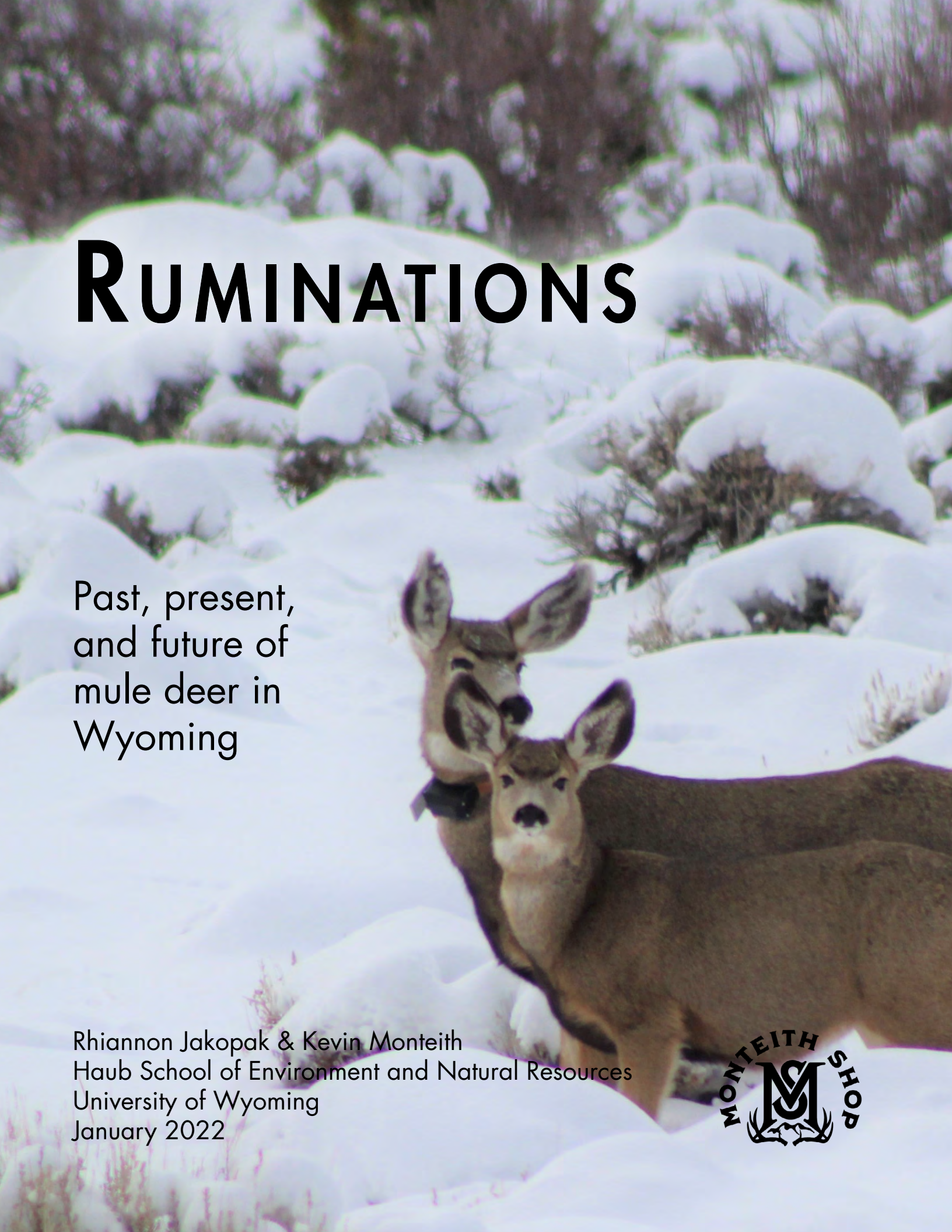

RUMINATIONS

Past, present, and future of mule deer in Wyoming

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MONTEITH SHOP

Mule deer management rests on a large body of evidence.

Mule deer are an icon of the American West: we trudge up steep slopes in search of elusive males, we watch them effortlessly bound across our highways, and we stop our morning activities for a glimpse of a fawn out our kitchen windows.

Yet, having large, strong populations of mule deer is not a given, and across their range, mule deer populations today rarely reach the levels that we desire.

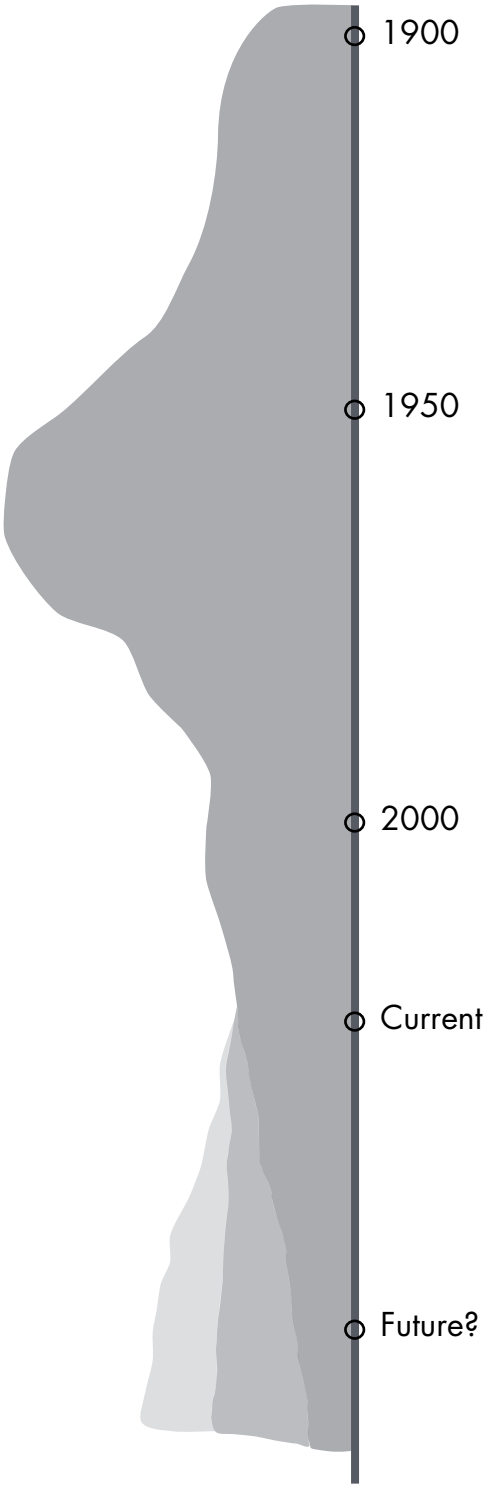
From hunters to wildlife watchers to wildlife biologists, we all want to see robust populations of mule deer throughout Wyoming. Getting there requires, in part, a solid foundation in science and research. The following pages summarize recent research relating to mule deer in Wyoming, with a focus on how the factors interact with various elements of the environments in which mule deer live. We hope that stakeholders can use this information to incorporate evidence into discussions of mule deer management.

Research helps us improve our chances that an action we take will have the outcome we intend. What is happening in each herd depends on local circumstances and habitats, but there are commonalities that make research from one herd applicable to others. We can use these commonalities and lessons to shape management decisions. Keeping the current state of the science and understanding of mule deer in mind during working groups and collaborative processes can help increase certainty of how our actions may help reach goals for our mule deer populations.

LaSharr

Mule deer timeline and background

Mule deer populations have fluctuated through time because of a complex interaction between what mule deer require to live out their lives, what humans desire, and the realities of what a landscape can support. Looking at their population trends through time can give important insight into the mule deer populations of today and for what is possible in the future.



Mule deer numbers begin to rebound after westwide population declines caused by colonization.

Populations peak, but likely rose above what environments could support over the long term.

Largely because of habitat limitations, mule deer populations across the western US begin to decline relative to their peaks in the 1950s and 1960s.

Some populations have stabilized, while others remain in decline. Most are below herd objectives. Mule deer currently face increasing droughts, major fire suppression, major habitat loss and fragmentation, shifts in livestock grazing, and complex interactions with other species.

The future of mule deer is, of course, unknown. Sustainable mule deer populations in the future depend on future environmental conditions, various pressures on the landscapes mule deer live in, and the management efforts we implement today.


LaSharr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Jakopak

Key takeaways

Nutritional condition integrates environmental context to indicate how a species is faring.

Mule deer live in a risky world, with limited ways of responding to risk.

Success of habitat treatments depends on habitat type and environmental conditions in a specific area.

Energy development affects mule deer populations by directly removing habitat, and indirectly by shifting deer away from their preferred habitats and the food that comes with it.

Migrations expand access to food and habitat, leading to larger and more robust populations of mule deer.

The status of current mule deer populations reflect landscapes and processes that affected past generations.

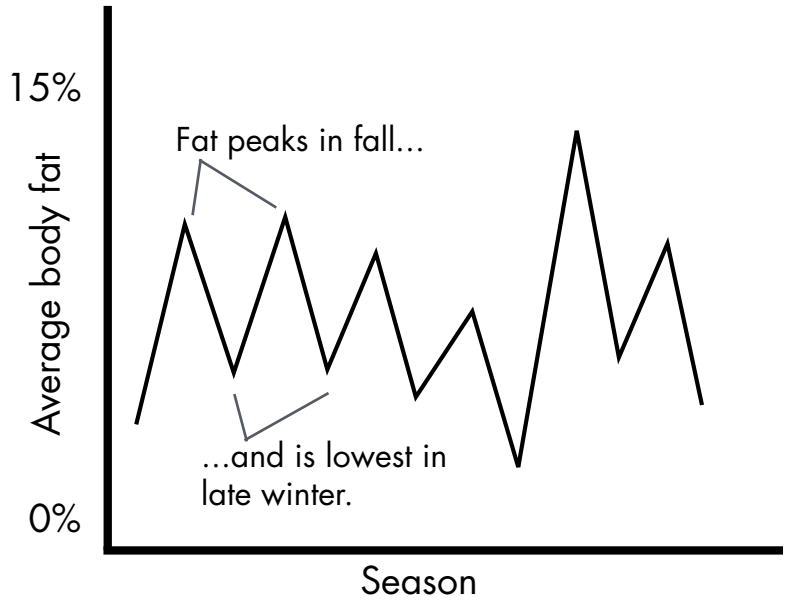
Food is the foundation for any mule deer population.

We grab most of our food off of shelves in grocery stores, but life is not so easy for mule deer. Mule deer spend much of their days getting the food they need to grow antlers, raise offspring, and meet their daily energetic demands. If deer have access to high-quality food, males can grow large antlers and females can raise more fawns. Without enough food, males could be small or populations could dwindle.

Unlike our grocery stores, mule deer habitat is not stocked with high-quality food year-round. Winter usually brings cold temperatures, deep snow, and meager forage. Deer nibble on shrubs, but they also get some of their energy over winter by burning fat they built up over summer. Having fat increases the chances that a mule deer will survive a winter, and for females, it increases the chance that she can successfully raise fawns the following summer. Whether a mule deer survives the winter often depends on previous seasons, including where they spent their summers and even the harshness of previous winters. How fat deer are influences whether a population increases, stays steady, or declines.

The building block for any population is food. Without it, no other aspect of what could affect a deer population will matter. Therefore, how we think about the size of deer populations, and how big they could grow to be, should start with thinking about food.

Researchers use ultrasounds to measure fat levels and pregnancy status of mule deer, which is critical for understanding the role that food and nutrition play on populations. This photo shows the eye of a mule deer fetus. The size of a fetus is often connected to mom's nutrition and the location of her summer range.



Mule deer fat fluctuates between seasons since they build up fat over the summer and use most of those stores over the winter. If a deer loses too much fat, they will die from malnutrition. Paying attention to these fluctuations can help us understand how the population is doing.


LaSharr

Predators can, but don't always, influence mule deer populations.

Mule deer have many predators, including golden eagles, bobcats, grizzly bears, mountain lions, and humans. Multiple species prey on fawns, but mountain lions tend to be the primary non-human predator for adult mule deer. Although predators can and do play a negative role in some instances, predators only contribute to low or declining population sizes of mule deer in certain circumstances.

Predators often play a role in making sure that mule deer don't eat themselves out of house and home. In the past, we have removed nearly all predators from a specific area, and watched as mule deer populations first increased dramatically, then crashed as their numbers went above what their habitat could handle. In other instances, however, when mule deer populations are low, predators can kill animals and either slow down population increases or cause populations to decline. Though they are often an easy target to blame for declines in deer populations, assuming predators are the reason without considering other factors can lead to fruitless actions to reverse declines.

How do we know whether food or predators are the main factors shaping mule deer populations?

To answer this question, we need to know a lot about a population, including how much food is available, population density, and whether predators are killing animals that would otherwise die from causes like starvation.

But there are some key trends that we can look for to figure out what is contributing to declines. If habitat is the main factor, we expect adult females will show the effects by having less body fat and produce fawns with low chances of survival. If predators are the main factor, we expect the opposite: adult females with more body fat and producing robust fawns. A predator killing a fawn or an adult doesn't automatically mean bad things for the population, because if a population is near the level that the habitat can support, losing a fawn or adult to a predator can simply mean more food for those deer than remain. But, if there are ample food resources, predators killing fawns or adults can stall population increases, or even cause decreases.


Shakeri

Survival requires simultaneously balancing multiple risks.

Mule deer live in complex, dynamic environments. To survive, they must balance risks of finding enough food, caring for young, reproducing, interacting with other species, avoiding predators, and more, all at once.

Once mule deer reach adulthood, their survival tends to be high. Getting to adulthood, however, is challenging, and young mule deer in most populations have low survival. In most places, 9 out of 10 adult females will survive each year, but sometimes fewer than 3 out of 10 fawns will reach their first year of age. Malnutrition, predation, chronic wasting disease (CWD), adenovirus, and vehicle collisions, among others, all contribute to mule deer mortality.

The home ranges of mule deer frequently overlap with those of elk, and stakeholders and scientists alike are concerned about competition that could occur between the species and what that could mean for mule deer populations. Whereas deer are rigid in their behaviors, elk are more flexibile, which helps elk thrive in a variety of situations. Emerging science is showing that elk and mule deer can eat similar plants, which could cause elk and mule deer to be in competition with each other.

We are just starting to realize how disease shapes the population dynamics of mule deer, although much research is still needed to paint a full picture. CWD is now found throughout much of Wyoming, and it is an especially thorny disease because it is always fatal and can transmit between individuals through both direct contact and the environment. Populations with high levels of CWD can face sharp declines; for example, a population in eastern Wyoming with 20% infection rates faced a 21% population decline. Adenovirus hemorrhagic disease, which is a virus that primarily leads to mortality in mule deer fawns, is another noteworthy disease for mule deer in Wyoming, although little is known about how it affects populations.


Rankins

Left: Mule deer often share the same habitat with species like elk, and often eat the same food.
Below: Diseases like adenovirus, which killed this young deer, are important factors to keep in mind.


Haeussler

In addition to balancing natural sources of risk, mule deer must also navigate a world that is increasingly changed by humans. Well pads and oil rigs are as much a fixture of Wyoming's landscapes as mule deer are, and they create new sources of risk for mule deer to balance.

The interactions between mule deer and energy development is one of the best-studied topics dealing with Wyoming's wildlife. In studies that have examined how mule deer move near energy development in western Wyoming, researchers found that mule deer on average tended to avoid elements of energy development like well pads. Mule deer especially avoid areas that have high traffic. Mule deer do not get used to well pads, even after development has been on the landscape for many years.

Mule deer avoid energy development infrastructure, and they give a wide buffer around it. On average, mule deer will choose to be 0.85 miles away from energy development. By avoiding areas around oil and gas development in addition to the development itself, mule deer are giving up habitat that would otherwise be suitable and accessible. For every unit of habitat loss associated with the construction of well pads and roads, mule deer give up an additional 4.6 units of habitat, and therefore food. This indirect loss substantially reduces the amount of food that is available for a herd, which can reduce herd abundance.

By directly and indirectly removing habitat, energy development can lead to smaller deer populations. One study found that a mule deer population decreased by 36% during a 15-year period with energy development. As discussions of other forms of energy development, such as wind and solar, occur in Wyoming, we can apply the lessons learned from other forms of energy development.


Dwinnell

If mule deer avoid energy development, why do we still see deer near well pads?

The answer is in the details. Studies show that most deer tend to avoid energy development most of the time. Studies don't show that all deer avoid energy development all the time. At the herd level, deer used those areas close to development less than places farther away from development, but we might see individuals near a well pad for a short amount of time.

On-the-ground work can improve mule deer habitat.

Because mule deer are so intimately connected to their landscapes, wildlife and habitat managers can implement on-the-ground treatments to improve habitat conditions and forage quality.

Mule deer rely on sagebrush and other shrubby habitat throughout the winter when few other plants are available to feed on. As sagebrush ages, however, it grows less and becomes less nutritious. Mowing sagebrush is one of the tools used to improve mule deer habitat. Mowing sagebrush removes older, less nutritious parts of the plants and encourages new, nutritious growth.

Focusing on other plant species can help improve mule deer habitat as well. Cheatgrass and other invasive annual grasses are changing the landscapes that mule deer live in, as well as the food that they have access to. As cheatgrass, one of the most infamous invasive species, continues to spread throughout mule deer summer and winter ranges, the invasive grass replaces other plants that are more nutritious for mule deer. Preventing the spread of this species can help mule deer, as well as many other species.

Aspen stands, in contrast, are productive habitat for mule deer. Aspen stands are home to nutritious plants and their dense vegetation provides protective cover for newborn fawns. Habitat treatments, especially fire, can improve aspen stands and help deer that live there.


Jakopak


Randall

Above: Aspen stands are good habitat for mule deer. Two mule deer fawns were born in this aspen stand.

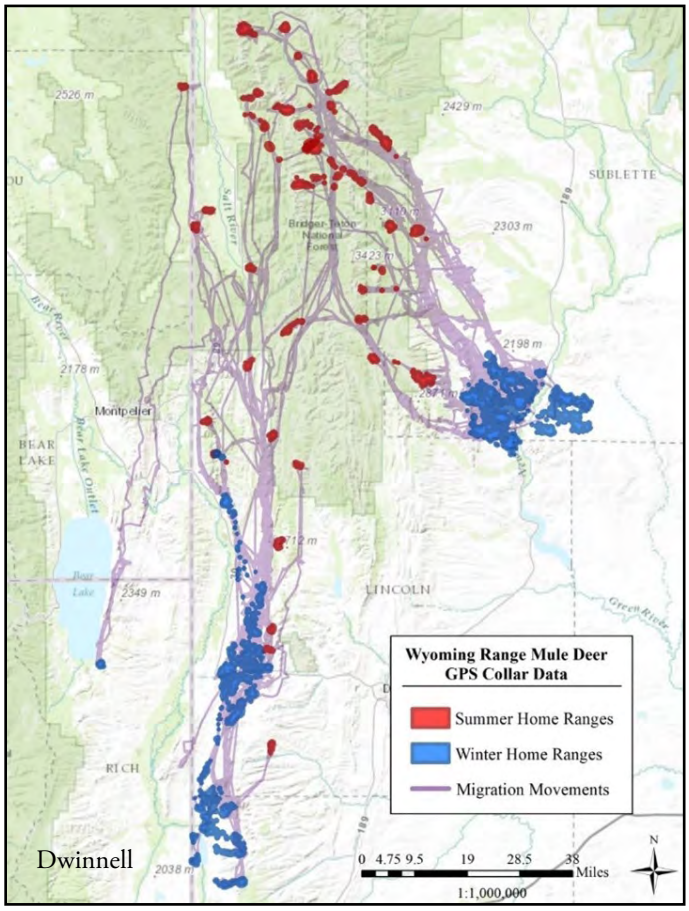
Left: Mowing sagebrush, as this tractor is doing, might help improve forage for mule deer.

The thousands of miles of fences in Wyoming can make chunks of habitat either hard to access or completely inaccessible for mule deer. Fawns have trouble crossing woven-wire fences and adults can get their legs tangled in loose barbed wire. Converting fencing to wildlife-friendly fencing can help reduce risks and mortality for mule deer and numerous other species. There are not currently estimates of how many miles of fencing have been converted to wildlife-friendly fencing across the state, although numerous state agencies, non-profits, non-governmental organizations, and private landowners are actively working to upgrade fences with wildlife in mind.

Although habitat is critical to mule deer, treating and improving habitat isn't straightforward. Even if habitats are perfectly suited for mule deer to live in them, mule deer won't always move into vacant space becuase they are incredibly faithful to where they live. Even though habitat treatments in that pocket won't suddenly lead to more deer, deer could slowly creep into the vacant space in the following decades. Because habitat treatments are expensive and hard to implement, they often occur on small spatial scales, which can make it hard to benefit a large portion of the population. Additionally, mule deer like to stay close to where they know, so they rarely seek out new habitat. This means that habitat management needs to happen at a broad, landscape-scale, and that we need to be patient to see the payoffs for investing in habitat treatments.

Despite these complexities, numerous entities, including non-profit and non-governmental organizations, wildlife agenies, governmental organizations, private landowners, and interested members of the public have come together to help with the important work of improving mule deer habitat.

Some fences are not friendly to wildlife, but updating fences to be wildlife friendly can reduce the risk to mule deer and other species.



Above: When they migrate, mule deer often move from low-elevation winter ranges (blue) to high-elevation summer ranges (red) by way of migratory routes (purple).

Some mule deer migrate to improve access to habitat.

Mule deer can't always meet all of their yearly requirements in a single place because the environments in Wyoming change so much throughout the year. Instead, they often move between separate summer and winter ranges by way of a migratory route. Sometimes these movements are a handful of miles, and other times mule deer migrate over 200 miles each way.

Even though deer have the ability to travel long distances, they rarely change their migratory routes. In a study of 10 mule deer herds, mule deer were more than 80% faithful to their migratory routes. Mule deer use memories of previous migratory routes to guide where they go each year. Mule deer might only need to travel a route one time to be able to remember it well enough to retrace their hoofprints. Scientists are currently trying to understand how mule deer learn their migratory routes in the first place and are trying to determine whether offspring learn their migratory routes from their mothers.

Mule deer take their time traveling between summer and winter ranges, and the migratory path that mule deer take is habitat in its own right. Spring migration can take 4-5 weeks, even though they could cover that distance in just a few days if they traveled straight through. Mule deer move so that they are traveling across the landscape at the same pace as plants grow in the spring. This pace lets them eat nutritious food, gain fat, and start to recover from winter. Females will give birth on a day that is in line with how long her migratory route is and when nutritious plants are available, showing just how tightly their mule deer are linked to their environments.

Many mule deer herds in Wyoming migrate to some degree, and many of our biggest herds, like the Wyoming Range, Sublette, and Baggs herds, are migratory. Nevertheless, some individuals or entire herds are residents that do not complete migrations. Emerging science is showing that maintaining multiple different movement strategies can help promote healthy herds.

Multiple circumstances can influence migration for mule deer. Drought can interfere with plant growth in the spring, which then reduces how much food deer can eat while migrating. Energy development causes mule deer to move through areas more quickly and to reduce the amount of time they spend at stopovers. It takes more calories to move faster, and giving up time at stopovers means giving up prime foraging opportunities. Even the very route that mule deer take can influence their survival, and some routes lead to higher survival than others.

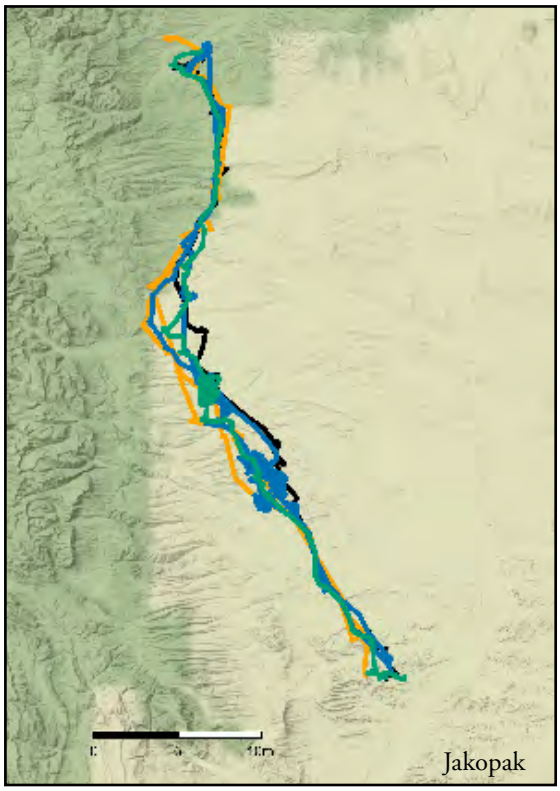
Migrating allows mule deer to access food in more places on a landscape, which spreads out their impact on any single place and increases the amount of food and habitat they have access to. In other words, migration often leads to more mule deer, which means that reducing migrations will lead to declines in populations. Because migration is closely linked with landscape, keeping migrations depends on minimizing factors that disrupt migration and maintaining connections throughout the landscapes mule deer live in. This is a challenging endeavor that requires the continued cooperation and collaboration between landowners, stakeholders, non-profits, scientists, and government agencies.

Current mule deer populations are the culmination of previous generations.

When we see a deer on a landscape, it's usually a result of generations of deer surviving and reproducing in that area. Mule deer tend to stick to what they know and exhibit strong faithfulness to their summer, winter, and migratory ranges. They tend to be faithful even when faced with big changes to their landscapes caused by humans or if the habitat quality declines.

Their faithfulness also means that deer management strategies need to be nuanced. If a pocket that once had plenty of deer suddenly loses those animals, that pocket could be vacant space for generations. Losing memory to a route or a summer range could leave parts of the landscape under-used, even though they might be perfectly suitable mule deer habitat. Over-hunting could remove segments of a herd that will be slow to reoccupy that area in the future. Their faithfulness and these cross-generational aspects of their biology have almost certainly played a role in their limited ability to respond to a changing environment. To help prevent irreparable damage, we need to understand how seasonal ranges and migratory routes are established in the first place, and researchers are working on this topic.

Mule deer live in the environments they have inherited from previous generations, which means that any management strategy we employ needs to keep this context in mind. If we fail to consider this longer-term context, we can quickly develop unreasonable expectations or have to wrestle with unintended consequences of our actions.



F014, a mule deer from the Wyoming Range, follows her mom's migratory route (black) year after year. The orange, blue, and green lines show the routes that F014 took during her first 3 years of life; it's obvious that F014's routes are similar to her mother's.

The future of mule deer in Wyoming depends on us.

People across stakeholder groups agree that something is causing a decline in mule deer, and that this decline is worth paying attention to. Stakeholders, however, disagree on how to get there. However we proceed in the future, effective management of mule deer requires public communication and support. Changes in management and conservation of mule deer will demand effective communication and understanding the values that shape public perception. The effectiveness of any long-term management strategy will also rely on maintaining and promoting good-quality habitat on both public and private lands throughout Wyoming.

To plan for where our mule deer herds could be in the future, we need to keep in mind the historical context of mule deer to plan our management and conservation actions today accordingly. Though we still have much to learn, we fortunately have a large body of research that we can draw on to inform our decisions. This research continuously highlights just how interconnected mule deer are with their landscapes, and the complexities of this connection means that humans might not be able to readily replicate it if something should happen. The actions we take today need to be proactive, not reactive, if we want to protect this cherished species.

Jakopak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Mule deer are well-researched.

Although there is still much to learn, we benefit from the numerous studies on mule deer, both in Wyoming and beyond. Here are the peer-reviewed references we relied on to build this document.

If you've not heard of peer review before, it is the gold-standard of scientific research, and it is a process that all rigorous science must go through. Once scientists have finished a study, they send their results out to other experts in the field. These experts assess whether the methods the scientists used were appropriate and whether their findings are accurate. This careful process can take months to even years. Each one of the articles below has been through the rigorous peer-review process.

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LaSharr

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