



Wyoming Range Mule Deer Project Summer 2019 Update



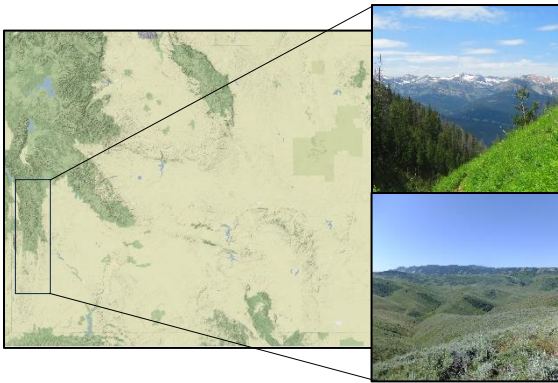
MONTEITH SHOP

HAUB SCHOOL OF ENVIRONMENT
& NATURAL RESOURCES

WYOMING COOPERATIVE FISH
& WILDLIFE RESEARCH UNIT



PROJECT BACKGROUND



Above: The Wyoming Range, highlighted in the black inset, is a remarkable landscape full of wildlife, forests. Locals and non-residents alike use this area to hunt and recreate in.

Below: Male mule deer in the Wyoming Range are venerated throughout the western US and are highly sought-after by hunters.



We at the Monteith Shop have been working to understand myriad aspects of mule deer ecology to inform on-the-ground management, conservation, and policy of Wyoming Range mule deer since 2013. Our work primarily centers on tracking mule deer throughout their lives, while assessing their nutritional condition, movement, habitat use, and survival, among other elements. The Wyoming Range Mule Deer research encompasses multiple projects to provide solutions for immediate management concerns, as well as answer foundational questions in wildlife ecology. Through these efforts, we are uncovering previously unknown aspects of mule deer behavior, life history, and population dynamics that have direct implications for the conservation of mule deer in the Wyoming Range and beyond.

The Wyoming Range is home to breathtaking landscapes, abundant wildlife, lush wildflowers, and ample recreation opportunities. Of all the remarkable landscape characteristics in the Wyoming Range, the mule deer are held in especially high regard. Many in the public are intensely invested in the well-being of this herd of mule deer, and the Wyoming Game and Fish Department has worked to ensure that this population remains robust enough to support sufficient hunting opportunities while protecting the herd overall. Yet, despite substantial efforts to increase mule deer abundance, this population has historically experienced instances of dramatic declines, followed by moderate recovery. Further, since the most notable decline in the mid-1990s, the Wyoming Range mule deer population has remained stagnant or declined. These concerning trends have motivated inquiry into the factors that regulate this cherished herd.

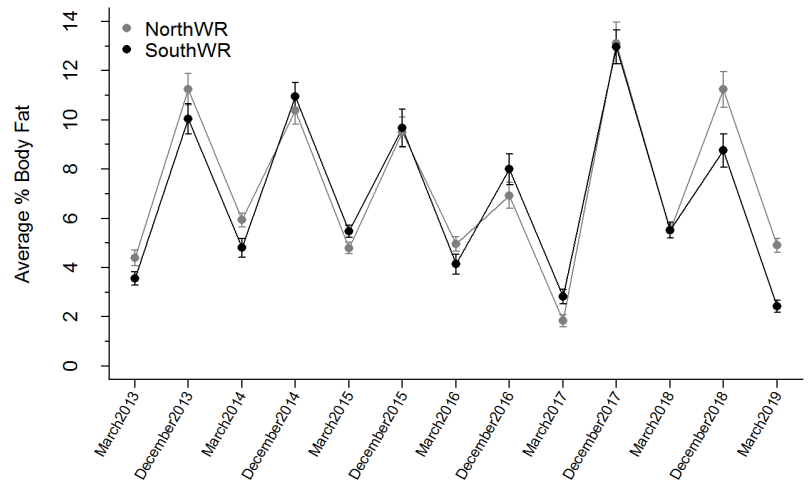


Above: This cross-generational study, which starts with the birth of a fawn, gives us a detailed view into the factors affecting the Wyoming Range mule deer herd. We then monitor individuals throughout their lives, allowing us to assess factors such as nutritional condition, reproduction, and behavior throughout multiple life stages and seasons.

A LONGITUDINAL LOOK AT MULE DEER IN WYOMING

Fawns must grow enough to survive their first winter, yearlings must establish home ranges, adult males fight for the chance to mate, and adult females raise offspring; even this simplistic representation of the demands a deer faces throughout their life suggests that different factors will be important to an animal depending upon where they are in life. Yet, there is a common thread that fuels all of these demands: food.

Over the past 6 years, we have been taking a longitudinal look at the factors influencing the Wyoming Range mule deer herd, using a nutritional ecology framework. Through longitudinal research, we are able to assess how the factors that are most influential might change throughout an animal's life, as well as across generations. This long-term look allows us to identify trends and relationships that shorter studies may have missed. Through the nutritional ecology framework, we evaluate how resources such as food affect individuals, and eventually populations. Using this unique approach, we have begun to develop a comprehensive understanding of how the connections individual deer have with their environments influences population dynamics. This long-term research project has allowed researchers, scientists, and managers to answer on-the-ground management questions and better understand broad ecological phenomena.



Above: Average percent of body fat of adult, female mule deer in the Wyoming Range from March 2013 to March 2019. Long term study of this population has allowed us to document significant crashes in condition of animals during harsh winters.

Each year, we recapture animals each spring and autumn with helicopter netgunning to evaluate their condition as they leave seasonal ranges. Each capture event, we fit an animal with a GPS collar and use ultrasonography to evaluate percent body fat and pregnancy. By capturing animals multiple times throughout their life, we can link various life-history characteristics with behaviors and habitat conditions of individual animals.



Above: At each capture event, we collect a suite of different data points, including measurements of body size, pregnancy and nutritional condition, and biological samples such as blood and fecal samples.

The following pages include updates on the projects we are working on!

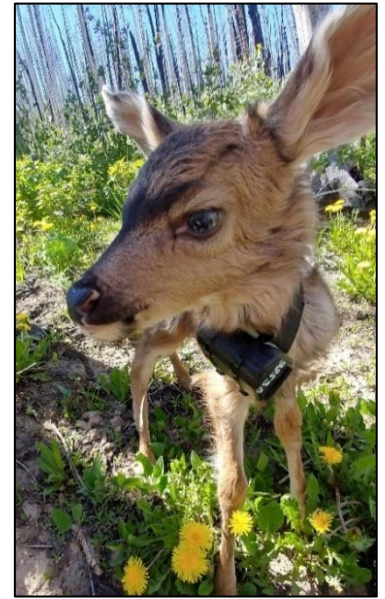
HOW DO FAWNS FARE OVER SUMMER?

Over the past 5 summers, we have collared neonatal mule deer that belong to collared females to monitor survival and determine cause-specific mortality of the most vulnerable segment of the population. Since 2015, we have successfully tracked 341 fawns and have been continually monitoring their survival.



Above: WY Game and Fish biologist, Gary Fralick, collars a fawn during the summer of 2015.

Fawn survival over the past five summers has been variable, and leading cause of mortalities differs from year to year. In 2015, disease was the leading cause of death in fawns over summer. Following a particularly harsh winter in 2016-2017, stillbirths were the leading cause of death in fawns the following summer. This component of the project is still ongoing, but so far we have detected a breadth of various causes for fawn mortality including predation, disease, malnutrition, drowning, hypothermia, vehicle-collision, and just being caught in vegetation.

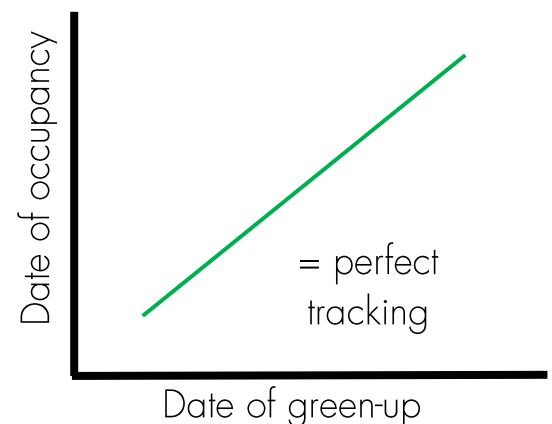


Above: A male fawn collared in June 2018. He survived his first summer and migrated with his brother and their mom to their winter range near Calpet during the fall of 2018.

WHAT DO MULE DEER EAT WHILE MIGRATING?

Migration is a complex phenomenon that allows animals to use high-quality resources available on one seasonal range (e.g., summer ranges), while avoiding resource deficiencies on the other (e.g. winter ranges). Until recently, little has been known about how animals behave along their migration routes, and the potential benefits animals might gain by using different paths at different times. To understand this process better, we evaluated how well animals can match their movement to emerging vegetation. Emerging vegetation provides high quality food during an important period of the year for these animals and might play an important role on their ability to recruit offspring into the population, and ultimately survive.

We found that animals were able to match their movements closely with newly emergent, high-quality forage along elevational gradients on their migration routes. The ability for animals to match their movement to high quality food allows them to maximize the resources on their way to summer range.



Above: An animal that is a 'perfect surfer' matches the date that they use an area on the landscape perfectly with the date that area has the highest quality of resources (or 'green-up').

This research is published!

Aikens, E.O., M. J. Kauffman, J. A. Merkle, S. P. H. Dwinnell, G. L. Fralick, and K. L. Monteith. 2017. The greenscape shapes surfing of resource waves in a large migratory herbivore. *Ecology Letters* 20:741-750.

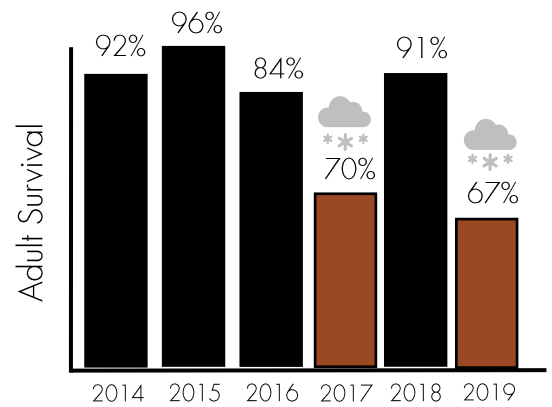
HOW DO MULE DEER RECOVER FROM HARSH WINTERS?

Winters in the Wyoming Range can be extremely harsh, which can cause dramatic dips in over-winter survival and may have long-term effects on population dynamics. We are working to understand the consequences of harsh winter conditions and the associated recovery from severe winters.



Above: Mule deer in Whitney Canyon, WY migrating towards winter range during December 2018.

In 2016 – 2017, the Wyoming Range mule deer herd experienced one of the worst winters on record, and survival of adults was very low compared to years with average winter conditions. Only two years later during the 2018 – 2019 winter, winter conditions again were extremely harsh, and overwinter survival of adults dropped even lower than what we detected in 2016 – 2017. Understanding how animals cope with severe winter conditions and how they survive and reproduce successfully during extreme weather may help to manage populations better under increasingly stochastic and harsh winter conditions.



Above: Overwinter survival of adult, female mule deer in the Wyoming Range.

WHAT DOES THE PUBLIC THINK ABOUT MULE DEER ECOLOGY?

Effective wildlife management hinges on decisions grounded in science, as well as public support of issues relating to wildlife. Lack of public support can cause members of the public to resist, and potentially prevent, management actions from being implemented. To increase public support, many wildlife scientists have increasingly shared their findings and the importance of their work with members of the public. Scientists rarely, however, stop to evaluate whether they are presenting information in the most effective way. To improve communication with members of the public, we are examining how multiple stakeholder groups think about the issues affecting mule deer populations in Wyoming. Results from this research will help to shape future communication strategies, towards the goal of preventing more effective science outreach.



Above: A board game developed by the Monteith Shop to teach the public about the costs and benefits of migration. Using multiple media to interact with different members of the public can be an effective tool in both outreach and education about wildlife in Wyoming.

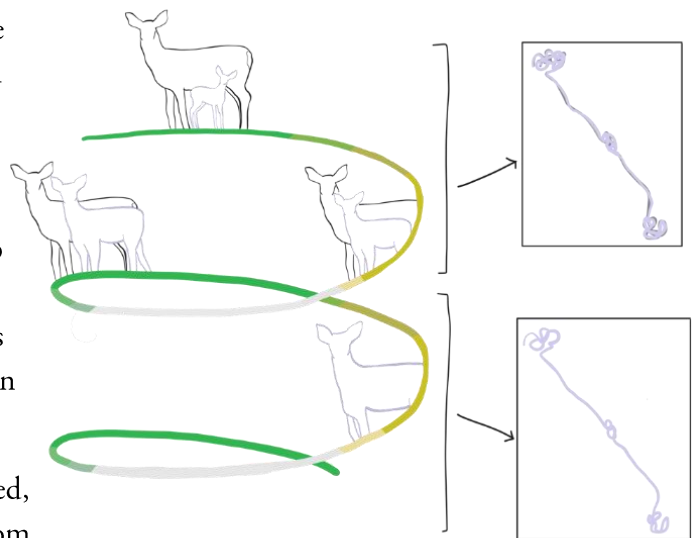
HOW IS MULE DEER MIGRATION ESTABLISHED?

Each year, millions of ungulates migrate across seasonally changing landscapes to access forage that is only available during certain times of the year, to reduce risk of predation and disease, or to escape harsh climactic conditions. These migrations are rarely spontaneous movements, but instead are continuations of behaviors that have been in place for years. Individual mule deer, for example, are extremely faithful to their migratory routes year after year, and rarely deviate from their migratory paths. Despite the high degree of faithfulness scientists have observed, how these behaviors are established in the first place still remains a mystery.

To better understand how migratory behaviors are established, we are evaluating whether migratory behaviors are learned from an animal's mother during the first year of their life. By understanding how migratory behaviors are established, our efforts will aid management seeking to protect migratory behaviors into the future.

Part of this research is published!

Jakopak, R. P., T. N. LaSharr, S. P. H. Dwinnell, G. L. Fralick, and K. L. Monteith. 2019. Rapid acquisition of memory in a complex landscape by a mule deer. *Ecology*. *In press*.

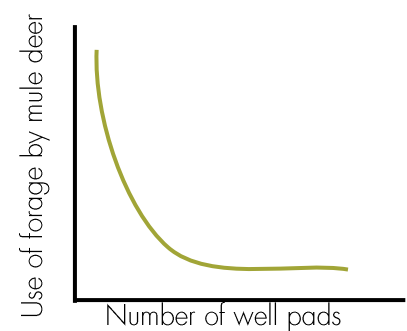


Above: After daughters are born (top center of spiral), we suspect that they migrate with their mother for their first fall migration (right side of spiral) and their first spring migration (left side of spiral). During that first year, mother and daughter will likely migrate together (top right). If migratory behaviors are established during that first year of life, daughters will continue along that same route later in life (bottom right).

HOW DO MULE DEER RESPOND TO ENERGY DEVELOPMENT?

Oil and natural gas are a crucial part of Wyoming's economy, but energy development often co-occurs with wildlife habitat. Understanding how mule deer respond to energy development is critical to the successful management of many of the herds across the state. We evaluated how varying levels energy development on critical winter range affected feeding behavior of mule deer.

Disturbance on winter ranges prompts avoidance, resulting in a loss of otherwise available food—revealing a missing link to population level consequences of behavioral avoidance of disturbance. Animals avoided human disturbance from energy development at both the home range and winter range scales, resulting in indirect habitat loss that was 4.6x greater than the habitat loss from infrastructure, roads, and well pads alone. This work shows that increased energy development on critical winter range has limiting effects on populations.



Above: As wellpads increased, mule deer tended to forage less.

This research is published!

Dwinnell S. P. H., H. Sawyer, J. E. Randall, J. L. Beck, J. S. Forbey, G. L. Fralick, and K. Monteith. 2019. Where to forage when afraid: Does perceived risk impair use of the foodscape? *Ecological Applications*. *In press*.

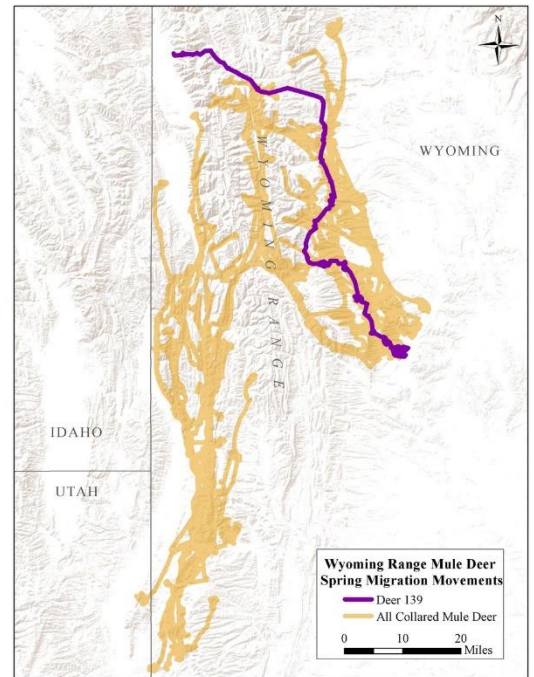
DEER 139 FILM

To highlight the intimate connection between wildlife and their environment, we are creating a film that follows 3 women as they hike, ski, and paddle the migratory route of one of the Wyoming Range mule deer, Deer 139. Sam Dwinnell has been involved with the Wyoming Range Mule Deer project since the beginning, and during the spring of 2018, she along with an all-women team of fellow adventurers and naturalists followed Deer 139's migration trail for 85 miles. The team travelled from Deer 139's winter range in the sagebrush steppe outside LaBarge, Wyoming, up into and over the Wyoming Range, across the Greys River, to an alpine cirque in the Salt River Range, to see first-hand this long, complex, and, until now, largely invisible journey.

The overall objectives with this film was to illuminate the mysteries of long-distance migration, demonstrate the toughness of a seemingly ordinary species like mule deer, and draw in a broad audience by highlighting an all-women team of adventurers and scientists.



This film is coming soon!
This film will be available for viewing in the fall of 2019!



Above: Deer 139's spring migration (purple) and migrations of all other collared mule deer (yellow).

DOES THE ECOLOGY OF MALE AND FEMALE MULE DEER DIFFER?



Above: Until recently, we have assumed that males migrate in the same way females do. Our work will help to elucidate the differences between male and female migration in the Wyoming Range.

The Wyoming Range mule deer herd is revered by locals and many across the West, in large part because of the ample opportunities to harvest high-quality males. Wyoming Range bucks are highly sought-after and ensuring that populations are managed in a way that promotes hunting opportunities for future generations hinges on management practices that are rooted in science.

Surprisingly, we know relatively little about the ecology of males, including their migratory behaviors, dispersal, and vulnerability to harvest. We are exploring the ecology of male mule deer to yield greater context to their presence and management. In particular, we aim to address questions related to migration, habitat selection, and harvest. Males and females differ dramatically in the stressors they face: females expend the most energy in rearing offspring, whereas males focus on obtaining mating opportunities. To date, however, most research concerning the management of mule deer has focused primarily on females because of their role in driving population dynamics; yet, this singular focus renders a weaker understanding of the ecology of the male segment of our deer populations.

FUTURE DIRECTIONS

The overall goal of our continued work in the Wyoming Range will be to build on our understanding of the nutritional and population ecology of this herd. As before, our overall approach will continue to weave data on nutritional condition, habitat condition, migration, and population performance together to understand factors regulating Wyoming Range mule deer and the ability of the current habitat to support mule deer. With a distinct reduction in density following the several harsh winters this herd has experienced, habitat and density-dependent feedbacks onto the population should illuminate even more so than previously. Our approach will allow us to continue to elucidate the relative roles of habitat, nutrition, predation, and disease on the regulation of deer in western Wyoming, and fully grasp the magnitude and extent of the effects of the transient, but clearly regulatory role of winter.



OUR TEAM

The Wyoming Range Mule Deer project is conducted in collaboration with Wyoming Game and Fish, BLM, and the USFS. This project is led by Principal Investigator Dr. Kevin Monteith, along with master's students, doctoral students, and research associates at the University of Wyoming.



Ellen



Rhiannon



Tayler



Samantha



Kevin

PARTNERS

The Wyoming Range Deer Project is a collaborative partnership in inception, development, operations, and funding. Without all the active partners, this work would not be possible. Funds have been provided by the Wyoming Game and Fish Department, Wyoming Game and Fish Commission, Wyoming Wildlife and Natural Resource Trust, Muley Fanatic Foundation, Bureau of Land Management, Knobloch Family Foundation, U.S. Geological Survey, National Science Foundation, Wyoming Governor's Big Game License Coalition, Boone and Crockett Club, Animal Damage Management Board, Ridgeline Energy Atlantic Power, Bowhunters of Wyoming, and the Wyoming Outfitters and Guides Association. Special thanks to the Wyoming Game and Fish Department, Bureau of Land Management, and Wyoming State Veterinary Lab for assistance with logistics, lab analyses, and fieldwork. Also, thanks to the Cokeville Meadows National Wildlife Refuge and U.S. Forest Service for providing field housing.



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