the necessary nutrition to sustain deer throughout the year. Lack of quality habitat has been associated with decreased survival and recruitment of fawns, increased age at first reproduction, decreased reproductive output, and decreased survival by adults (Monteith et al. 2014, Lamb et al. 2023, Hersey 2024).

Loss and degradation of habitat are thought to be the main reasons for mule deer population declines in western North America over the last few decades (Workman and Low 1976, WAFWA 2003). Crucial mule deer habitat has been and continues to be lost in many parts of Utah and severely fragmented in others due to human population expansion, development, and natural events. For purposes of this plan, crucial mule deer habitat is defined as habitat essential to the life history requirements of mule deer. Continued degradation and loss of crucial habitat will lead to significant declines in carrying capacity and/or numbers of mule deer. Urbanization, road construction, off-highway vehicle (OHV) use, energy development, drought, catastrophic wildfire, and expansion of invasive plant species have all resulted in loss or degradation of mule deer habitat.

The quality and quantity of forage available on important mule deer ranges can be limited by a variety of factors. The encroachment of pinyon and juniper threatens to choke out understory forbs and shrubs and increase risk of catastrophic wildfire. Annual weeds such as cheatgrass alter natural fire cycles by increasing fire frequencies, often resulting in shrublands being converted to less productive annual grasslands. Aspen habitat is declining in part due to conifer encroachment resulting from the suppression of naturally occurring fires. The seeding of aggressive introduced perennial grasses that outcompete native shrubs and forbs can reduce the ability of rangelands to meet the dietary requirements of mule deer. The DWR Range Trend Project (https://wildlife.utah.gov/range-trends.html) has documented many of these threats and how mule deer habitat in Utah has changed over the last 40 years (UDWR 2018-2023). During the 1940s and 1950s, deer herds increased in response to abundant shrub growth on mule deer ranges throughout the state, as a result of heavy grazing on most rangelands (deVos et al. 2003). West-wide the entire sagebrush biome is imperiled. The loss and degradation of this ecosystem continues due to altered fire regimes, invasive plants, conifer expansion, overabundant free-roaming equids, and human land uses (Remington et al. 2020, Doherty et al. 2022).

To address the decline in mule deer habitat throughout Utah, restoration projects are being implemented to target habitat improvement on crucial mule deer ranges that have shifted in dominance to less desirable types or have degraded and provide little productivity. In Utah, treatment projects on both summer and winter ranges have proven beneficial to mule deer. On winter ranges, mule deer selecting for treated areas had reduced rates of fat decline as compared to animals not using treatments (Hersey 2024). Similarly, mule deer showing greater use of treated areas on summer ranges had greater body fat in December compared to animals with less use (Hersey 2024). In Colorado, Bergman et al. (2014) found higher deer fawn survival in pinyon-juniper areas that had been treated as compared to those with no treatment. Habitat restoration projects are designed to move communities to earlier successional states, while restoring community functionality by providing a diversity of grasses, forbs, and shrubs that are available during critical seasons throughout the year. Ideally, restoration projects that benefit mule deer should be large in scale, include mosaic patterns to increase patchiness and edge effects, and be conducted in areas with high potential for success (Larsen et al. 2023). Although fire can be beneficial for mule deer habitat, particularly in high-elevation summer habitat, in some instances large wildfires can be extremely destructive by removing critical browse species that do not readily resprout (e.g., when on winter range). Projects in recently burned areas are designed to restore lost food and shelter and protect water and soil resources. Restoration of shrubs in these communities can be a slow process, but can improve mule deer habitat throughout Utah, which in turn, will provide the necessary habitat requirements to meet statewide and unit population objectives.

B. Water Distribution

Water is a fundamental need for mule deer (Larsen et al. 2023). When browse, forbs, and grasses consumed by mule deer have high water content, mule deer don’t need to drink as they can obtain adequate amounts of water from their food. However, when forage contains only limited amounts of water, access to drinking water becomes important. The spatial distribution of mule deer populations is often positively associated with the availability of water in arid regions of western North America (Hervert and Krausman 1986, Boroski and Mossman 1996). Consequently, recent work by state wildlife agencies depicts large expanses of the Intermountain West ecoregion as water-limiting to mule deer (Wasley et al. 2008). Wildlife water developments, or guzzlers, can help provide water to mule deer in arid areas, but need to be designed and placed in areas conducive to use by mule deer. To maximize benefits to mule deer, guzzlers should be built in areas used by females with young and spaced less than 5 km from other water sources. Fencing should be of sufficient size to allow access (Krausman et al. 2006, Larsen et al. 2011, Shields et al. 2012).

C. Energy Development

Energy is a $20.9 billion industry in Utah, generating $656 million in state and local revenues. Currently, Utah ranks 13th in natural gas production, 9th in crude oil production and #10 in solar generating capacity among US states (https://www.energy.utah.gov/plan/). Energy development can fragment crucial mule deer habitat and have direct and indirect loss of habitat (Northrup et al. 2015). All impacts of energy development on mule deer are not fully known but generally include added physiological stress, disturbance and displacement, habitat fragmentation and isolation, and other secondary effects (e.g. oil/chemical spills and contamination, increased noxious weeds, etc.; Sawyer et al. 2002, Lutz et. al. 2011). Small, isolated disturbances within non-limiting habitats are of minor consequence within most ecosystems. However, larger-scale developments within limited habitat types are a major concern to managers because such impacts cannot be relieved or absorbed by surrounding, unaltered habitats (Watkins et al. 2007). For mule deer populations to thrive in areas of extensive energy development, it is essential to work closely with energy companies to minimize and mitigate for potential impacts.

D. Population Objectives

The current statewide population objective for mule deer in Utah is 404,900 and is based on the sum of the population objectives from individual unit plans. Deer unit plans are approved through a public process, and population objectives are set based on what the habitat can biologically support, while considering possible detrimental impacts to surrounding land uses. When deer unit plans are revised, it is essential that the best possible population and range data be used to assess the current unit conditions. In some instances, these data may indicate the population objective is too low and should be raised to allow for more deer. In other situations, the data may show that the objective is too high and cannot be attained under current habitat and climatic conditions. In these cases, population objectives should be lowered to reflect a realistic view of what can be obtained in the foreseeable future. Population objectives can be revisited as needed to address improving conditions for mule deer.

E. Predator Management

Predators are often identified as one of the main causes for mule deer herd declines in Utah. However, predator-prey relationships are complex and not always easily understood. There are often many factors which can negatively affect mule deer populations including predation. The complex relationship between predators and habitat is described by Geist (1999). "Inevitably predators are blamed for declining mule deer populations, in particular when the survival of fawns is low. There is no doubt that today's predators are effective in killing deer. However, predation is not independent of poor habitat quality. Such translates itself less as a reduced birth rate, but as fawns born too small, too poorly developed and too weak to be viable. Here predators take fawns that have a low chance of survival anyway. Improved habitat quality, which leads to better growth and larger body size in deer, is also expected to lead to large, vigorous fawns that are more difficult for predators to catch."

Ballard et al. (2001) reviewed 40 published papers on the response of deer to predator control and found removing predators is most effective when 1) the deer population is below carrying capacity, 2) predation is identified as a limiting factor, 3) control efforts reduce predator populations enough to yield results, 4) removal of predators occurred just prior to the reproductive periods of predators or deer, and 5) control efforts occurred at a focused scale. Mountain lions, coyotes, and in some areas black bears are the primary predators of mule deer in Utah (Smith 1983). On Monroe Mountain In southern Utah, the primary cause of death among fawn mule deer was predation by both coyotes and mountain lions (Hall

2018). In this study, predator control of coyotes had the potential to enhance fawn survival their first six months of life as long as the removal effort occurred over consecutive years, were spatially explicit targeting fawning habitat, and occurred when the likelihood of additive mortality was high and prey populations have the resources available to grow. (McMillan et al. 2023).

Since 2014, UDWR and its partners have monitored the survival of more than 5500 individual mule deer using GPS collars. From these collared animals, the cause-specific mortality was assessed on nearly 1800 adult and fawn mule deer (Table 5). By monitoring body condition, survival, and cause-specific mortality on many herds throughout the state, managers have the ability to identify populations that appear to be limited by predation (e.g. mountain lions are removing >7% of the adult population each year) and not habitat (i.e., animals are in relatively good body condition with significant fat stores). In these areas, it is likely for predation to be an additive source of mortality, and, as such, predator control is more likely to lead to an increase in the size of the mule deer population. In contrast, we can also identify populations that are in relatively poor body condition suggesting that habitat is limiting in quantity, quality, or both. Predator control in such areas would likely have little or no effect on the mule deer population as predation is likely a source of compensatory mortality; habitat improvement would be the only way to enhance populations in those areas.

Predator management in Utah is guided by a predator management policy (UDWR 2024). This policy specifies that predator management can occur on units below population objectives providing a predator management plan is written and approved. The Utah Wildlife Board has set triggers to evaluate if a predator management plan should be written. Intensive predator management is costly, and therefore is probably not warranted on units that are near objective or where habitat is limiting population growth. Mountain lion populations should be managed at levels that allow mule deer population objectives to be met. On some units, this may require additional reduction of mountain lion populations which are negatively impacting mule deer populations. In regards to coyotes, the Utah Legislature passed the Mule Deer Protection Act in 2012 which allocates additional funds for coyote control efforts in Utah. These funds allow for a statewide bounty and targeted removal of coyotes by USDA Wildlife Services and private contractors. While not common, if black bear predation is identified to be a limiting factor to mule deer biologists should consider increasing bear harvest on those units through conversion to a more liberal harvest strategy.

F. Disease

Identifying, understanding, and monitoring disease is important for mule deer management. Chronic Wasting Disease (CWD) is a contagious, chronic, degenerative disease that affects members of the cervid family including mule deer, white-tailed deer, elk, and moose. CWD affects the central nervous system of an infected animal, which results in weight loss, progressive neurologic deterioration, and death. At present, there is no known vaccine, treatment, or way to eradicate the disease. CWD was first detected in Utah in 2002 and is currently the biggest disease concern for mule deer populations in the state. Appendix A contains the CWD plan, which provides more information on CWD and adaptive management actions aimed at preventing the spread of CWD within Utah.

Epizootic Hemorrhagic Disease (EHD), and less commonly Bluetongue, are viral diseases that may affect mule deer in Utah. Outbreaks of EHD generally occur during late summer and early autumn where the insect vector *Culicoides* is most active. EHD outbreaks have been documented in several areas throughout Utah in recent years, and although losses to these diseases can be substantial within focal areas, they are isolated events and populations generally recover quickly.

Other diseases that occasionally have been diagnosed in mule deer across Utah have included pneumonia, diarrhea, neoplasms, brain abscesses, encephalitis, exotic lice (*Bovicola tibialis*) infestation, *Elaeophora* infection, malignant catarrhal fever, and mineral deficiencies. However, in most cases only single individuals have been affected.

G. Access Management

The use of Off-Highway Vehicles (OHVs) in Utah has dramatically increased in recent years. OHV registrations increased more than quadrupled from 1998 to 2022 (from approximately 52,000 to 220,000). Uncontrolled use of motorized vehicles and OHVs can cause damage to mule deer habitat and disturbance to mule deer during critical phases of their life cycle. State and federal land management agencies are currently struggling with issues involving the use of OHVs on public land. Those agencies acknowledge OHVs as a legitimate use of public land, but also recognize the potential problems associated with uncontrolled activity. As such, these agencies have developed or are currently working on travel management plans on federal lands.

Shed antler gathering and the associated human disturbance on crucial winter ranges, especially with the use of vehicles, can cause undue stress on mule deer during a time when they must conserve energy. The Utah Wildlife Board and UDWR in conjunction with an external committee formed in 2024 continue to evaluate shed antler gathering activities and potential reform and regulation to minimize negative impacts to wildlife.

There is also a demand for walk-in and horseback only access areas in Utah. Many hunters want the opportunity to hunt in a remote area that has lower hunter densities, where they don't have to compete with vehicle traffic. Biologically, limiting areas to foot and horse travel can limit hunter pressure, reduce harvest, and increase buck to doe ratios.

H. Depredation Issues

Depredation of private croplands is an ongoing challenge and, in some areas, can be a significant problem for deer to reach their management objectives. The Division has committed substantial resources to address depredation concerns, and there are numerous programs designed to assist landowners with depredation situations. Depredation problems need to be addressed within the sideboards of state code, rule, and policy, and in a timely and efficient manner so that landowners will better tolerate migratory mule deer populations on their lands.

I. Private Land / Cooperative Wildlife Management Unit Issues

The value of private lands to the overall deer population in Utah is substantial. Many crucial mule deer habitats throughout the state are on privately owned lands. Unfortunately, some of those private rangelands have been converted from mule deer habitat to housing developments, recreational properties, or other uses. As such, programs that provide incentives to private landowners to manage their properties for mule deer and other wildlife are critical to the success of the state's deer management program. Programs like cooperative wildlife management units (CWMUs), landowner associations (LOAs), general-season landowner permits, and walk-in access currently provide incentives for landowners to manage for healthy habitat and deer populations on their properties. Additionally, the Utah Watershed Restoration Initiative (WRI) has worked with numerous cooperating landowners to provide funding and other resources to accomplish vegetation treatments on private and public lands to benefit mule deer and other wildlife, as well as livestock.

J. Winter Feeding

Supplemental feeding is often viewed by the public as a solution to a lack of forage on crucial deer winter ranges, especially during severe winters. Although feeding can benefit populations (Bishop et al. 2009), there is evidence that the potential harm created by feeding mule deer may outweigh the benefits (WAFWA 2003). When conducted properly, feeding programs have been shown to reduce overwinter body fat declines and improve adult and fawn survival rates (UDWR, Rich County 2023, unpublished data). However, winter feeding programs are costly and require a tremendous amount of work and personnel to be successful. Additionally, supplemental feeding can potentially cause problems for mule deer including disruption of natural movement patterns, range/habitat destruction, and increased disease transmission. Additionally, feeding deer in winter may have limited value because of the complex and highly specialized digestive system of mule deer (WAFWA 2013). If deer do not adapt quickly enough to dietary changes, deer may die of starvation despite having a full stomach.

In some extremely severe winters, it may be necessary to feed deer to sustain a base population (WAFWA 2003). If necessary, winter feeding of mule deer in Utah will be guided by the winter feeding policy (UDWR 20*22*). To be successful, feeding programs need to be initiated at the correct time, feed the correct feed and at the proper amounts, spread the feed out to reduce competition, and be done through partnerships to ensure there is enough help to be successful. The Division will not participate in any emergency big game feeding program that occurs within the known range or use area of any big game population where CWD, brucellosis, or tuberculosis has been detected as feeding concentrates animals and can increase disease transmission and prevalence.

K. Competition

Competition can occur in two ways: interspecific (between species) or intraspecific (between animals of the same species). Interspecific competition occurs when two species use the same limited resource, and both of the species suffers in some way because of that use (WAFWA 2003). When resources are limited, competition may potentially occur between deer and other ungulates such as horses, livestock or elk. This competition could be direct for specific resources such as food or water, or a more general displacement of a species from preferred habitats due to behavioral characteristics.

From a direct resource competition standpoint, it is often assumed that deer and elk do not compete for forage since elk diets consist primarily of graminoids (grasses) and mule deer largely consume woody vegetation or browse. Although this may be true much of the year, there are circumstances when diet overlap can become a concern. For example, during a hard winter when forage is limited, elk can successfully shift to a diet largely comprised of browse causing a high degree of diet overlap with mule deer (Frisina et al. 2008). This overlap can create direct competition for forage between elk and mule deer when mule deer are most vulnerable.

Mule deer can also experience behavioral and spatial competition with elk. Behavioral competition is most likely to occur on summer ranges during drought years or on generally arid units. The mere presence of elk may displace mule deer into lower quality habitats. GPS collar data from Oregon has shown that mule deer avoid elk when selecting habitat, but elk habitat selection is independent of mule deer distribution (Stewart et al. 2002). Interestingly, a recent study from the Book Cliffs found the opposite result with elk presence having a positive effect on mule deer habitat selection (Sallee et al. 2022).

Feral horse populations in Utah continue to grow. Horses are less efficient at extracting nutrients from forage than ruminants like mule deer and elk. As such, horses must consume larger quantities of forage to survive. In arid environments, horses may also defend water sources from other species (Gooch et al. 2017, Hall et al. 2016). More specifically, feral horses have a negative effect on water use by mule deer (Hall et al. 2018) suggesting that an increase in horse numbers will negatively affect populations of mule deer. It is crucial that the Division work closely with federal land management agencies to actively manage horses on federal lands to minimize negative impacts to wildlife habitat.

In addition to interspecific competition, intraspecific competition can occur if individuals of the same species are competing with each other. For mule deer, since males and females have different niche requirements and are generally segregated in space outside the mating period, competition between sexes has typically been assumed to be minimal (Main and Coblentz 1996; Bleich et al. 1997; Kie and Bowyer 1999; Bowyer and Kie 2004). However, recent research from Utah suggests that increasing the proportion of males in a population negatively affects female body fat reserves entering winter, regardless of population density (Pal et al. 2024, in review). Previous research found an increase in the buck: doe ratio in the population coincided with a decline in fawn:doe ratio (Bishop et al. 2005; Bergman et al. 2011), but did not explore the underlying mechanism for it. Although the data indicate declining adult female fat reserves as buck:doe ratio increases, we do not yet know when the intrasexual competition is occurring. Hypotheses include habitat overlap during rutting activities which is also when does are trying to replenish depleted fat reserves, habitat overlap on winter ranges, and increased agonistic behavior during the breeding season as females attempt to displace unwanted males.

Crucial ranges where elk, livestock, and/or horses coexist with mule deer should be closely monitored to prevent overuse and competition. Although competition may exist in some areas where resources are limited, the Division continues to work closely with our partners to restore and improve habitats to benefit both wildlife and livestock.

L. Movements and Migration Corridors

One of the primary ways that mule deer respond and adapt to changes in the environment is through movement. The ability to freely move allows deer to take advantage of seasonal resources, colonize new habitats and find mates. It also helps them avoid competitors, predators and parasites.

Some of the longest movements that mule deer make are seasonal migrations between summer and winter ranges. Most mule deer in Utah are migratory, with some individuals moving up to 70 miles (van de Kerk et al 2021). In Wyoming, mule deer migrations up to 150 miles have been documented (Sawyer et al. 2016). Mule deer exhibit high fidelity to their seasonal ranges and often use the same migration corridors year after year to move between seasonal ranges (Brown 1992). Through extensive data collection, many mule deer migration corridors in Utah have been mapped and the information is used to make recommendations and management decisions.

In 2017, the Division founded the Utah Wildlife Migration Initiative to document, preserve, and enhance wildlife movement throughout Utah. This initiative uses state-of-the-art GPS tracking technology to monitor the movements of species in near real-time. Information generated by tracking collars is used to define critical habitats for species, including migration corridors. Currently, the Migration Initiative is putting a large focus on documenting mule deer movements. In the winter of 2023-2024, 929 mule deer were captured and fitted with GPS tracking collars in 19 wildlife management units throughout the state (Figure 7).

GPS tracking information allows the Division to precisely define migration corridors for mule deer (Figure 8). The Division uses the information in many ways to preserve wildlife movement. This includes collaborating with partners to provide safe wildlife passage across roads and mitigating deer-vehicle collisions. The data are used to engage with landowners and municipalities to preserve open space or promote sustainable land use practices. Also, information is used to target habitat treatment sites and evaluate treatment effectiveness. Furthermore, the data are used to balance infrastructure needs with wildlife conservation.

N. Poaching

While the effect of poaching on wildlife populations can be difficult to assess, the illegal take of wildlife is unacceptable. Law enforcement will continue to make mule deer protection a high priority by concentrating efforts on prioritized winter ranges. Success will only be achieved with vigilance and assistance from our conservation partners and the general public.

O. Outdoor Recreation

Utah is known for its diverse outdoor recreation opportunities like hiking, skiing, rock climbing, hunting, ATV users. Annually 2.5 million Utahns find themselves participating in some kind of outdoor recreation (https://recreation.utah.gov/utah-outdoor-recreation-strategic-plan/). Outdoor recreation has the potential to negatively affect wildlife populations (Czech et al. 2000). Conflicts can arise when outdoor recreation occurs in mule deer habitats during crucial timeframes, especially if habitat quality is limited or fragmented. While conflict can occur between outdoor recreation and wildlife if land managers consider those effects and mitigation strategies are used such as timing restrictions, recreation site placement along with other site specific measures effects can be greatly reduced or avoided.

IV. USE AND DEMAND

Mule deer are the most important game animal in Utah. Hunter demand and interest has always been high and the family tradition of mule deer hunting is strongly rooted in Utah. From 1960 to 1993, more than than 150,000 hunters participated in the annual mule deer hunt. Over 200,000 hunters participated in the deer hunt each year from 1977 to 1992, except in 1984.

Although the number of general buck deer permits available has been slowly trending lower for over 2 decades, the number of applicants for permits continues to increase annually resulting in increased demand for shrinking supply of both limited-entry and general-season permits (Table 7). In 2024, the resident odds of drawing a limited-entry buck permit were 1 in 25.4, compared to 1 in 7.5 in 1998. In 2018 odds were as long as 1 in 28.7, but those odds have slightly improved in the last several years due to the increased limited entry permits originating from the limited late-season muzzleloader permits offered on general season units (in 2024 there were 356 limited entry late-season muzzleloader on general unit permits). The odds of drawing a general-season permit also increased from 1 in 1.1 in 2000 to 1 in 2.3 in 2024. Although limited-entry permits are popular, many Utah hunters are also interested in being able to hunt every year. With fewer permits available, the number of deer hunters afield continues to decline. The North American model of wildlife management is based on the premise that hunters are largely responsible for funding the management of game animals. If we continue to lose hunters and fail to recruit youth hunters, the current system under which we manage wildlife may be in jeopardy. In addition, for hunting to remain socially relevant and acceptable it is important that hunters are diverse in age and socio-econoic status across Utah. When the general population no longer knows a family member, friend or neighbor that hunts, hunting becomes more niche and less socially relevant and acceptable. It is critical to the future of hunting and wildlife management in Utah to provide large, diverse groups of people with the opportunity to hunt on a regular basis.

Mule deer are also a high interest watchable wildlife species that hunters and non-hunters alike enjoy seeing deer in the wild. Many thousands of hours and considerable dollars are expended each year in deer watching activities. Units that produce large bucks are especially attractive not only to hunters but wildlife watchers and photographers as well.

## V. CONCLUSION

Mule deer are the most abundant big game animal in Utah and are of high interest to hunters and nonconsumptive users. The mule deer population in Utah is lower than what it was in the 1960s and early 1980s, and we have seen encouraging periods of growth over the past 2 decades with overall numbers approaching what was present 40 years ago. Mule deer face a myriad of factors that can have a cumulative impact on their ability to flourish. Unfavorable weather conditions combined with the loss and degradation of habitat have likely had the most significant impact on mule deer numbers. Other factors such as predation and disease are also significant. If deer herds are to reach their population objectives in Utah, extensive habitat work will need to be done to rehabilitate crucial mule deer ranges and compensate for a climatic trend toward hotter and drier conditions. This habitat work must also be combined with predator management on units and in situations where data indicates top-down population limitations from predation. It is vital that the Division, state agencies, tribes, federal agencies, conservation organizations, private landowners, and others work together to protect and improve mule deer habitat if we hope to maintain and expand mule deer populations to meet management goals.

VI. STATEWIDE MANAGEMENT GOALS AND OBJECTIVES

**Population Management Goal:** Expand and improve mule deer populations throughout the state within the carrying capacity of available habitats and in consideration of other land uses. This goal will be accomplished through habitat improvement, restoration, and protection in conjunction with private lands habitat incentives, disease management, directed predator management and strategic antlerless hunting when necessary.

**Direct Population Management Objective:** By 2030, manage mule deer populations within the state as conditions allow and bring all populations to their unit objective (404,900 as of 2024)

*Implications: This objective can be accomplished if favorable environmental conditions exist and through the implementation of the strategies in this plan*

Strategies:

A. Population Objectives
    a. Review individual unit management plans and revise where necessary to provide consistency with this plan. Unit plans will be revised and approved internally by the Division Director unless:
        i. New unit plan
        ii. Change in the population objective
        iii. Major boundary change.
    b. Use current research (body condition scores (BCS), survival rates, cause-specific mortality, range trend data, etc.), historic population estimates, and production data to set realistic and attainable population objectives
    c. Consider managing mule deer populations below biological carrying capacity to increase herd productivity
    d. Use the most reliable population models and data to evaluate herd size and population trends over time
    e. Continue to support law enforcement efforts to educate the public concerning poaching and reduce illegal take of deer
    f. Implement emergency feeding when needed in accordance with the DWR feeding policy and educate the public on the implications of winter deer feeding

B. Direct Population Management
    a. Use current research including cause-specific mortality information and body condition data to identify limiting factors and make short and long term plans to address those limiting factors in deer unit plans and through predator management plans to manage for optimized, sustainable deer populations
    b. Manage to buck-to-doe ratios that optimize herd productivity and reduce disease risks, especially on general season units and CWD positive units
    c. Use antlerless harvest as the primary tool to directly manage deer populations
    d. Use antlerless harvest in combination with the Urban Deer Rule to reduce conflict and damage in urban areas

C. Population Monitoring and Research
   a. Continue to monitor all mule deer populations annually to evaluate fawn production and herd composition
   b. Continue to collect annual adult doe and fawn survival rates, body condition scores, and cause specific mortality to identify limiting factors on representative units distributed across the state
   c. Support the Utah Migration Initiative in identifying and protecting migratory corridors
   d. Evaluate the effectiveness of the crossing structures and other mitigation options over time and implement new technologies to minimize highway mortality
   e. Continue to implement research studies on specific herd units that are chronically below population objective to identify limiting factors, test management strategies and assess biological response as well as public reception and use research results to recommend solutions
   f. Increase monitoring and assessment of deer populations on units with active predator management plans

D. Populations on Private Lands
   a. Support incentive programs for landowners that will increase tolerance and promote deer populations on private lands such as the CWMU, landowner permits, and Walk-In Access programs
   b. Address all depredation problems in a timely and efficient manner to increase landowner tolerance of mule deer
   c. Educate, advocate and work with municipalities/counties to enact sound management plans on zoning decisions in order to minimize and mitigate the loss of crucial mule deer habitat and to maintain the integrity of migration corridors
   d. Educate the public on the value of private landowner incentive programs

E. Predator Management
   a. Actively manage predators according to the predator management policy, where habitat is not limiting and predators are demonstrated to have a negative impact on the population

F. Disease Management
   a. Investigate and manage diseases that threaten mule deer populations
   b. Monitor and manage CWD in accordance with CWD plan (Appendix A)
   c. In areas with high prevalence of Chronic Wasting Disease (CWD) offer additional deer hunting opportunities to reduce prevalence and spread of CWD through reduction of overall deer densities and especially the removal of older age class bucks, typically during late season buck hunts
      i. In public land dominated CWD concentration areas (boundary contains considerable public acreage holding deer and/or is 70%+ public lands), permit numbers and season dates will be presented to the Wildlife Board and permits will be allocated to public hunters through a permit drawing, an alternative list process or a hunter pool process

ii. In private lands dominated CWD concentration areas (boundary contains 70%+ private lands and/or has little publicly accessible acreage holding deer) DWR staff will present proposed permit numbers and season date windows to the Wildlife Board in the spring and, if approved, distribute buck and/or doe permit vouchers directly to cooperative/participating landowners
iii. In areas with mixed land ownership and substantial deer distribution on both public and private lands, DWR will use a hybrid system with a proportional number of permits being proposed to the wildlife board and then offered to landowners and proportional number of permits allocated to public hunters through a permit drawing, an alternative list process or a hunter pool process

**Habitat Objective 1:** Maintain mule deer habitat throughout the state by protecting and enhancing existing crucial habitats and mitigating for losses due to natural and human impacts

*Implications: Loss of crucial mule deer habitat will need to be minimized to achieve population objectives. Mitigation is essential for loss or degradation of all crucial habitats due to natural and human impacts*

Strategies:

A. Habitat Classification and Assessment
    a. Continue to identify, map, and characterize crucial[1] mule deer habitats including migration routes throughout the state
    b. Identify and rank threats and limiting factors within each unit plan
    c. Continue to support the interagency Big Game Range Trend Studies crew in monitoring the long-term trends of crucial mule deer ranges throughout the state

B. Habitat Management and Conservation
    a. Work with local, state and federal land management agencies via land management plans and with private landowners to identify and actively manage and protect crucial mule deer habitats including summer (especially fawning), winter, and migration areas as defined in Sawyer et al. 2009
    b. Avoid, minimize and mitigate impacts to crucial habitats due to human impacts (travel management, energy development, outdoor recreation, and human encroachment, disturbance and development)
        a. Where crucial mule habitat will be lost, if avoidance is not practical, mitigation should be encouraged. A voluntary mitigation ratio of 4:1, improving or conserving 4 acres for every 1 acre disturbed, is recommended.
        Minimize project-related activities and associated disturbances within crucial mule deer habitats occur outside of Dec. 1 to April 15 for crucial winter ranges and May 15 to July 15 for parturition.
    c. Acquire additional crucial mule deer habitats through fee title and conservation easements
    d. Educate, advocate and work with municipalities/counties to enact sound management plans on zoning decisions in order to avoid, minimize and mitigate the loss of crucial mule deer habitat and to maintain the integrity of migration corridors
    e. Conduct any mule deer feeding in accordance with Division policy to limit habitat damage.
    f. Manage elk populations to minimize competition with mule deer on crucial ranges
    g. Work with local, state and federal land management agencies and ranchers to properly manage livestock to enhance crucial mule deer ranges

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[1] Crucial value - habitat on which the local population of a wildlife species depends for survival because there are no alternative ranges or habitats available. Crucial value habitat is essential to the life history requirements of a wildlife species. Degradation or unavailability of crucial habitat will lead to significant declines in carrying capacity and/or numbers of wildlife species in question.

h. Encourage and support federal land management agencies, state agencies, and tribal entities efforts to minimize competition with wildlife from horses and burros and to manage these animals at appropriate management levels (AML)

C. Wildlife Management Areas (WMA)
  a. The Division manages many Wildlife Management Areas across the state for deer and other species to conserve critical wildlife habitats, to minimize and mitigate depredation on private property, and to provide hunting opportunities.
    i. Support WMA Habitat Management Plans
    ii. Provide seasonal closures to minimize impacts on deer during crucial seasons (closure dates will be specific to the WMA, seasonal issues and other factors)

D. Travel Management
  a. Assist local, state and federal agencies with the development of travel management plans
  b. Support the responsible use of OHVs in specified areas during hunting seasons
  c. Consider the use of seasonal closures as appropriate to mitigate impacts from new permanent roads in crucial mule deer habitats and migration corridors
  d. Work with UDOT and other road departments to minimize and mitigate wildlife-vehicle collisions through right-of-way exclusionary fencing and wildlife crossings

E. Land Management Plans
  a. Coordinate with local, state, and/or federal agencies on land management type plans such as Forest Plans, Resources Management Plans, County Resource Plans, etc.
    i. Reinforce state wildlife management mandate
    ii. Where appropriate, promote hunting, recreational shooting, habitat treatments and the collection of wildlife parts

F. Energy Development
  a. Coordinate with local, state, and/or federal agencies and energy development proponents to develop an effective mitigation approach for large-scale energy or other related land use activities or developments that have the potential to impact migration routes and crucial mule deer habitat
  b. Encourage energy development companies to avoid or minimize the impact of disturbance while using Best Management Practices to promote the conservation of wildlife resources
  c. Promote movement corridors in areas of large-scale disturbance or areas that will be fenced

G. Outdoor Recreation
  a. Coordinate with local, state, and federal agencies and other interested parties on recreational projects or plans to avoid, minimize or mitigate impacts in migration corridors and crucial mule deer habitats.

H. Human Encroachment, Disturbance and Development
    a. Approach local, state, and/or federal agencies and developers to consider effective mitigation approaches for new developments (residential, commercial, etc.) that have the potential to impact migration routes and crucial mule deer habitat.

I. Wildlife-Friendly Fencing
    a. Consider installing or modifying wildlife-friendly fencing for effective and safe mule deer movements

J. Drought
    a. Manage vegetation communities to be resistant
    b. Follow best management practices for guzzler maintenance

K. Private Lands
    a. Support existing incentive programs for landowners that increase tolerance, enhance habitat and promote deer populations on private lands such as the CWMU program, landowner permit programs, Walk-In Access, depredation mitigation program, and NRCS Farm Bill programs for wildlife habitat, etc.

**Habitat Objective 2:** Improve the quality and quantity of vegetation for mule deer on a minimum of 600,000 acres of crucial range by 2030

*Implications: Habitat will need to be improved on at least 600,000 acres of crucial mule deer range to meet the population objectives in this plan. If habitat improvement projects cannot be completed because of inadequate funding, environmental restrictions, or unfavorable climatic conditions, population objectives may not be achieved. Additionally, because habitat treatments often require a number of years before they provide optimal benefits to mule deer, and if large catastrophic wildfires and energy developments continue to negatively impact crucial mule deer ranges, the population and habitat goals of this plan may not be achieved within the 6-year life of this plan*

Strategies:

A. Utah's Watershed Restoration Initiative (WRI)
    a. Utilize WRI as a tool to improve deer habitat with all partners across the state
    b. Continue to support and provide leadership for WRI, which emphasizes improving sagebrush-steppe, aspen, and riparian habitats throughout Utah
    c. Work with land management agencies, conservation organizations, private landowners, and local leaders through the regional WRI teams working groups to identify and prioritize mule deer habitats that are in need of enhancement or restoration (Figure 6). Emphasis should be placed on crucial habitats which include summer range habitats such as improving aspen, winter ranges sagebrush habitats, and improving riparian areas.
    d. Work with partners such as NRCS and university extension to increase landowner participation in the Watershed Restoration Initiative program

e. Initiate broad scale vegetative treatment projects to improve and restore mule deer habitat with emphasis on drought or fire damaged sagebrush winter ranges, ranges that have been taken over by invasive annual grass species, and ranges being diminished by encroachment of conifers into sagebrush or aspen habitats, ensuring that seed mixes contain sufficient forbs and browse species
f. Encourage land managers to manage portions of pinyon-juniper woodlands and aspen-conifer forests in early successional stages using various methods including timber harvest and managed fire
g. Support post-fire rehabilitation on crucial mid/low elevation deer ranges which are susceptible to weed invasion and loss of critical browse
h. Continue to support conservation permit, wildlife habitat account, federal aid and other funding sources which provide critical funding for habitat improvement efforts
i. Explore opportunities to engage with non-traditional users to fund habitat improvements
j. Continue to seek new funding sources for habitat improvement projects
k. Financially support early planning (NEPA) and/or clearances needed to implement habitat treatments

B. Public Support
    a. Educate the public on the value of the general license, conservation, and convention permits for mule deer habitat improvement projects
    b. Promote and enhance programs that encourage volunteer participation in habitat restoration projects that benefit mule deer
    c. Educate the public on the primary purpose and value of Wildlife Management Areas for wildlife habitat and hunting opportunity

**Sustainable Harvest Goal:** Provide a diversity of mule deer hunting experiences and opportunities throughout the state

**Sustainable Harvest Objective 1:** Provide sustainable mule deer hunting that encourages a variety of diverse hunting experiences and opportunities while maintaining population objectives

*Implications: Current hunting programs can be maintained if hunting implemented at appropriate levels identified in this management plan, allowing for sustainable harvest compatible with population goals*

Strategies:

A. Hunting Strategies: Continue to provide three hunt unit categories (general season, limited entry and premium limited entry) in approximately the current distribution to provide a variety of hunting opportunities
    a. General Season
        i. Manage general-season units for a buck-to-doe ratio of 15–17 or 18–20 as specified in the statewide plan (see Table 1 for units and objectives)
        ii. Provide an "extended archery only" general season deer hunt opportunity that allows permit holders to hunt only the extended archery deer hunt areas/season dates
        iii. Division biologists will make proactive general season buck permit recommendations using a model taking into account:
            1. Current unit population estimate
            2. Observed buck-to-doe and fawn-to-doe ratios - including current data as well as recent years and trends
            3. Anticipated adult and fawn survival based on:
                a. GPS collar survival
                b. Observed body condition and body fat percentages
                c. Habitat conditions
                d. Weather including current conditions and extended forecast
            4. Unit hunter harvest success (historic and recent trends)
        iv. Annual permit adjustments to manage to the unit buck-to-doe ratio objective will be made automatically for all changes (increases or decreases) up to 30% from the previous year's permit number for any unit/hunt. Annual permit number changes exceeding a 30% change from the previous year will go through the public RAC and Wildlife Board process in the spring cycle and will be subject to Wildlife Board approval.
        v. Annual permit recommendations on public land units (>50% of deer habitat is on public land) should be made to make progress toward the buck:doe ratio objective for the unit. Units with large percentages of private lands or very low deer densities where classification data collection is difficult may take other factors such as crowding, hunter satisfaction, and harvest success rates ito account to come to a reasonable permit recommendation acknowledging that buck-to-doe ratios may exceed the objective on some of these units.

b. Limited Entry
   i. Manage designated limited-entry units for 25–30 bucks per 100 does, see Table 3 for units and objectives (some limited entry buck deer hunts not included in Table 3 are designed to assist with disease management and/or are limited entry primarily based on timing or limited permit numbers rather than a buck-to-doe ratio objective and this objective will not apply to those hunts)
   ii. When setting/recommending permit numbers biologists should take into account:
      1. Current unit population estimate
      2. Observed buck-to-doe and fawn-to-doe ratios - including current data as well as recent years and trends
      3. Unit hunter harvest success (both historic and recent trends)
      4. Anticipated adult and fawn survival based on:
         a. GPS collar survival
         b. Observed body condition and body fat percentages
         c. Habitat conditions
         d. Weather including current conditions and extended forecast
   iii. Annual permit adjustments to manage to the unit buck-to-doe ratio objective will be made automatically for all changes (increases or decreases) up to 30% from the previous year's permit number for any unit/hunt. Annual permit number changes exceeding a 30% change from the previous year will go through the public RAC and Wildlife Board process in the spring cycle and will be subject to Wildlife Board approval.

c. Premium Limited Entry
   i. Manage premium limited-entry units for 35–40 bucks per 100 does (see Table 2 for units and objectives)
   ii. When setting/recommending permit numbers biologists should take into account:
      1. Current unit population estimate
      2. Observed buck-to-doe and fawn-to-doe ratios - including current data as well as recent years and trends
      3. Unit hunter harvest success (both historic and recent trends)
      4. Anticipated adult and fawn survival based on:
         a. GPS collar survival
         b. Observed body condition and body fat percentages
         c. Habitat conditions
         d. Weather including current conditions and extended forecast
   iii. Annual permit adjustments to manage to the unit buck-to-doe ratio objective will be made automatically for all changes (increases or decreases) up to 30% from the previous year's permit number for any unit/hunt. Annual permit number changes exceeding a 30% change from the previous year will go through the public RAC and Wildlife Board process in the spring cycle and will be subject to Wildlife Board approval.

    iv. Biologists will recommend that between 10-20% of the total permits for premium limited entry hunts be issued as "management buck permits"
    v. Biologists may recommend cactus buck permits as needed/available

B. Hunt Types/Weapon Splits
  a. Recommend permits for the 3 weapon types based on the following percentages: 20% archery, 20% muzzleloader, and 60% any weapon. On some units, these percentages may be altered to help achieve buck-to-doe ratio objectives. When an early any legal weapon hunt is added to a unit, the allocation guidelines would be - 20% archery, 20% muzzleloader, 20% early any legal weapon and 40% late any legal weapon
  b. On units where crowding may be a concern or in the light of other complicating factors, additional hunts may be added or weapon type/season percentages may be altered from allocation guidelines to effectively manage to approved buck-to-doe ratios
  c. On limited-entry and premium limited-entry units with sufficient public draw permits, provide a multi-season hunting opportunity that will allow 3% of the hunters to hunt all seasons for an increased fee. The permits for this hunt will be removed from the any-weapon quota

C. Hunting Seasons
  a. Establish season lengths that provide adequate hunting opportunity using the following season lengths as guidelines:
    i. 28-day archery season
    ii. 9-day muzzleloader season
    iii. 5-day early any weapon season (on select units to address hunter distribution)
    iv. 9-day any weapon season
    v. 9-day late limited entry muzzleloader season
  b. Limited-entry late muzzleloader hunts on all general-season units
    i. Permits will be recommended up to 0.5% of the general-season draw permit total with a minimum of 5 permits on each unit
  c. Season lengths for some hunts may be altered to accommodate:
    i. High-country buck hunts/overlapping deer and elk seasons
    ii. Deer migration
    iii. Extended archery areas
    iv. Management buck hunts
    v. Cactus buck hunts
    vi. Handgun, archery, muzzleloader, shotgun, straight-walled rifle (HAMSS) hunts
    vii. Multi state agreements
    viii. Other unique and compelling situations or circumstances

D. Additional Hunt Strategies
  a. Continue to evaluate hunt boundaries to manage hunting pressure on a unit/subunit scale. Unit hunt boundaries should:
    i. Encompass the majority of the movements of specific deer herds
    ii. Maintain easily identifiable boundaries

   iii. Consider private lands issues
b. Continue to support incentives to landowners that provide crucial habitat for mule deer
c. Evaluate units, subunits and targeted areas for unique, additional limited entry opportunities. Potential hunt areas will typically meet at least one of the following criteria:
   i. Low densities of deer
   ii. Underutilized by hunters
   iii. High potential for conflict with humans
   iv. Migratory deer populations (or segments of the population) that are not able to be hunted during standard seasons
   v. Disease management considerations
d. Continue to evaluate areas for new extended archery hunt units
e. Work with land managers to maintain access during hunting seasons where appropriate
f. Consider cactus buck hunts on units with an appreciable number of cactus bucks

**Outreach and Education Goal:** Have broad-based public support and engagement for mule deer conservation and management

**Outreach and Education 1**. Increase opportunities to educate the public about the needs of mule deer and the importance of habitat and other limiting factors

*Implications: In order to gain support for mule deer and mule deer management, it is crucial that the public understand factors that drive and limit mule deer populations. Efforts need to be made to educate the public about mule deer and promote everything that is being done to benefit mule deer and mule deer habitat in Utah*

Strategies:

A. Education and Nonconsumptive Use
    a. Work with partners (conservation organizations, state and federal agencies, etc.) to increase outreach efforts to promote mule deer conservation
    b. Use electronic media, podcasts, and traditional media to educate the public about mule deer and mule deer management
        i. Youth hunting opportunities
            1. Highlight and explain existing youth programs and opportunities
            2. Give tips and potential draw strategies to assist parents/guardians in obtaining deer permits for youth hunters
        ii. Conservation
            1. Share information on where and how to view mule deer
            2. Emphasize the importance of proper population management
            3. Provide updates on current research and management actions
        iii. Habitat restoration
            1. Highlight the importance of the Watershed Restoration Initiative
            2. Share importance of identifying and protecting migration routes and corridors
        iv. Impacts of disturbance
            1. Impacts of highways and development and the importance of crossing structures that offer safe passage
            2. Potential positive and negative impacts of wildfire
            3. Human activities on winter range
        v. Factors that impact mule deer population growth
            1. Impacts of predators on mule deer populations
            2. Habitat carrying capacity and how it is dynamic
            3. Effects of severe weather
            4. Deer-vehicle collisions
            5. Disease

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Figure 1. Statewide trends in mule deer hunters afield and harvest, Utah 1925–2023.

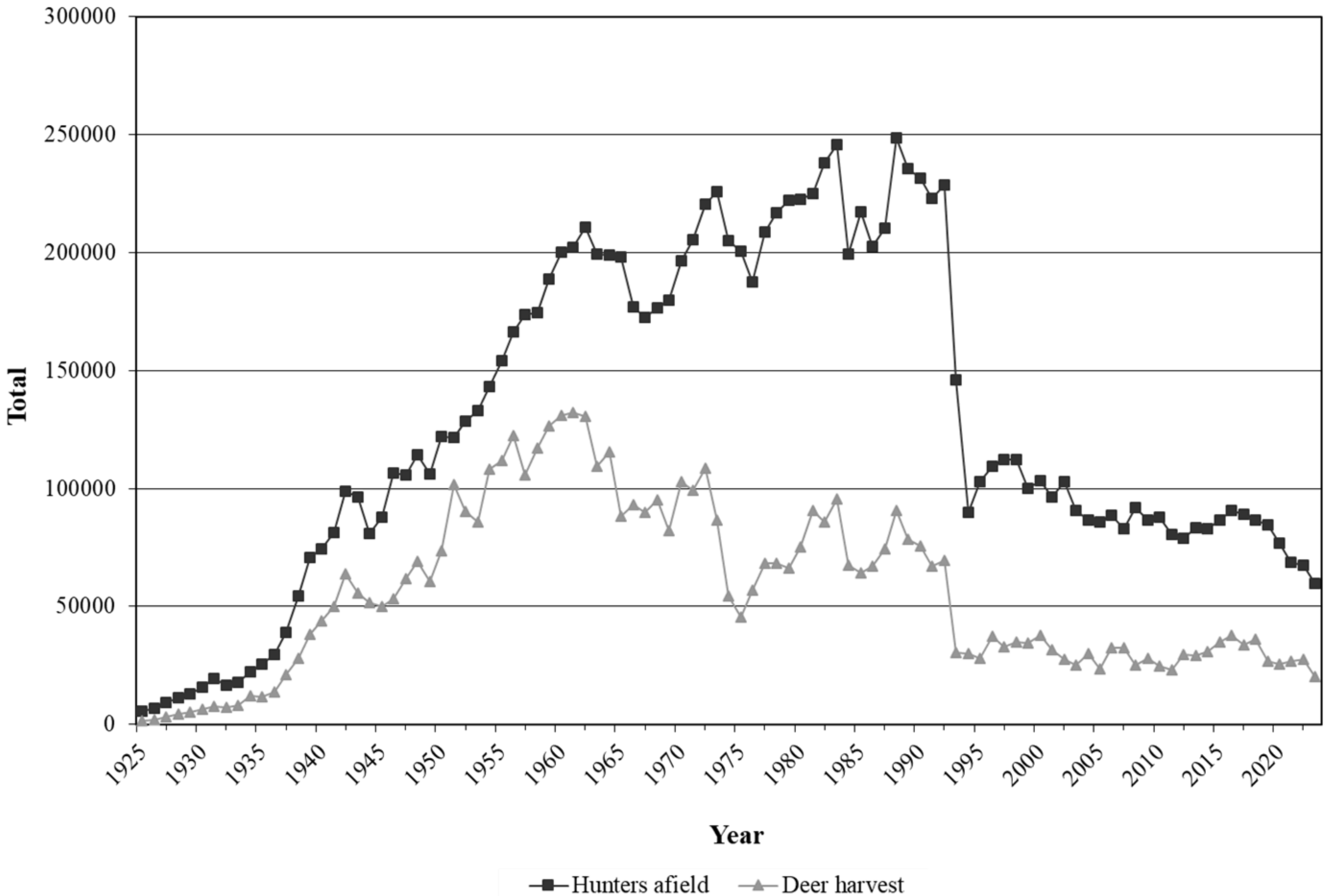


Figure 2. Statewide post-season buck-to-doe ratio estimates, Utah 1993–2023.

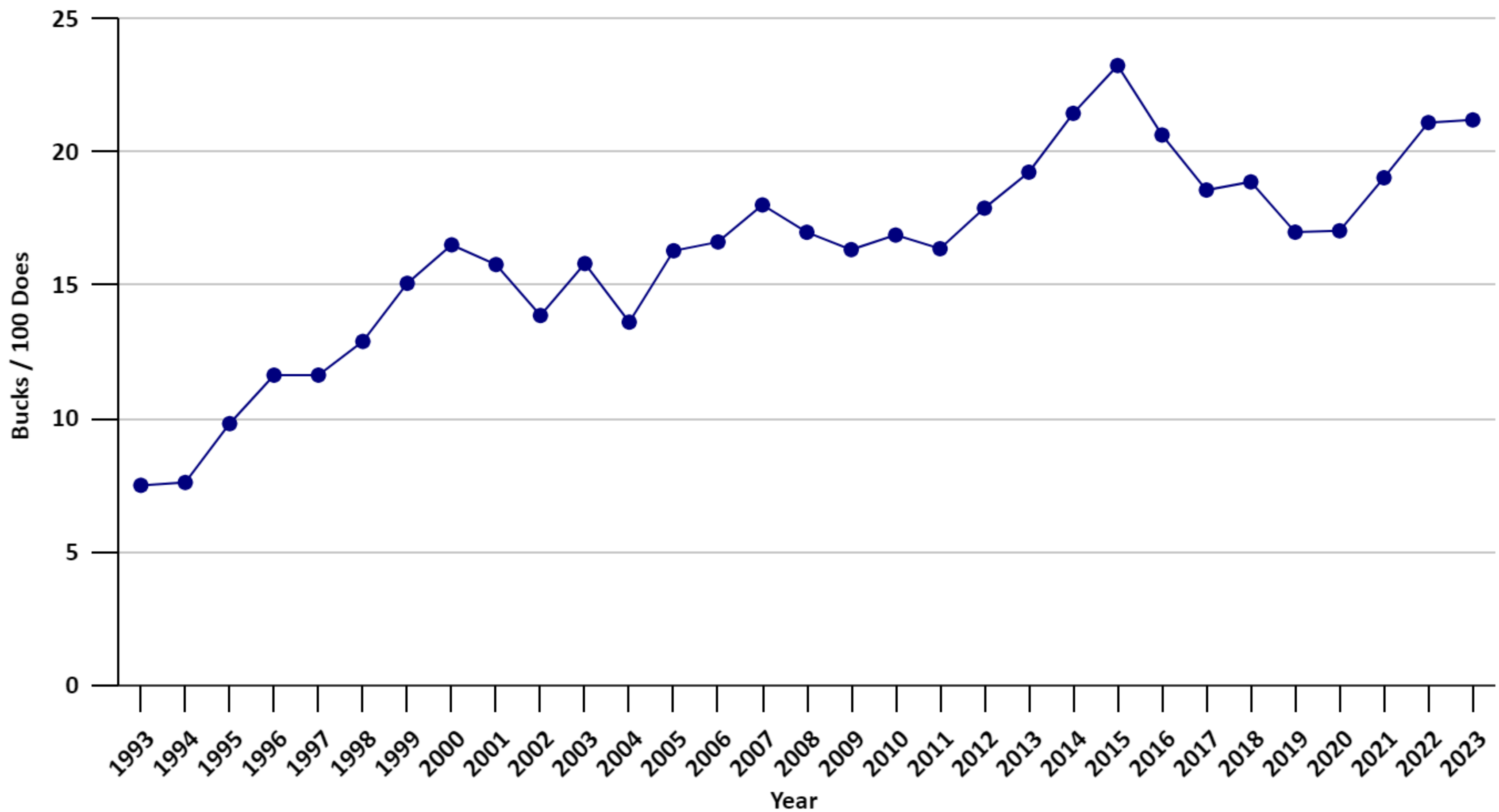


Figure 3. Statewide post-season mule deer population estimates, Utah 1992–2023.

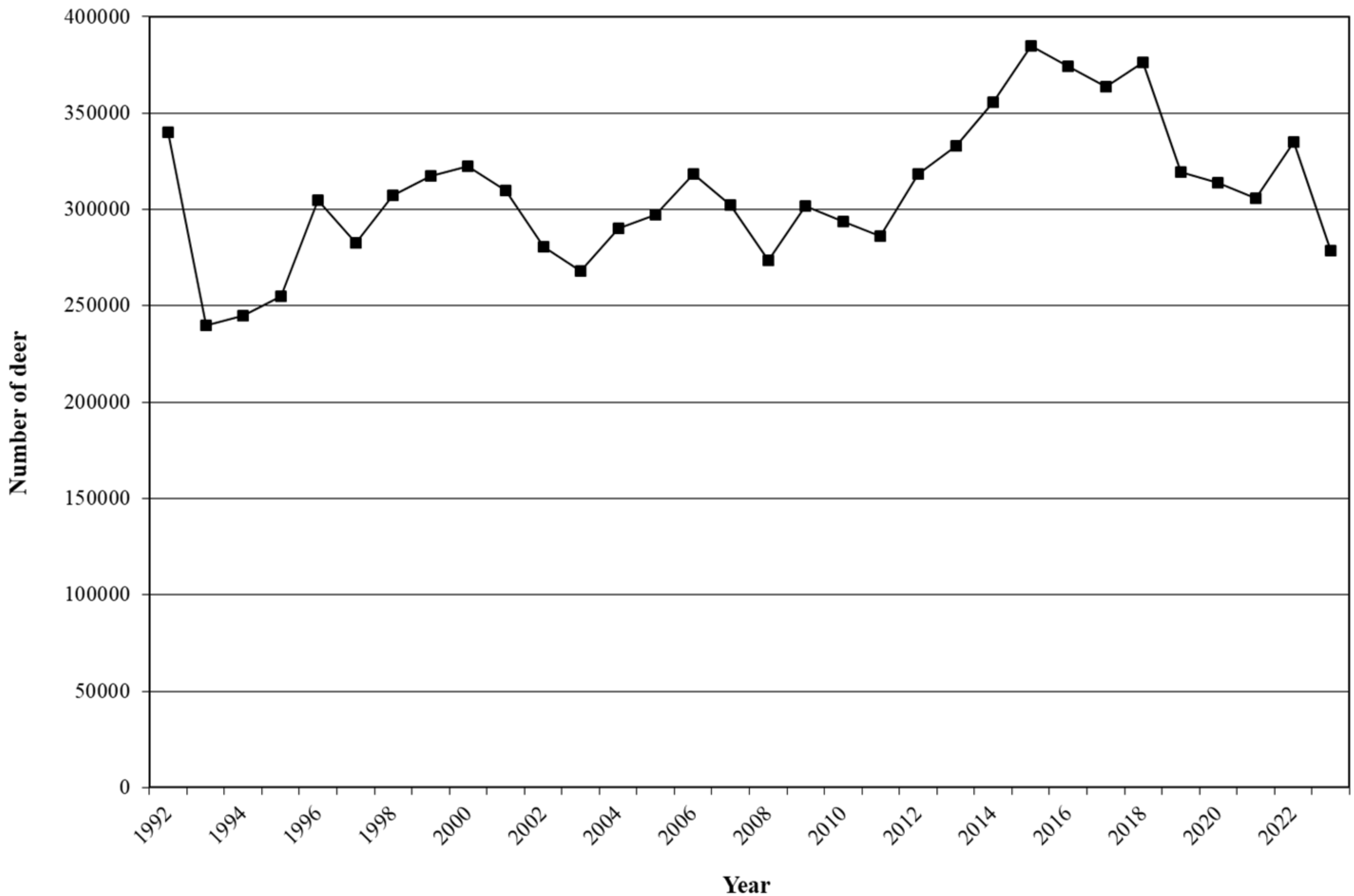


Figure 4. Statewide post-season fawn-to-doe ratio estimates, Utah 1993–2023.

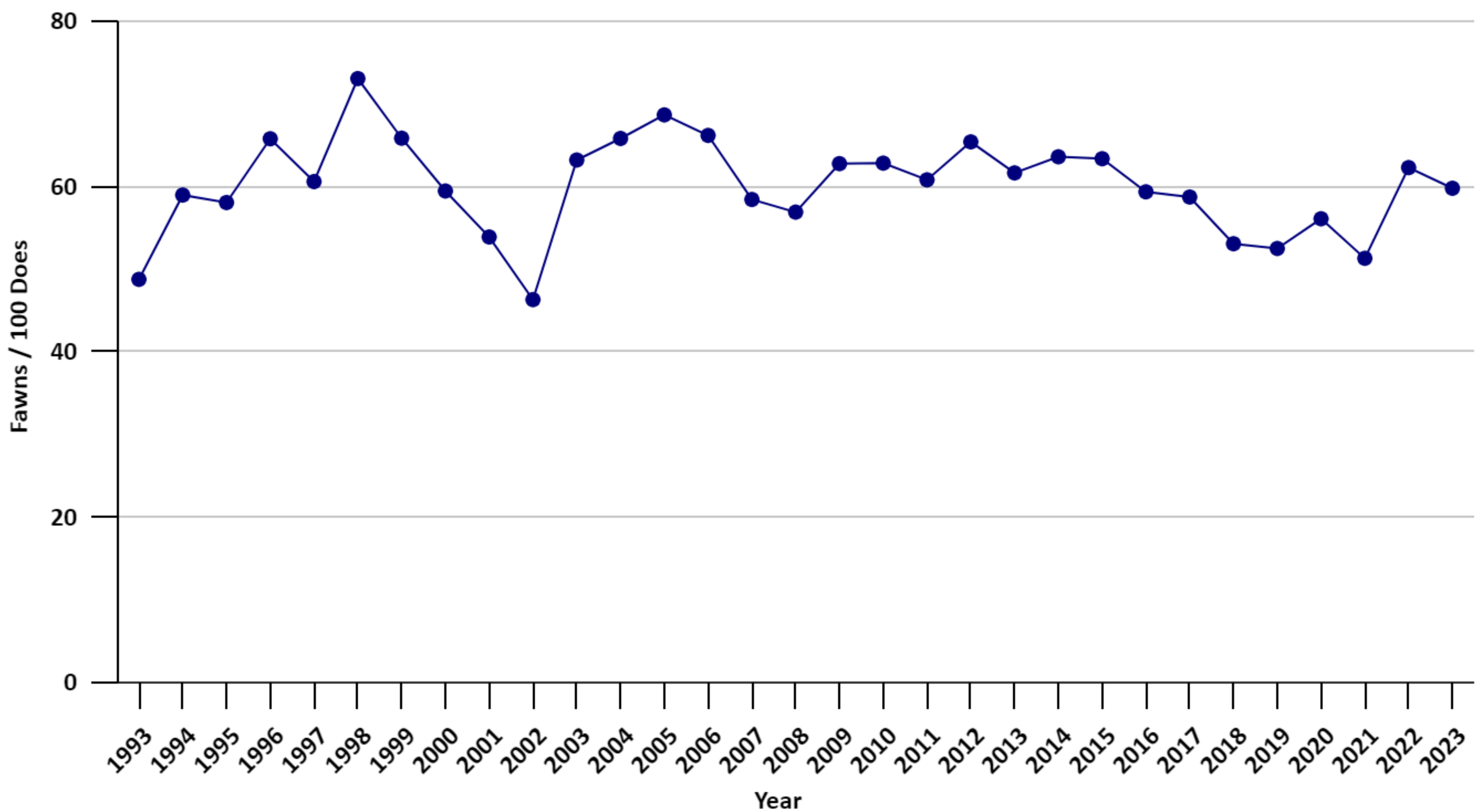


Figure 5. Mule deer habitat, Utah 2019.

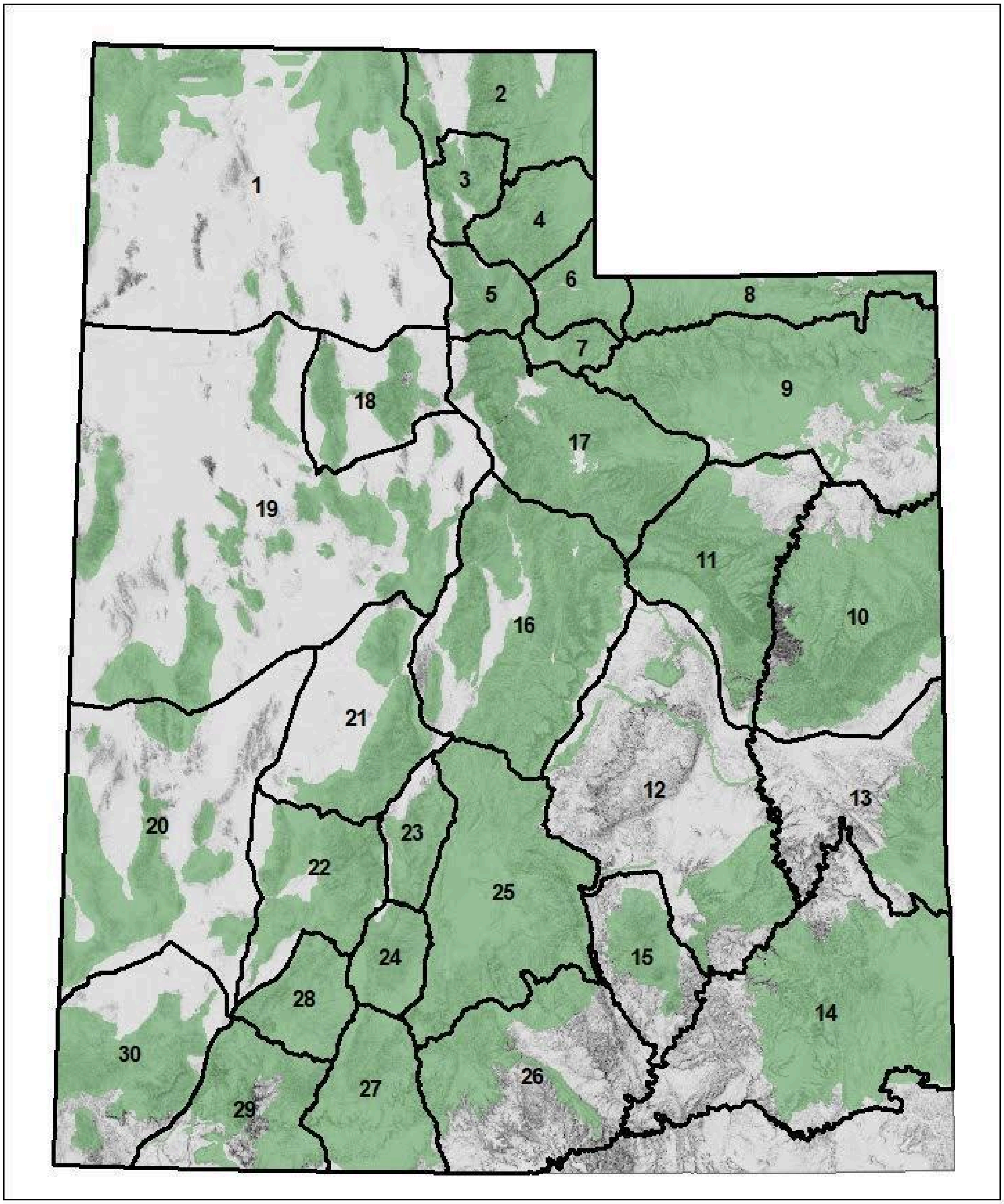


Figure 6. Crucial mule deer habitat restoration priority areas, Utah 2019.

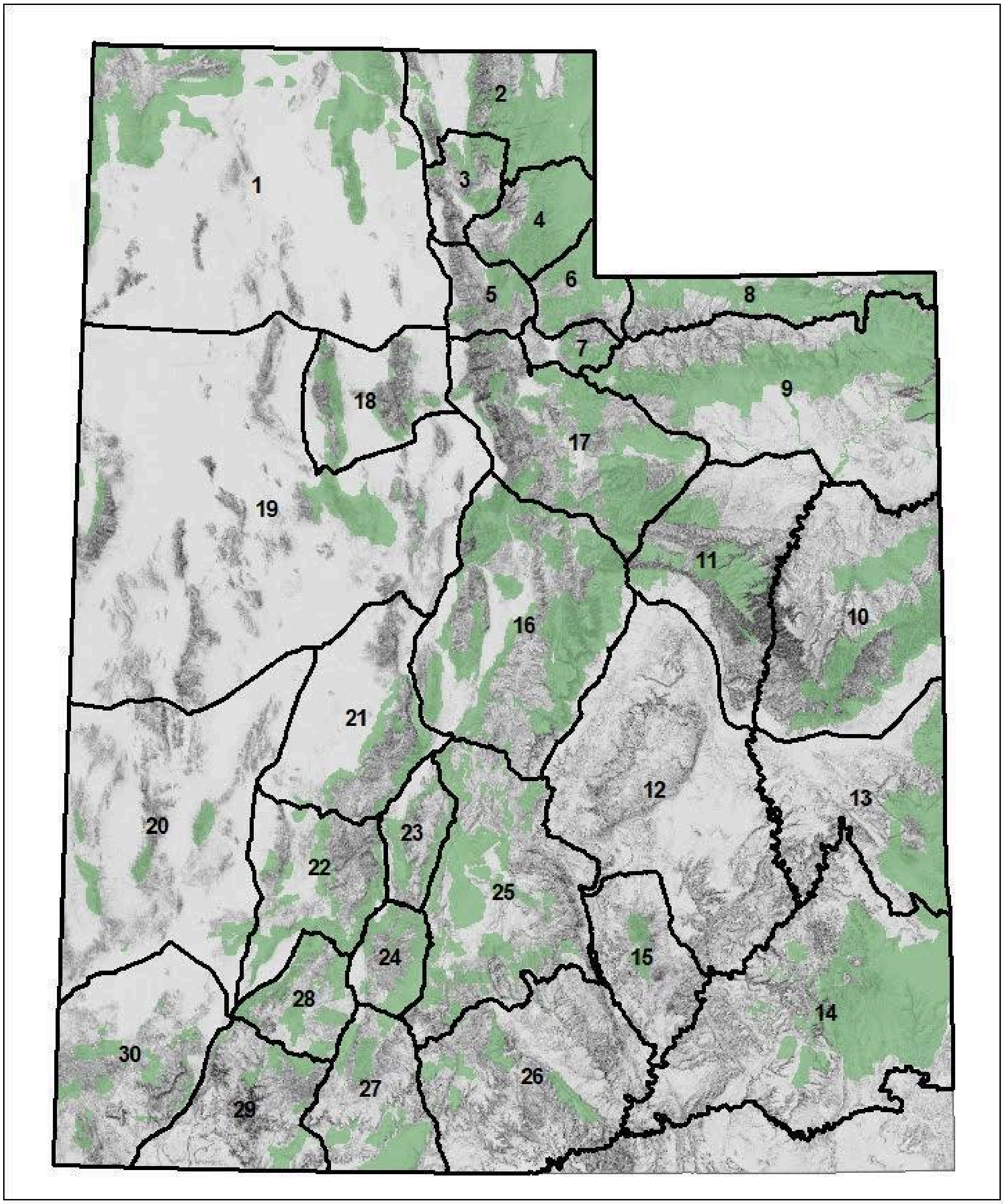


Figure 7. Locations of over 4,000 mule deer that were monitored with GPS tracking technology (data points on January 1st 2019-2023).

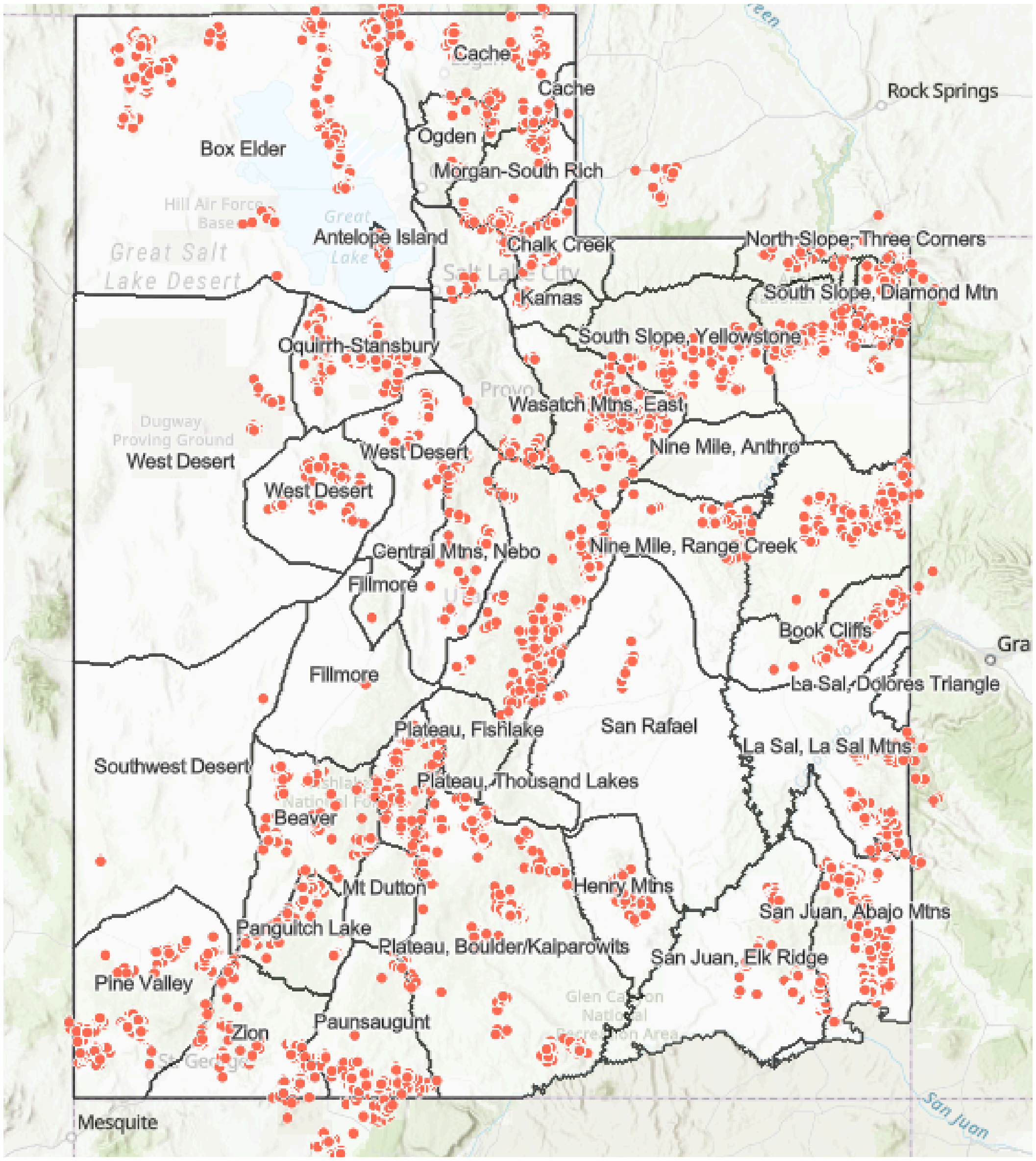


Figure 8. Mapped mule deer migration corridors through 2023 (unmapped areas black hash)

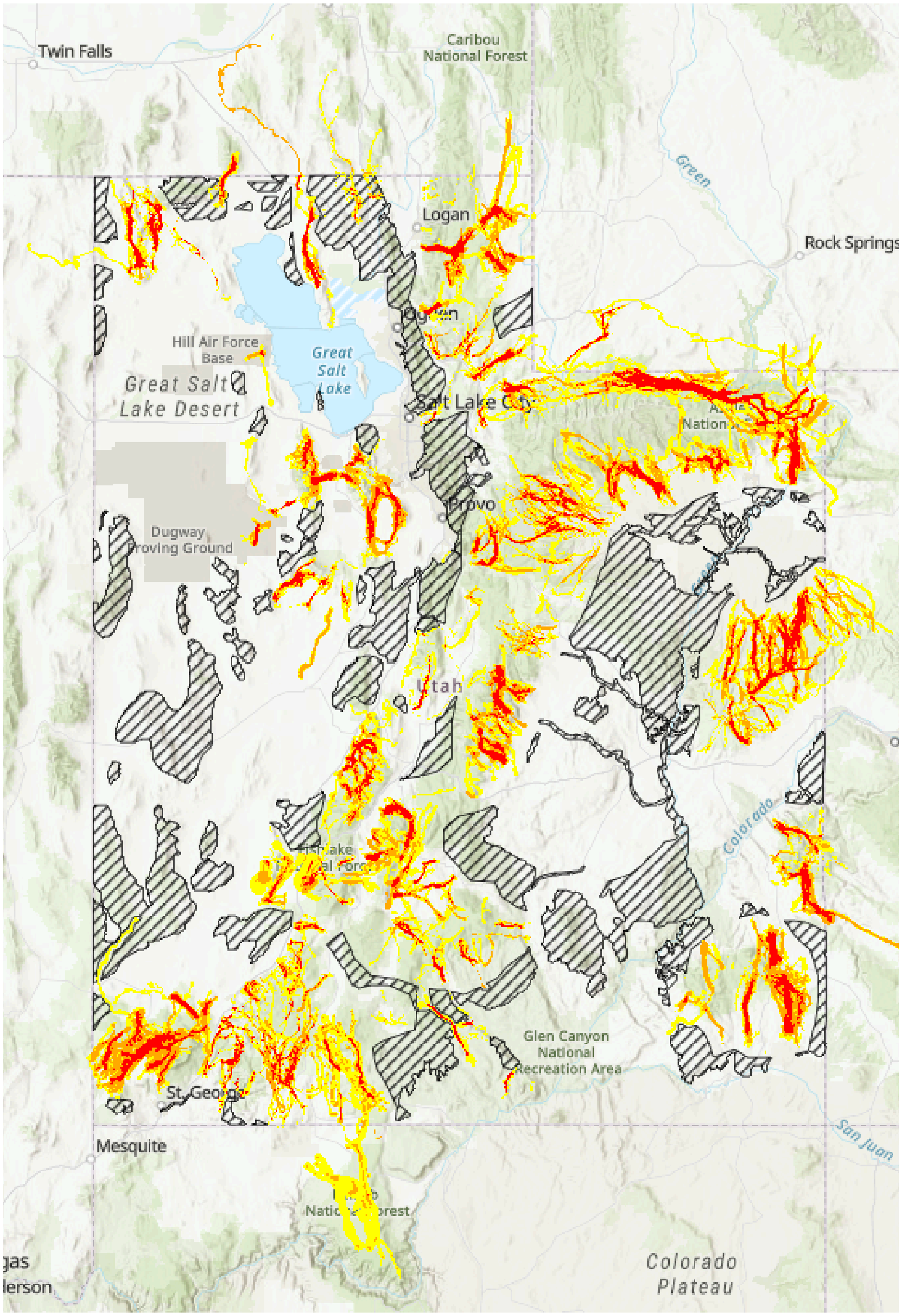


Table 1. General season unit observed buck-to-doe ratios and objectives, Utah 2021–2023.

| General season unit | Unit # | Objective | 2021 | 2022 | 2023 | 3 year average |
|---|---|---|---|---|---|---|
| Beaver, East* | 22 | 15-17 | 14.8 | 17.3 | 20.4 | 17.5 |
| Beaver, West* | 22 | 15-17 | —- | —- | —- | —- |
| Boulder/Kaiparowits | 25C/26 | 15-17 | 20.5 | 24.6 | 30.8 | 25.3 |
| Box Elder | 1 | 18-20 | 30.0 | 26.4 | 22.1 | 26.2 |
| Cache | 2 | 15-17 | 22.0 | 20.4 | 18.8 | 20.4 |
| Cedar/Stansbury* | 18A | 15-17 | —- | —- | —- | —- |
| Chalk Creek | 4 | 18-20 | 24.9 | 28.0 | 24.1 | 25.7 |
| East Canyon | 5 | 18-20 | 27.8 | 24.2 | 21.9 | 24.6 |
| Fillmore | | 15-17 | 18.7 | 18.3 | 23.9 | 20.3 |
| Fishlake | 25A | 15-17 | 20.4 | 21.4 | 24.3 | 22.0 |
| Kamas | 7 | 18-20 | 20.9 | 24.1 | 23.0 | 22.7 |
| La Sal, La Sal Mtns | 13A | 15-17 | 16.4 | 26.1 | 17.4 | 20.0 |
| Manti/San Rafael | 16B/12 | 15-17 | 20.1 | 22.0 | 18.9 | 20.3 |
| Monroe | 23 | 15-17 | 16.7 | 18.4 | 20.8 | 18.6 |
| Morgan-South Rich | 6 | 18-20 | 26.6 | 28.6 | 21.3 | 25.5 |
| Mt. Dutton | 24 | 15-17 | 17.4 | 20.6 | 22.3 | 20.1 |
| Nebo | 16A | 15-17 | 21.0 | 21.0 | 17.4 | 19.8 |
| Nine Mile | 11 | 18-20 | 16.9 | 15.7 | 22.5 | 18.4 |
| North Slope | 8 | 15-17 | 19.3 | 20.4 | 19.7 | 19.8 |
| Ogden | 3 | 18-20 | 23.0 | 22.8 | 20.0 | 22.0 |
| Oquirrh/Tintic* | 18B | 18-20 | —- | —- | —- | —- |
| Panguitch Lake | 28 | 15-17 | 20.4 | 17.8 | 22.6 | 20.3 |
| Pine Valley | 30 | 18-20 | 16.1 | 19.4 | 22.6 | 19.4 |
| San Juan, Abajo Mtns | 14A | 15-17 | 22.6 | 19.9 | 17.1 | 19.9 |
| Southwest Desert | 20 | 15-17 | 15.6 | 21.3 | 21.5 | 19.5 |
| Vernal/Bonanza | 9DB | 15-17 | 16.9 | 20.4 | 16.1 | 17.8 |
| Wasatch Mtns, East | 17BC | 15-17 | 20.8 | 25.8 | 25.0 | 23.9 |
| Wasatch Mtns, West | 17A | 15–17 | 14.8 | 15.6 | 15.3 | 15.2 |
| West Desert, Swasey* | 19D | 15–17 | —- | —- | —- | —- |
| Yellowstone | 9A | 18–20 | 18.4 | 20.7 | 18.6 | 19.3 |
| Zion | 29 | 18–20 | 17.8 | 20.9 | 24.1 | 20.9 |

*New general season unit this plan

Table 2. Premium limited-entry unit observed buck-to-doe ratios and objectives, Utah 2021–2023.

| Premium limited-entry unit | | Objective | 2021 | 2022 | 2023 | 3 year average |
|---|---|---|---|---|---|---|
| Henry Mtns | Buck-to-doe ratio | 40–45 | 40.1 | 35.5 | 54.8 | 43.5 |
| Paunsaugunt | Buck-to-doe ratio | 40–45 | 43.9 | 42.4 | 45.9 | 44.1 |

Table 3. Limited-entry unit observed buck-to-doe ratios and objectives, Utah 2021–2023.

| Limited-entry unit | Objective | 2021 | 2022 | 2023 | 3 year average |
|---|---|---|---|---|---|
| Cache, Crawford Mtn | 25–30 | 17.6 | 21.8 | 21.8 | 20.4 |
| South Slope, Diamond Mtn | 25–30 | 32.9 | 31.4 | 32.9 | 32.4 |
| Book Cliffs | 25–30 | 26.5 | 33.1 | 37.2 | 32.3 |
| La Sal, Dolores Triangle | 25–30 | 25.0 | 28.8 | 27.2 | 27.0 |
| San Juan, Elk Ridge | 25–30 | 43.6 | 33.9 | 33.9 | 37.1 |
| Thousand Lakes* | 25–30 | 21.1 | 24.6 | 18.7 | 21.5 |
| West Desert, Vernon | 25–30 | 22.6 | 31.0 | 35.4 | 29.6 |
| Fillmore, Oak Creek | 25–30 | 37.2 | 43.2 | 32.2 | 37.5 |

*New limited-entry unit this plan

Table 4. Estimated survival of adult and fawn mule deer monitored by satellite GPS collars, Utah 2013–2023.

| Unit | Year | Adult Survival | Fawn Survival |
|---|---|---|---|
| Book Cliffs | 2017–2018 | 0.64 | 0.54 |
| | 2018–2019 | 0.69 | 0.61 |
| | 2019–2020 | 0.81 | 0.67 |
| | 2020-2021 | 0.84 | 0.24 |
| | 2021-2022 | 0.85 | 0.60 |
| | 2022-2023 | 0.94 | —- |
| Cache | 2013–2014 | 0.82 | 0.77 |
| | 2014–2015 | 0.92 | 0.79 |
| | 2015–2016 | 0.84 | 0.27 |
| | 2016–2017 | 0.71 | 0.10 |
| | 2017–2018 | 0.91 | 0.59 |
| | 2018–2019 | 0.67 | 0.06 |
| | 2019–2020 | 0.82 | 0.25 |
| | 2020-2021 | 0.92 | 0.56 |
| | 2021-2022 | 0.88 | 0.61 |
| | 2022-2023 | 0.53 | 0.05 |
| Monroe | 2013–2014 | 0.82 | 0.86 |
| | 2014–2015 | 0.82 | 0.75 |
| | 2015–2016 | 0.79 | 0.44 |
| | 2016–2017 | 0.75 | 0.38 |
| | 2017–2018 | 0.76 | 0.41 |
| | 2018–2019 | 0.71 | 0.58 |
| | 2019–2020 | 0.76 | 0.31 |
| | 2020-2021 | 0.74 | 0.30 |
| | 2021-2022 | 0.77 | 0.55 |
| | 2022-2023 | 0.81 | 0.74 |
| Oquirrh-Stansbury | 2013–2014 | 0.80 | 0.78 |
| | 2014–2015 | 0.78 | 0.61 |
| | 2015–2016 | 0.72 | 0.27 |
| | 2016–2017 | 0.72 | 0.18 |
| | 2017–2018 | 0.82 | 0.81 |
| | 2018–2019 | 0.62 | 0.35 |
| | 2019–2020 | 0.76 | 0.53 |
| | 2020-2021 | 0.80 | 0.54 |
| | 2021-2022 | 0.91 | 0.54 |
| | 2022-2023 | 0.75 | 0.44 |
| Pine Valley | 2013–2014 | 0.84 | 0.93 |
| | 2014–2015 | 0.86 | 0.90 |
| | 2015–2016 | 0.89 | 0.41 |
| | 2016–2017 | 0.84 | 0.50 |

| | | | |
|---|---|---|---|
| | 2017–2018 | 0.79 | 0.43 |
| | 2018–2019 | 0.90 | 0.53 |
| | 2019–2020 | 0.80 | 0.63 |
| | 2020-2021 | 0.77 | 0.47 |
| | 2021-2022 | 0.83 | 0.63 |
| | 2022-2023 | 0.77 | 0.72 |
| San Juan | 2013–2014 | 0.86 | 0.79 |
| | 2014–2015 | 0.84 | 0.71 |
| | 2015–2016 | 0.80 | 0.71 |
| | 2016–2017 | 0.75 | 0.41 |
| | 2017–2018 | 0.73 | 0.00 |
| | 2018–2019 | 0.76 | 0.27 |
| | 2019–2020 | 0.90 | 0.72 |
| | 2020-2021 | 0.91 | 0.47 |
| | 2021-2022 | 0.88 | 0.36 |
| | 2022-2023 | 0.84 | 0.53 |
| South Slope | 2013–2014 | 0.93 | 0.83 |
| | 2014–2015 | 0.82 | 0.93 |
| | 2015–2016 | 0.78 | 0.59 |
| | 2016–2017 | 0.71 | 0.18 |
| | 2017–2018 | 0.88 | 0.75 |
| | 2018–2019 | 0.67 | 0.24 |
| | 2019–2020 | 0.83 | 0.61 |
| | 2020-2021 | 0.82 | 0.35 |
| | 2021-2022 | 0.92 | 0.61 |
| | 2022-2023 | 0.73 | 0.19 |
| Manti | 2013–2014 | 0.81 | 0.80 |
| | 2014–2015 | 0.82 | 0.69 |
| | 2015–2016 | 0.81 | 0.31 |
| | 2016–2017 | 0.80 | 0.53 |
| | 2017–2018 | 0.77 | 0.75 |
| | 2018–2019 | 0.83 | 0.39 |
| | 2019–2020 | 0.73 | 0.71 |
| | 2020-2021 | 0.82 | 0.48 |
| | 2021-2022 | 0.90 | 0.58 |
| | 2022-2023 | 0.74 | 0.18 |
| Statewide | 2013–2014 | 0.84 | 0.82 |
| | 2014–2015 | 0.84 | 0.77 |
| | 2015–2016 | 0.80 | 0.43 |
| | 2016–2017 | 0.79 | 0.30 |
| | 2017–2018 | 0.79 | 0.53 |
| | 2018–2019 | 0.75 | 0.37 |
| | 2019–2020 | 0.79 | 0.61 |
| | 2020-2021 | 0.79 | 0.39 |

| | | | |
|---|---|---|---|
| | 2021-2022 | 0.87 | 0.59 |
| | 2022-2023 | 0.72 | 0.40 |

Table 5. Probable causes of mortality for GPS collared adult female and fawn mule deer, Utah 2014–2023 (n=1765).

| Mortality Cause | n | % |
|---|---|---|
| Birth complication | 10 | <1 |
| Disease | 43 | 2 |
| Hunter harvest | 24 | 1 |
| Malnutrition | 229 | 13 |
| Poaching | 15 | <1 |
| Predation, bear | 3 | <1 |
| Predation, bobcat | 21 | 1 |
| Predation, cougar | 454 | 26 |
| Predation, coyote | 327 | 19 |
| Predation, domestic dog | 3 | <1 |
| Predation, golden eagle | 1 | <1 |
| Roadkill | 118 | 7 |
| Train | 2 | <1 |
| Unknown | 475 | 27 |

Table 6. December ingesta-free body fat (IFBF) values for adult female mule deer by management unit, Utah 2014–2023.

| | Percent (%) Ingesta Free Body Fat (IFBF) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Unit** | **Dec 2014** | **Dec 2015** | **Dec 2016** | **Dec 2017** | **Dec 2018** | **Dec 2019** | **Dec 2020** | **Dec 2021** | **Dec 2022** | **Dec 2023** |
| **Box Elder** | | | | | | 8.79 | 9.30 | 12.42 | | |
| **Cache** | | 11.02 | 9.59 | 13.65 | 10.32 | 13.71 | 12.13 | 12.88 | 10.44 | 14.40 |
| **Morgan** | | | | | | | 8.84 | 10.84 | | 14.97 |
| **South Slope** | 11.31 | 9.46 | 9.00 | 9.56 | 7.24 | 9.90 | 8.52 | 12.18 | 8.65 | 11.02 |
| **Oquirrh-Stansbury** | 10.52 | 8.43 | 9.56 | 8.79 | 7.39 | 8.46 | 8.26 | 10.91 | 9.91 | 10.02 |
| **Chalk Creek/Kamas** | | | | | 7.19 | 11.02 | 10.75 | | | |
| **Wasatch-Manti** | | 8.76 | 9.22 | 10.23 | 9.32 | 11.11 | 8.97 | 10.28 | 9.40 | 12.02 |
| **Wasatch West (Heber)** | | | | | | | | | | 13.92 |
| **Wasatch East** | | | | | | 11.51 | 12.26 | 10.78 | | |
| **Southeast Manti** | | | 8.87 | | | 9.42 | 9.25 | 10.89 | 8.03 | |
| **Southwest Manti** | | | | | | | 7.30 | | | |
| **Nebo-Tintic** | | | | | | | | 12.67 | 8.88 | 12.61 |
| **Book Cliffs** | | | | 7.56 | 6.35 | 8.80 | 7.13 | 8.88 | | 6.65 |
| **Range Creek** | | | | | | | | | 8.48 | 11.25 |
| **West Desert** | | | | | 6.33 | 8.04 | | | | |
| **Monroe** | 8.10 | 8.98 | 8.23 | 9.53 | 6.50 | 10.37 | 8.56 | 11.28 | 8.40 | 12.23 |
| **Beaver** | | | | | | 7.75 | 8.44 | 9.67 | | |
| **Boulder** | | | | | | 8.54 | 5.96 | | | 10.05 |
| **Pine Valley** | | 7.42 | 6.68 | 6.54 | 6.91 | 6.86 | 6.77 | 7.71 | 7.25 | 8.92 |
| **Zion** | | | | | 8.48 | 9.04 | | | | 7.21 |
| **LaSal** | | | | | | 8.63 | | 7.61 | 8.91 | 11.46 |
| **San Juan** | | 9.35 | 9.25 | 7.60 | 7.77 | 9.50 | 8.11 | 8.79 | 7.97 | 9.22 |
| | | | | | | | | | | |
| **Statewide** | 9.98 | 9.06 | 8.80 | 9.18 | 7.78 | 9.48 | 8.61 | 10.52 | 8.76 | 11.05 |

**Blue** - highest recorded value
**Gold** - lowest recorded value

Table 7. Limited-entry and general-season odds of obtaining a permit, Utah 1998–2024.

| Permit type | Year | Resident odds | Nonresident odds | Overall odds |
|---|---|---|---|---|
| Limited entry | 1998 | 1 in 7.5 | 1 in 19.7 | 1 in 8.3 |
| | 1999 | 1 in 7.9 | 1 in 16.3 | 1 in 8.5 |
| | 2000 | 1 in 8.9 | 1 in 14.4 | 1 in 9.3 |
| | 2001 | 1 in 9.9 | 1 in 18.1 | 1 in 10.6 |
| | 2002 | 1 in 12.8 | 1 in 24.8 | 1 in 13.8 |
| | 2003 | 1 in 15.2 | 1 in 34.0 | 1 in 16.7 |
| | 2004 | 1 in 17.2 | 1 in 40.4 | 1 in 19.1 |
| | 2005 | 1 in 19.5 | 1 in 48.3 | 1 in 21.7 |
| | 2006 | 1 in 19.9 | 1 in 49.7 | 1 in 22.1 |
| | 2007 | 1 in 21.0 | 1 in 62.2 | 1 in 23.7 |
| | 2008 | 1 in 20.6 | 1 in 48.2 | 1 in 22.5 |
| | 2009 | 1 in 19.8 | 1 in 74.1 | 1 in 23.8 |
| | 2010 | 1 in 20.3 | 1 in 72.1 | 1 in 24.3 |
| | 2011 | 1 in 21.3 | 1 in 76.5 | 1 in 25.5 |
| | 2012 | 1 in 23.5 | 1 in 79.0 | 1 in 27.9 |
| | 2013 | 1 in 27.1 | 1 in 98.4 | 1 in 32.5 |
| | 2014 | 1 in 28.7 | 1 in 108.8 | 1 in 34.8 |
| | 2015 | 1 in 26.8 | 1 in 92.9 | 1 in 32.4 |
| | 2016 | 1 in 24.9 | 1 in 91.1 | 1 in 30.4 |
| | 2017 | 1 in 26.1 | 1 in 98.3 | 1 in 32.5 |
| | 2018 | 1 in 26.0 | 1 in 111.5 | 1 in 33.1 |
| | 2019 | 1 in 25.6 | 1 in 117.2 | 1 in 33.2 |
| | 2020 | 1 in 23.9 | 1 in 112.6 | 1 in 31.4 |
| | 2021 | 1 in 28.5 | 1 in 134.3 | 1 in 37.6 |
| | 2022 | 1 in 28.2 | 1 in 141.4 | 1 in 37.7 |
| | 2023 | 1 in 25.6 | 1 in 138.2 | 1 in 34.8 |
| | 2024 | 1 in 25.4 | 1 in 134.7 | 1 in 34.7 |
| General season | 2000 | — | — | 1 in 1.1 |
| | 2001 | 1 in 1.2 | 1 in 1.6 | 1 in 1.2 |
| | 2002 | 1 in 1.3 | 1 in 1.7 | 1 in 1.3 |
| | 2003 | 1 in 1.3 | 1 in 1.9 | 1 in 1.3 |
| | 2004 | 1 in 1.3 | 1 in 1.7 | 1 in 1.3 |
| | 2005 | 1 in 1.4 | 1 in 1.7 | 1 in 1.4 |
| | 2006 | 1 in 1.3 | 1 in 1.7 | 1 in 1.4 |
| | 2007 | 1 in 1.4 | 1 in 1.7 | 1 in 1.5 |
| | 2008 | 1 in 1.4 | 1 in 1.5 | 1 in 1.4 |
| | 2009 | 1 in 1.4 | 1 in 1.5 | 1 in 1.4 |
| | 2010 | 1 in 1.3 | 1 in 1.4 | 1 in 1.3 |
| | 2011 | 1 in 1.4 | 1 in 1.5 | 1 in 1.4 |
| | 2012 | 1 in 1.5 | 1 in 1.8 | 1 in 1.5 |

| | | | | |
|---|---|---|---|---|
| | 2013 | 1 in 1.6 | 1 in 1.8 | 1 in 1.6 |
| | 2014 | 1 in 1.7 | 1 in 2.1 | 1 in 1.7 |
| | 2015 | 1 in 1.8 | 1 in 2.1 | 1 in 1.8 |
| | 2016 | 1 in 1.8 | 1 in 2.1 | 1 in 1.8 |
| | 2017 | 1 in 1.9 | 1 in 2.2 | 1 in 1.9 |
| | 2018 | 1 in 1.9 | 1 in 2.3 | 1 in 1.9 |
| | 2019 | 1 in 1.9 | 1 in 2.3 | 1 in 1.9 |
| | 2020 | 1 in 2.1 | 1 in 2.6 | 1 in 2.1 |
| | 2021 | 1 in 2.5 | 1 in 3.0 | 1 in 2.5 |
| | 2022 | 1 in 2.4 | 1 in 2.9 | 1 in 2.5 |
| | 2023 | 1 in 2.6 | 1 in 2.6 | 1 in 2.6 |
| | 2024 | 1 in 2.3 | 1 in 2.2 | 1 in 2.3 |

**Appendix A.**

**Utah Division of Wildlife Resources**
**Chronic Wasting Disease Management Plan**

**Goals of the plan:**

The goals of this plan are to provide adaptable directions for management and prevention of spread of Chronic Wasting Disease (CWD) in free-ranging deer (*Odocoileus hemionus*), elk (*Cervus elaphus*), and moose (*Alces alces*) in Utah. The disease has been present in Utah for at least two decades, and eradication, although desired, is likely not realistic at this point in time. Specific objectives addressed in this plan are to 1) reduce the rate of spread and prevalence of Chronic Wasting Disease in Utah; 2) provide guidelines for response to detection of new infection foci; 3) communicate with the public and participate in scientific research.

**Background:**

Chronic Wasting Disease (CWD) is a neurodegenerative disease of deer, elk, moose, and caribou/reindeer caused by infectious proteinaceous particles called prions (Haley 2015). The disease is classified as a transmissible spongiform encephalopathy (TSE) similarly to bovine spongiform encephalopathy in cattle, scrapie in sheep, and kuru and Creutzfeldt-Jakob Disease in humans (Haley 2015). Incubation time from infection to clinical signs averages at approximately 16 months (Williams & Miller 2002). Clinical symptoms in affected animals can vary but can include progressive weight loss, behavioral changes, ataxia, excessive salivation, head tremor, aimless wandering, and always results in death of the affected animal (Williams 2005; Haley 2015). In infected animals, prions are predominantly present in nervous and lymphoid tissues, but have also been detected in antler velvet, muscle, saliva, blood, intestinal tract, bladder, urine, feces, and fetal tissues (Henderson *et al.* 2015; Angers *et al.* 2006; Mathiason *et al.* 2006; Angers *et al.* 2009; Haley *et al.* 2011; Nalls et al. 2021). Transmission can occur directly from animal to animal via contact with infectious body fluids (Haley 2015), however, prions are highly resistant in the environment and environmental contamination may contribute to the spread of the disease (Miller 2004; Miller *et al.* 2004; Haley 2015).

Chronic wasting disease can have consequences for both free ranging and captive populations. Studies have shown that CWD can cause declines in free-ranging deer populations, especially with high disease prevalence (Wasserberg *et al.* 2009; Edmunds *et al.* 2016) and environmental persistence (Almberg *et al.* 2011). Survival studies in deer and elk utilizing radio collars showed that CWD infected animals have lower survival, consequently leading to lower population growth rates (Miller *et al.* 2008; Monello *et al.* 2014; Geremia *et al.* 2015; DeVivo *et al.* 2017). Chronic wasting disease continues to be a major concern for the domestic cervid industry, and is a concern in Utah's domestic cervids.

To date, CWD has been detected in multiple US states and Canadian provinces (for a map of the current distribution visit http://cwd-info.org/map-chronic-wasting-disease-in-north-america/, as well as in Norway (Benestad *et al.* 2016), Finland, and South Korea (Sohn *et al.* 2002; Kim *et al.* 2005). The disease has mainly spread to new areas via natural animal migrations, translocations of cervids, and escape of CWD infected cervids from captive facilities (Miller & Fischer 2016). Other risk factors may include transport of infected carcasses or animal products such as urine, saliva, feces etc., and artificially concentrating animals through baiting or feeding (Miller & Fischer 2016).

**Chronic Wasting Disease in Utah:**

The Utah Division of Wildlife Resources (UDWR) first began conducting CWD surveillance in 1998 upon the request of the Center for Disease Control and Prevention. The first case of CWD was found in a hunter-killed buck taken near Vernal in Uintah County in 2002. To date, 254 mule deer and six elk have tested positive for CWD in 13 Wildlife Management Units (WMU) statewide (Figure 1). The highest prevalence in Utah is found in WMU 13 in the La Sal Mountains where the proportion of CWD positive samples have varied between 0 – 25% since 2003 with an increasing trend (Table 1, Figure 2). The proportion of CWD positive samples have varied between 0 and 20% in the other positive WMU's (5, 8, 9, 11, 14, 16) but also with an increasing trend (Table 1, Figure 2). The disease appears to be slowly spreading, with potential exponential growth within the past couple of years. To date, only six elk and no moose have tested positive for CWD in Utah.

Deer continue to test positive near Myton, which is located in the western part of unit 9. It has grown to be a larger CWD hotspot with the majority of positives in that area of the state occurring near Myton, although there has been an increase in prevalence around Vernal. A CWD hunt was started in 2020 for antlerless deer to reduce densities and a late season muzzleloader buck hunt in 2022. The success has been varied.

A new infection foci was detected in the East Canyon unit around Bountiful beginning in 2021, which has included mostly resident, town deer. After sampling for two years, the prevalence is around 20%. There is an ongoing effort to collect more samples in the area to calculate a more accurate prevalence along with collaring efforts to determine the deer's home range and connectivity to other herds. .

Domestic elk ranching is administered through the Utah Department of Agriculture and Food (UDAF). There have been positive CWD cases in captive facilities over the past five years, with several of them quarantined at this time. Due to Canada's high prevalence of CWD in Alberta and Saskatchewan, options for importation are limited. Spread of CWD from domestic to wild cervids and from free-ranging to captive populations continues to be a significant concern.

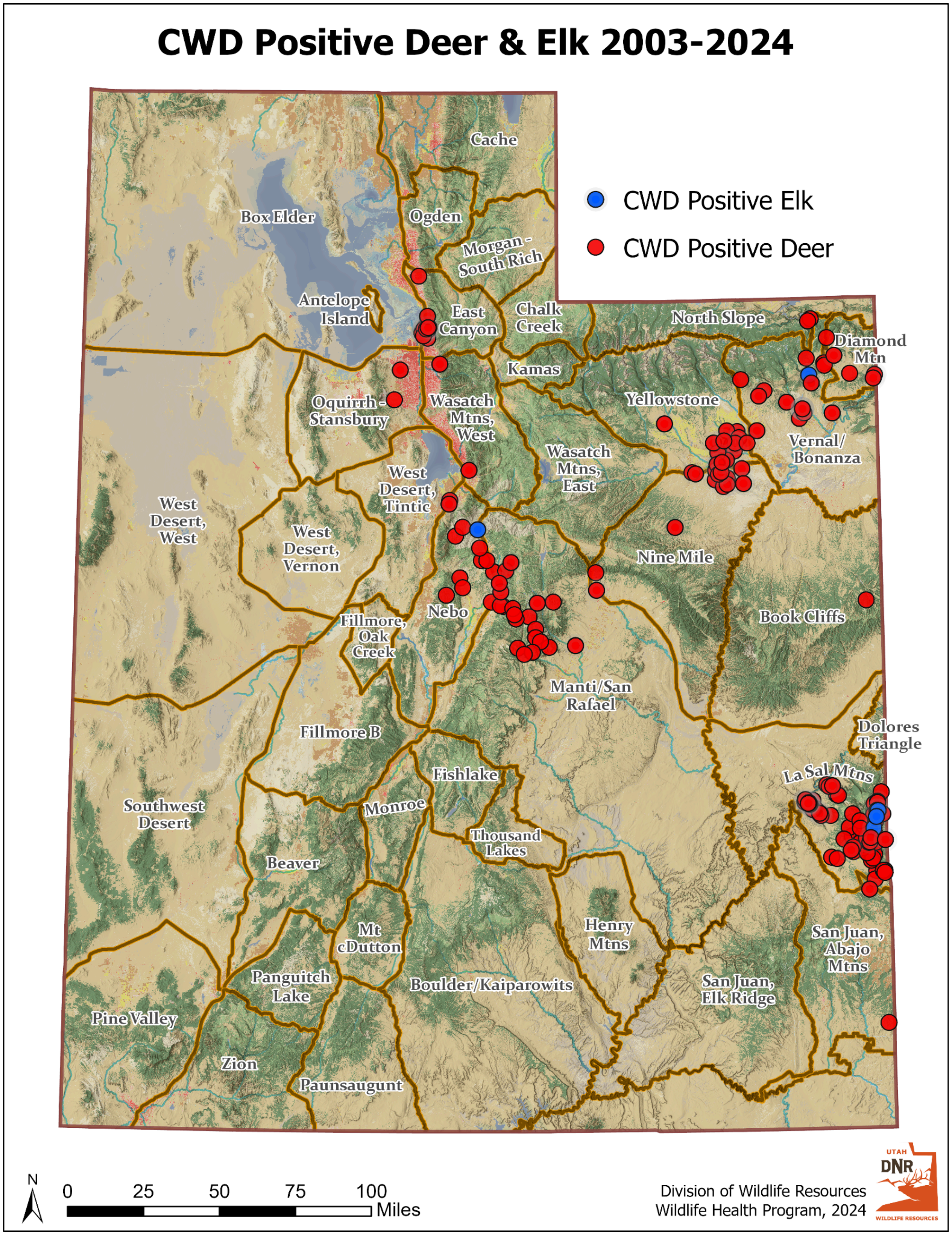
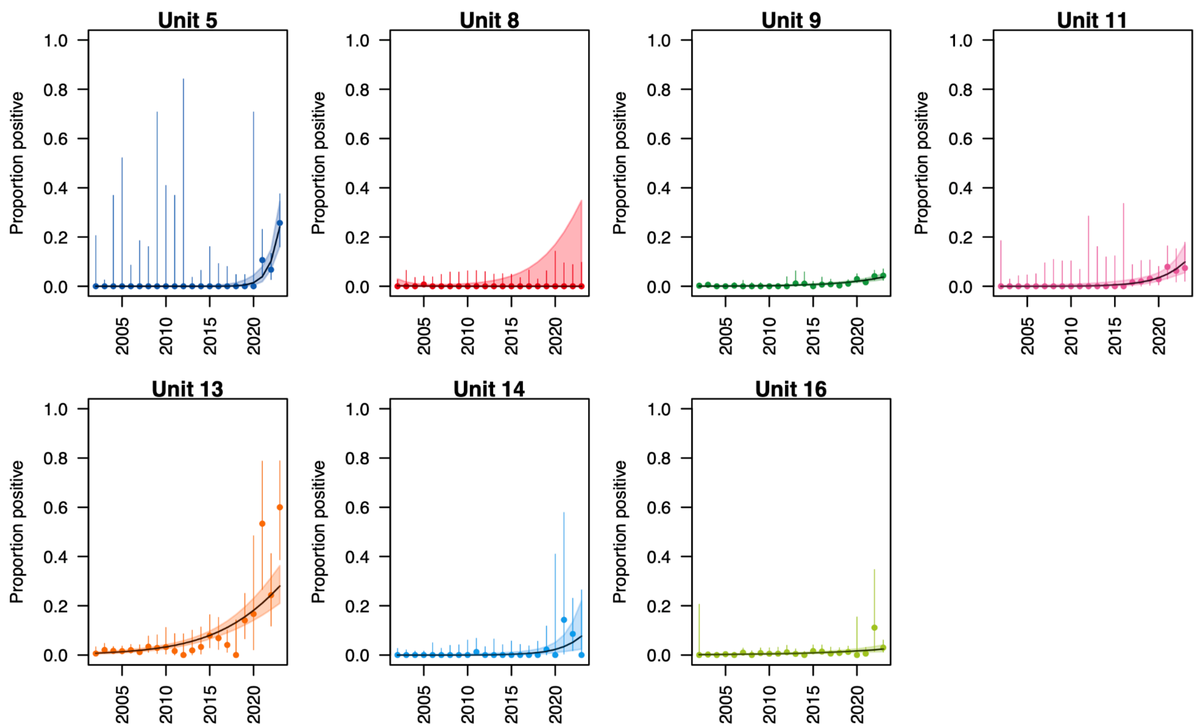



**Figure 1**: Locations of CWD positive deer and elk in Utah from 2002-2024.

**Table 1**. Total number of samples collected (Total) and number (Positive) and percent positive (%) mule deer in CWD positive units in Utah from 2002 – 2024. In addition to the data shown in the table, six elk have tested positive for CWD during this time period, one in Unit 9, four in Unit 13, and one in Unit 16.

| | Unit 5 | | | Unit 8 | | | Unit 9 | | | Unit 11 | | | Unit 13 | | | Unit 14 | | | Unit 16 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **Total** | **Positive** | **%** | **Total** | **Positive** | **%** | **Total** | **Positive** | **%** | **Total** | **Positive** | **%** | **Total** | **Positive** | **%** | **Total** | **Positive** | **%** | **Total** | **Positive** | **%** |
| **2002-03** | 16 | 0 | 0.00 | 138 | 0 | 0.00 | 423 | 1 | 0.24 | 18 | 0 | 0.00 | 166 | 1 | 0.60 | 136 | 0 | 0.00 | 16 | 0 | 0.00 |
| **2003-04** | 141 | 0 | 0.00 | 55 | 0 | 0.00 | 495 | 3 | 0.61 | 125 | 0 | 0.00 | 244 | 5 | 2.05 | 175 | 0 | 0.00 | 549 | 1 | 0.18 |
| **2004-05** | 8 | 0 | 0.00 | 102 | 0 | 0.00 | 563 | 0 | 0.00 | 85 | 0 | 0.00 | 420 | 7 | 1.67 | 226 | 0 | 0.00 | 549 | 0 | 0.00 |
| **2005-06** | 5 | 0 | 0.00 | 133 | 1 | 0.75 | 493 | 0 | 0.00 | 78 | 0 | 0.00 | 316 | 5 | 1.58 | 223 | 0 | 0.00 | 594 | 2 | 0.34 |
| **2006-07** | 41 | 0 | 0.00 | 94 | 0 | 0.00 | 375 | 1 | 0.27 | 71 | 0 | 0.00 | 300 | 6 | 2.00 | 72 | 0 | 0.00 | 392 | 0 | 0.00 |
| **2007-08** | 18 | 0 | 0.00 | 75 | 0 | 0.00 | 151 | 0 | 0.00 | 37 | 0 | 0.00 | 171 | 2 | 1.17 | 133 | 0 | 0.00 | 308 | 3 | 0.97 |
| **2008-09** | 21 | 0 | 0.00 | 62 | 0 | 0.00 | 251 | 0 | 0.00 | 32 | 0 | 0.00 | 148 | 5 | 3.38 | 93 | 0 | 0.00 | 210 | 0 | 0.00 |
| **2009-10** | 3 | 0 | 0.00 | 62 | 0 | 0.00 | 254 | 0 | 0.00 | 34 | 0 | 0.00 | 104 | 3 | 2.88 | 87 | 0 | 0.00 | 247 | 2 | 0.81 |
| **2010-11** | 7 | 0 | 0.00 | 57 | 0 | 0.00 | 391 | 0 | 0.00 | 34 | 0 | 0.00 | 62 | 2 | 3.23 | 59 | 0 | 0.00 | 187 | 1 | 0.53 |
| **2011-12** | 8 | 0 | 0.00 | 56 | 0 | 0.00 | 304 | 0 | 0.00 | 52 | 0 | 0.00 | 62 | 1 | 1.61 | 80 | 1 | 1.25 | 175 | 1 | 0.57 |
| **2012-13** | 2 | 0 | 0.00 | 60 | 0 | 0.00 | 93 | 0 | 0.00 | 11 | 0 | 0.00 | 41 | 0 | 0.00 | 107 | 0 | 0.00 | 181 | 2 | 1.10 |
| **2013-14** | 99 | 0 | 0.00 | 73 | 0 | 0.00 | 87 | 1 | 1.15 | 21 | 0 | 0.00 | 53 | 1 | 1.89 | 55 | 0 | 0.00 | 223 | 1 | 0.45 |
| **2014-15** | 55 | 0 | 0.00 | 70 | 0 | 0.00 | 93 | 1 | 1.08 | 29 | 0 | 0.00 | 61 | 2 | 3.28 | 86 | 0 | 0.00 | 239 | 0 | 0.00 |
| **2015-16** | 21 | 0 | 0.00 | 74 | 0 | 0.00 | 179 | 0 | 0.00 | 28 | 0 | 0.00 | 76 | 6 | 7.89 | 63 | 0 | 0.00 | 247 | 4 | 1.62 |
| **2016-17** | 38 | 0 | 0.00 | 104 | 0 | 0.00 | 148 | 1 | 0.68 | 9 | 0 | 0.00 | 73 | 5 | 6.85 | 84 | 0 | 0.00 | 213 | 3 | 1.41 |
| **2017-18** | 44 | 0 | 0.00 | 54 | 1 | 1.85 | 249 | 2 | 0.80 | 61 | 1 | 1.64 | 98 | 4 | 4.08 | 97 | 0 | 0.00 | 172 | 1 | 0.58 |
| **2018-19** | 76 | 0 | 0.00 | 123 | 1 | 0.81 | 308 | 1 | 0.32 | 51 | 1 | 1.96 | 24 | 0 | 0.00 | 64 | 0 | 0.00 | 238 | 2 | 0.84 |
| **2019-20** | 76 | 0 | 0.00 | 57 | 0 | 0.00 | 379 | 4 | 1.06 | 65 | 2 | 3.08 | 64 | 9 | 14.06 | 45 | 1 | 2.22 | 239 | 3 | 1.26 |
| **2020-21** | 3 | 0 | 0.00 | 24 | 0 | 0.00 | 407 | 12 | 2.95 | 106 | 3 | 2.83 | 12 | 2 | 16.67 | 7 | 0 | 0.00 | 22 | 0 | 0.00 |
| **2021-22** | 47 | 5 | 10.64 | 37 | 0 | 0.00 | 432 | 7 | 1.62 | 76 | 6 | 7.89 | 15 | 8 | 53.33 | 7 | 1 | 14.29 | 178 | 1 | 0.56 |
| **2022-23** | 104 | 7 | 6.73 | 40 | 0 | 0.00 | 412 | 17 | 4.13 | 64 | 4 | 6.25 | 37 | 9 | 24.32 | 35 | 3 | 8.57 | 18 | 2 | 11.11 |
| **2023-24** | 70 | 18 | 25.71 | 36 | 0 | 0.00 | 347 | 15 | 4.32 | 54 | 4 | 7.41 | 25 | 15 | 60.00 | 12 | 0 | 0.00 | 234 | 7 | 2.99 |
| **Total** | 903 | 30 | 3.32 | 1586 | 3 | 0.19 | 6834 | 66 | 0.97 | 1123 | 19 | 1.69 | 2572 | 98 | 3.81 | 1946 | 6 | 0.31 | 5431 | 36 | 0.66 |

**Figure 2:** The polygons are 95% confidence interval for the curve. The curve is a fit to a logistic regression of prevalence (# positives, total # tests) against the year. The lines run to 95% confidence intervals fit separately to each unit-year.




**Risk factors for spread of CWD and options for management:**

Once CWD is established in a population it is unlikely to be eradicated. Currently, there are no effective treatments or vaccines available for CWD. At the time of writing of this plan, Utah first detected CWD in its cervid population almost 2 decades ago. The goal of CWD management in Utah is therefore *to slow the spatial spread of the disease*, *to prevent further increase in CWD prevalences in affected areas*, and *detect new infection foci as early as possible*. As deer are more susceptible to CWD than elk and moose, CWD management actions and sampling efforts will therefore primarily target mule deer populations at this time, as a reduction in CWD prevalence in mule deer likely will reduce the spread of the disease to other cervid species as well.

Chronic wasting disease prions can persist in the environment (Almberg *et al.* 2011), and environmental contamination may contribute to transmission of the disease within infected areas. Deliberate, localized reduction of population densities ("hot-spot culling") has been utilized by multiple states and may be effective in reducing CWD prevalences locally. However, sustained actions are needed in order to achieve long term effects, and these efforts have therefore yielded mixed results (Miller & Fischer 2016; Wolfe 2018).

Male deer are more likely to be infected than females (Miller *et al.* 2000; Grear *et al.* 2006; Rees *et al.* 2012), and statistical modeling has shown that harvest management may be most effective when focused on antlered deer (Jennelle *et al.* 2014; Potapov *et al.* 2016). Bucks over 4 years of age are more likely to be infected with CWD (Miller & Conner 2005), and targeting older age bucks may therefore be a tool for reducing CWD prevalences. Hunts later in the hunting season and during the rut appear to be especially effective in increasing adult male harvest and may therefore be an effective tool for targeting this age group. Research is currently underway to better understand the effect of different harvest strategies on CWD prevalences and spread.

Other risk factors for spread of CWD include movements of animals and animal parts (Williams & Miller 2003), and artificial concentration of cervids through baiting and feeding (Fischer & Davidson 2005). Implementing and enforcing carcass import regulations, reducing artificial concentration of wild cervids by prohibiting baiting and feeding, and avoiding translocation of wild cervids are therefore management options that may reduce the risk of CWD transmission.

The Western Association of Fish and Wildlife Agencies (WAFWA) published Recommendations for adaptive management of Chronic Wasting Disease in the West (WAFWA 2017), which outlines possible CWD management strategies and recommendations for how to evaluate their effectiveness. Some of these recommendations have been incorporated in this plan.

**Human health risks associated with CWD:**

To date there has been no direct evidence that CWD is transmissible to humans (CDC 2018). A study investigated the occurrence of prion associated diseases over time in a CWD infected area of Colorado and did not find evidence of a higher incidence of prion associated diseases in residents (MaWhinney *et al.* 2006). Further, transgenic mice with human prion proteins, failed to develop the disease when exposed to elk CWD prions (Kong *et al.* 2005). Recently, a Canadian study successfully infected cynomolgus macaques by intracranial and oral routes (Czub 2017), however, a study by Race et al. 2018 reported no infection of the same species 11-13 years after experimental inoculation with CWD prions.
The UDWR maintains a website with information on CWD in the state and beyond and provides general advice on how to reduce the risk of exposure. Hunters are advised not to harvest animals that appear sick or eat meat from suspect or positive animals. The following simple precautions are recommended when handling the carcass of any deer, elk, or moose:

- Do not handle or consume wild game animals that appear sick. Instead, contact your local DWR office and notify them of the location of the sick animal.
- Do not consume meat from animals known to be infected with CWD.
- Wear rubber or latex gloves when field-dressing big game.
- On all deer, bone out the meat, and avoid consuming the brain, spinal cord, eyes, spleen and lymph nodes of harvested animals.
- Minimize handling of soft tissues and fluids. Wash hands with soap and warm water after handling any parts of the carcass.
- Knives, saws, and cutting table surfaces should be disinfected using a solution of 50 percent household bleach for at least an hour.
- Please contact the Utah Division of Wildlife Resources for additional information or if you see a sick animal while hunting.

**Objectives of the plan:**

1. Reduce the rate of spread of Chronic Wasting Disease in Utah and reduce the CWD prevalence in infected areas
2. Provide guidelines for response to detection of new infection foci
3. Communicate with the public and participate in scientific research

**Objective 1) Reduce the rate of spread and prevalence of CWD:**

This objective will be reached through the following strategies a) surveillance, b) harvest management, c) reducing risk of importing infected carcasses from other states by carcass import restrictions, d) restricting baiting and feeding of wildlife, e) limiting the translocation of wild cervids, f) prohibiting the rehabilitation of wild cervids, g) implementing clear requirements for disease testing of domestic cervids that are overseen by UDWR, and h) providing guidelines for proper carcass disposal.

**Strategies to achieve objective 1:**

**a) Surveillance:**

The UDWR has conducted CWD surveillance since 2002. To date, the surveillance has consisted of sampling hunter harvested animals in all wildlife management units across the state on a rotational schedule, sampling vehicle killed and other animals in areas with urban deer translocation programs, sample and test any symptomatic cervid, and test all cervids submitted for post mortem examination to the diagnostic laboratory for any reason. In addition, elk have been sampled opportunistically in areas where CWD has been confirmed. The sample efforts are designed to be able to detect ≥1% prevalence of CWD with 95% confidence and employs a weighted surveillance strategy (Walsh 2012). In this system, animals that are more likely to be infected (e.g. a symptomatic animal, vehicle killed animals, or adult bucks), are given a higher weight than animals considered at lower risk for being infected with CWD, (e.g. fawns or yearlings). An overview of the weights allocated to each sample type is shown in Table 2.

**Table 2**: Relative sample weights (points) associated with demographic groups of deer and elk for weighted surveillance of Chronic Wasting Disease. The weights were developed based on mule deer data from Colorado (Walsh 2012).

| | **Weight and species** | |
|---|---|---|
| **Demographic group** | **Mule deer** | **Elk** |
| Symptomatic female | 13.6 | 18.75 |
| Symptomatic male | 11.5 | 8.57 |
| Road-killed male/female, all ages except fawns/calves | 1.9 | 0.41 |
| Other mortalities (predation, other unexplained in adults and yearlings) | 1.9 | 0.41 |
| Harvest, adult males | 1 | 1.16 |
| Harvest, adult females | 0.56 | 1.00 |
| Harvest, yearling males | 0.19 | N/A |
| Harvest, yearling females | 0.33 | 0.23 |
| Harvest, fawns/calves | 0.001 | N/A |

The required sample size for determining a ≥1% prevalence of CWD with 95% confidence is 304 deer and 346 elk (due to lower test sensitivity in elk), using standard equations for determining freedom of disease (Dohoo 2010). Currently, the positive WMU's are sampled annually, whereas the WMU's considered free of CWD are sampled every 5 years on average in clusters of 2-3 units together. Table 3 is showing the sampling units that have been combined since 2006.

Hunter harvested samples are collected at check stations, meat processors, regional offices, and taxidermists. From each animal, the retropharyngeal lymph nodes will be collected. The obex may also be sampled if lymph nodes are not available. Samples will be screened for CWD with an Enzyme-Linked-Immunosorbent Assay (ELISA), and positives confirmed with Immunohistochemistry (IHC) at a National Animal Health Laboratory Network-accredited laboratory (Utah Veterinary Diagnostic Laboratory). Hunters who wish to have their animals tested from areas outside of the test zones can continue to do so at their own expense.

Test results are made available online for hunters to check on the DWR website. If an animal is positive, the hunter is contacted and, if the hunter agrees, the meat and antlers will be confiscated and properly disposed of.

**Table 3**: Wildlife management unit clusters sampled for CWD since 2006 in Utah.

| Year | Wildlife Management Units sampled (mainly hunter harvest) | | | | | | | | Urban |
|---|---|---|---|---|---|---|---|---|---|
| 2006-07 | 2,3,4 | 5,6,7 | 10,11 | 17 | 21,23,25 | 8,9 | 16 | 13,14 | * |
| 2007-08 | 2,3,4 | 6-7 | * | 17 | 21,23,25 | 8,9 | 16 | 13,14 | * |
| 2008-09 | 2,3,4 | 5,6,7 | * | 17 | 23,24,25 | 8,9 | 16 | 13,14 | * |
| 2009-10 | 2,3,4 | * | * | * | 21,22 | 8,9 | 16 | 13,14 | * |
| 2010-11 | 2,3,4 | * | * | * | 27,28,29,30 | 8,9 | 16 | 13,14 | * |
| 2011-12 | * | * | 10,11 | * | * | 8,9 | 16 | 13,14 | * |
| 2012-13 | * | * | * | * | * | 8,9 | 16 | 13,14 | * |
| 2013-14 | 2,3,4 | * | * | * | * | 8,9 | 16 | 13,14 | * |
| 2014-15 | * | 5,6,7 | * | 17 | * | 8,9 | 16 | 13,14 | * |
| 2015-16 | 2,3,4 | * | * | 17 | * | 8,9 | 16 | 13,14 | * |
| 2016-17 | 2,3,4 | * | * | * | 23,24,25 | 8,9 | 16 | 13,14 | * |
| 2017-18 | 2,3,4 | * | 10,11 | * | * | 8,9 | 16 | 13,14 | 5, 17,18,19 |
| 2018-19 | * | 5,6,7 | 10,11 | 17 | 21,22 | 8,9 | 16 | 13,14 | 5, 17,18,19 |
| 2019-20 | * | 5,6,7 | 10,11 | 17 | 21,22 | 8,9 | 16 | 13,14 | * |
| 2020-21 | 1,2,3 | * | 10,11 | 17,19 | 20,27,28,29, 30 | * | * | * | 18 |
| 2021-22 | 1,4 | 5,6 | 10,11 | 19 | 23,24,25,26 | 8,9 | 16 | * | 18 |
| 2022-23 | 4 | 5,6,7 | 11 | 17 | 27,28,29,30 | 8,9 | * | 13,14 | * |
| 2023-24 | 4 | 5,6 | 11,12 | 17 | 20,21,22 | 9 | 15,16 | * | 18 |
| 2024-25 | 2,3 | 5 | 10,11, 12 | * | 23,24,25 | 9 | 16 | 13,14 | 5 |

**Ongoing strategy for hunter harvest surveillance:**

Rotational hunter harvest surveillance:

The rotational hunter harvest surveillance will continue by targeting a cluster of 2-3 units at least every 5 years using the weighted surveillance approach. Known positive units will also be included in the rotational surveillance instead of being sampled every year. A suggested 5- year rotational schedule is outlined in Table 4.

Compulsory testing and other strategies to increase sample size:

In Utah, it has become increasingly difficult to obtain adequate sample sizes to achieve statistically meaningful results. Beginning in the fall of 2020, compulsory testing may be introduced in units that are being surveyed in a given year. Compulsory testing could entail sampling a subset or all of harvested deer in a given unit and year. Additional strategies to increase the number of CWD samples may include sending letters to hunters to request their participation in the CWD surveillance program, providing freezers in convenient locations where hunters can leave the head of their harvested animal, hiring additional staff during the hunting season, having hunters collect and submit their own samples, and working with meat processors and taxidermist to obtain samples.

**Table 4**: Possible 5-year rotational schedule for sampling of hunter harvested mule deer across Utah.

| **Year** | **Units** | | |
|---|---|---|---|
| Year 1 | 1 | 23,24,25 | 12,15,16 |
| Year 2 | 2,3,4 | 17 | 13,14 |
| Year 3 | 5,6,7 | 10,11 | 8,9 |
| Year 4 | 18,19 | 20,21,22 | 21,23,24 |
| Year 5 | 22,24,28 | 27,28,29,30 | - |
| Year 6 | Rotation begins from the top | | |

**b) Harvest management:**

Hunting is an important tool to manage cervid populations in Utah and continues to be the most effective source of surveillance samples. Harvest management may also be the most effective tool to reduce spread and reduce or maintain low CWD prevalences. Research has also shown that it may be most effective when focused on antlered deer (Jennelle *et al.* 2014; Potapov *et al.* 2016). To date, most of the CWD positive units in Utah have been managed at low buck to doe ratios, which may have contributed to the relatively low prevalence of CWD in Utah thus far (Conner *et al*, 2021). However, despite these efforts, the prevalence appears to be rising, and as the disease spreads, changes to existing harvest management will likely be necessary in order to prevent further spread of disease in the state.

Bucks over 4 years of age are more likely to be infected with CWD (Miller & Conner 2005), and targeting older age bucks may therefore be a tool for reducing CWD prevalences (WAFWA, 2017). Hunts later in the hunting season and during and after the rut appear to be effective in increasing harvest of older aged bucks infected with CWD (Conner et al., 2000).

Further, CWD does not occur randomly distributed over the landscape, but CWD positive animals are often harvested from within smaller focal areas. This is known because hunters that harvest CWD positive animals are requested to provide an approximate GPS location of harvest. An increase in sample size of animals tested for CWD, e.g. through compulsory testing, may facilitate more effective identification of disease hotspots. More accurately locating disease hotspots could enable managers to increase harvest within those focal areas with the goal of removing more CWD positive animals.

**Strategies to use harvest management as a tool to reduce the spread of CWD:**

Data from Colorado suggests that after initial introduction of CWD into an area, CWD prevalence slowly increases but remains < 5 % for years. However, when an ~5% infection rate is reached, the increase in CWD prevalence becomes exponential and population impacts become detectable (Colorado Parks and Wildlife, 2018). In Colorado, a 5% prevalence is also the threshold for mandatory management action to reduce the prevalence of CWD (Colorado Parks and Wildlife, 2018). In Utah, a 5% prevalence of infection likely has been reached in Unit 13 (La Sal Mountains), whereas in some other units, the prevalence is likely still below 2%, but also with an increasing trend. Because Utah still has a relatively low prevalence of CWD, setting the threshold for action at 5% would result in years of inaction while waiting for the prevalence to become higher. The consequence would not only be more disease in the populations, but also spread of CWD from its current infection foci to other areas. Potentially, valuable limited entry units bordering CWD positive areas could be infected if the prevalence is not kept at the lowest level possible.

Consequently, in order to reduce the risk of an increase in prevalence and spread of CWD, the threshold for implementation of CWD management actions in Utah should be set at detection of CWD. Currently, the CWD surveillance program is aimed at detecting a ~1% prevalence of CWD with 95% confidence. Based on this surveillance program, the threshold for taking action should therefore be set at the detection of the first CWD positive, which, if sample sizes are met, likely would mean that the CWD prevalence is ~1%. The type of action taken in a unit should be decided by the regional biologist, in consultation with the big game and wildlife health programs.

One or more of the following harvest management strategies can be implemented in units with ≥1% prevalence of CWD:

- The buck to doe ratio of each unit is outlined in the unit management plans. If CWD is present in a unit, the buck to doe ratio should be kept at the lowest end of the range outlined in the plan.
- Late season buck hunts may be implemented within focal hotspot areas within CWD positive units. The goal of such hunts is to target prime age class bucks that are more likely to be infected with CWD. The boundaries of such “hotspot” areas will be determined by the DWR veterinarian, regional biologists and managers and be based on previous CWD surveillance, deer movement data, and location of winter ranges. These boundaries may be changed if CWD spreads from the original infection foci.
- If CWD is detected in units with higher buck to doe ratios, a late season hunt can be implemented immediately to target prime age class bucks. The area in which the late season hunt is implemented should be determined by the area biologist and wildlife managers based on knowledge of deer movements and location of winter ranges. In addition, change in hunt management to lower the buck to doe ratio across the unit should be considered.
- Issuance of more buck and doe hunting licenses to lower the population density.

- Shifting of the harvest to later in the season during and after the rut to target prime age class bucks that are more likely to be infected with CWD.
- In extreme cases, adding a unit wide hunt later in the season during or after the rut to target prime age class bucks and increase overall harvest.
- Increasing harvest on private land and in urban areas by increasing collaboration with private landowners, wildlife management areas, cities, counties and other entities including issuing buck deer permit vouchers to cooperating landowners.

In order to reduce focal disease hotspots, managers could consider the following management options in addition to late season buck hunting:

- Increase the overall number of tags within a focal hotspot area.
- Add doe hunts within focal hot spot areas.

Ideally, the effectiveness of new management strategies should be evaluated over a period of at least 10-15 years (2-3 sampling rotations). Additionally, any implementation of targeted strategies (e.g. late season buck hunts within focal hotspot areas) should involve additional annual CWD monitoring to determine the prevalence of CWD within the focal area and longer term effectiveness of the strategy. As new science becomes available additional CWD management strategies may be added to this plan.

**c) Carcass import restrictions:**

The import of deer, elk and moose carcasses from known infection areas is prohibited. Only meat that is cut and wrapped either commercially or privately, quarters or other portion of meat with no part of the spinal column or head attached, meat that is boned out, hides with no heads attached, skulls or skull plates with antlers attached that have been cleaned of all brain matter and spinal column tissue, antlers with no meat or tissue attached, upper canine teeth known as buglers, whistlers or ivories, and finished taxidermy heads are allowed. The Division keeps a list of states, provinces, game management units, equivalent wildlife management units, or counties on their website, from which it is prohibited to import carcasses, except for the parts listed above. Prohibiting import from infected units or counties instead of from entire states that have CWD, significantly increases the risk of bringing in an infected carcass as finding CWD is very dependent on the quality of the surveillance.

**Strategy to reduce risk of importing CWD infected carcasses through import restrictions:**

It is prohibited to import carcasses, except for the carcass parts listed below from any state where CWD has been detected. Additional states may be added as necessary.

**Permitted parts**: Only the following parts of wild deer, elk and moose may be imported from states with confirmed CWD:

- Meat that is cut and wrapped either commercially or privately
- Quarters or other portion of meat with no part of the spinal column or head attached
- Meat that is boned out
- Hides with no heads attached
- Skulls and skull plates with antlers attached that have been cleaned of all brain matter and spinal column matter
- Antlers with no meat or tissue attached
- Upper canine teeth known as buglers, whistlers or ivories

- Finished taxidermy heads

**d) Baiting and feeding:**

Baiting and feeding of wildlife in Utah is currently legal and unregulated. However, with the exception of the elk feeding ground at Hardware Ranch in northern Utah, state managed feeding of wildlife only occurs on a very limited basis during extreme winter conditions. Baiting and feeding by private individuals may occur but the extent is unknown.

**Strategy to reduce the risk of CWD transmission through artificial concentration of cervids:**

Artificial concentration of wild cervids can facilitate transmission of CWD and should be avoided. Even during emergency conditions such as extreme winters, UDWR will not feed cervids in areas where CWD has been detected, or in high risk areas where CWD is suspected. All intentional feeding of wild cervids by private individuals should be limited to the largest extent possible. The UDWR will educate the public about the disease risks associated with feeding of wildlife.

**e) Translocation of cervids:**

Import and translocation of cervids significantly increases the risk of spreading CWD, and has been the single most important factor in spreading CWD in North America (Miller & Fischer 2016).

**Strategies to reduce risk of spread of CWD through translocation of cervids:**

The UDWR should not allow for import of free-ranging or captive deer (*Odocoileus* sp.), free-ranging elk (*Cervus elaphus* sp.), or free-ranging or captive moose (*Alces alces*) into Utah. The UDWR has previously translocated free-ranging cervids within the state from areas considered free of CWD. Such translocations carry significant risk of spreading undetected infections and should be limited to the largest extent possible. Translocation of moose away from urban areas is permitted within the same unit.

**f) Rehabilitation:**

Rehabilitation can lead to an unnatural mixing and concentration of wild cervids with unknown background and infection status, and it increases the risk of moving cervids from one area of the state to the other. Further, rehabilitated deer don't always acclimate well to natural conditions when released back into the wild, and these animals often congregate in urban areas resulting in nuisance and public safety concerns.

**Strategy to reduce risk of spreading CWD through wildlife rehabilitation:**

The Utah DWR prohibits the rehabilitation of deer, moose, or elk of any age in order to prevent the mixing of potentially infected and non-infected animals.

**g) Alternative livestock species:**

**Domesticated elk:**

Captive elk ranching is overseen by the UDAF. The Division will continue to collaborate with UDAF on captive elk ranching, prevention of ingress and egress of wild cervids, and finding sustainable solutions to reduce the risk of CWD transmission between captive and wild cervids. If wild deer are found in captive elk facilities, owners may apply for certificate of registration (COR) to lethally remove wild deer, in accordance with R657-71.

**Fallow deer and reindeer:**

Keeping of fallow deer and reindeer in Utah requires the possession of a valid COR issued by the UDWR. A recent rule change resulted in no new reindeer facilities being approved, but current COR holders are grandfathered in. Facilities must meet the standards for keeping fallow deer and reindeer as outlined in the COR, and no permit can be issued before a facility inspection has been conducted and the facility approved. Each fallow deer and reindeer must be identified with a unique identification, and a full herd inventory consisting of ID number, age, sex, disposition, place of origin, place to where the animal was sold (if sold) must be submitted annually. Any animal that dies for any reason must be tested for chronic wasting disease (retropharyngeal lymph nodes and/or obex) at a National Animal Health Laboratory Network (NAHLN) approved laboratory (such as the Utah Veterinary Diagnostic Laboratory) and the test results reported to the UDWR with the annual report. The Division has the right to conduct unannounced inspections at any time to determine whether the reported inventory is correct. Failure to comply with these regulations will lead to revocation of the COR.

**h) Carcass disposal:**

Disposal of infected carcasses is a concern for environmental contamination, and potentially could be a source of spread of CWD.

**Strategy to avoid CWD spread through carcass disposal**:

Incineration, alkaline hydrolysis tissue digestion, and burial in an approved, active landfill are considered suitable methods for carcass disposal (AFWA 2018). The DWR will continue to educate hunters, the public, meat processors, and taxidermists about the risk of CWD, and appropriate carcass disposal methods. Hunters and meat processors are encouraged to help prevent the spread of CWD by following management practices such as a) processing the carcass in the field and thereby not move it out of the area of origin, b) disposing carcasses by burial in a landfill, or c) disposing unused animal parts and wild game meat in double bagged plastic bags in the household trash for burial at the landfill.

**Objective 2) Provide guidelines for response to detection of new infection foci**

**Strategy: Implement population reduction and sampling to determine prevalence**

Aggressive sampling in focal areas was conducted early in the CWD epidemic in Utah but has not been used as a tool since. If CWD is detected in new areas, strategies as outlined under objective 1 should be implemented, but in addition, an immediate response should also be considered on a case by case basis. A more aggressive approach should especially be considered especially in areas where CWD has previously not been detected, and that are located far from previous infection foci.

Factors that may determine the strength of a response:

- o Distance to CWD positive areas

- Resident or migratory population
- Connectivity or isolation to other populations
- Size of the population
- Current hunt management of the population
- Presence of other cervid species
- Presence of domestic cervid facilities (elk, reindeer, fallow deer)
- Accessibility (private and public land)
- Hunting opportunity for the public
- Public perception of the proposed change or intervention
- Location with respect to another positive area out of the State of Utah or tribal ground

If CWD is detected within a new area, a feasible course of action should be determined by area biologist and wildlife managers based on factors listed above.

Strategies to consider may include:

- Immediate, localized reduction of population densities.
- Immediate, intensive sampling in areas around the positive animal in order to determine CWD prevalences.
- Immediate implementation of a late season hunt targeting older age class bucks.

**Objective 3) Communicate with the public and participate in scientific research.**

This objective will be reached through the following strategies: a) Communication with the public, and b) participation in relevant, applied research.

**a) Communication with the public:**

The UDWR is committed to providing the public with factual, timely and accurate information on the CWD prevalence, distribution, and management in the State. The Division will maintain an up to date website and release relevant information through other media outlets when necessary. The information provided will include where CWD has been found in the State, public health risks as determined by public health professionals, efforts to monitor the disease, links to laws and regulations pertaining to CWD, information on carcass import restrictions, and how the public can help minimize the spread of CWD. The UDWR will engage hunters in education about the disease transmission risks associated with baiting and feeding wildlife, using urine scents and lures, and harvest management to manage CWD prevalence in order to gain public support for any regulations and management actions that may be necessary. The location of hunter check stations, regional offices, and annual units for CWD surveillance will also be publicized on the CWD website and prior to the hunting season on social and other DWR media outlets.

**b) Participation in relevant, applied research:**

The Division will participate in applied research that is relevant for enhancing knowledge about CWD. Participation in relevant research projects will be decided and approved by UDWR on a case by case basis.

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