

TOUGHENING IT OUT: How Mule Deer Survive Winter Hardships



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Photos courtesy of Author

With wildlife biologists for parents, I can't claim a normal childhood. We kids were along for the ride as my mother and father fought the good fight for wildlife and natural resources in the West. Family camping trips, workdays with my dad, elbows deep in wild animals and wild places. I wasn't pushed or prodded into the wildlife field; it just progressed naturally from time spent afield before kindergarten then unfolded throughout my childhood, teenage years, and young adult life into a visceral addiction. Freezing days of winter fieldwork, getting kicked in the face by deer, and endless weeks of number-crunching were all to be expected in my fascinating quest to understand what makes creatures tick.



The author as a child with her wildlife biologist father and an orphaned mule deer fawn.

All in the Family

In my earliest memories, my dad and I are bouncing along in his dusty brown Ford truck with the insignia: Utah Division of Wildlife Resources.

I have memories of hiking in the snow with Dad, feeling like my fingers and toes just might freeze off. I recall a rusty horse trailer hauling moose he was helping transplant, and how at every stop I would climb onto the wheel well for a sneak peek at these huge animals. I remember feeding orphaned mule deer fawns from a bottle and crying when one didn't make it. I'd go along when Dad had to meet a landowner and spend the better part of the day playing with the ranch kids. Once, we checked a trap set and found that the trapper had not tagged his traps; Dad pulled the traps and left his business card there for him. The first time I watched a helicopter bring in hobbled and blindfolded bighorn sheep, it left the lasting impression of loud noise and dust stirred up by rotors. The sheep were beautiful and

I couldn't stop looking. When one died, I jumped right into the necropsy and caught my first whiff of rumen. Dad remembers me running off with a hind leg, chased by some other younger kids, likening the scene to a hyena being chased by a pack of jackals. (I mainly just remember the smelly rumen contents.)

It's little wonder that I majored in wildlife as an undergraduate student at the University of Arizona, my parents' alma mater. I suffered teasing from their previous professors including my major professor, Dr. Paul Krausman, who had also supervised Dad's master's research. When Dr. Krausman accepted the Boone and Crockett Professorship in Wildlife Conservation at the University of Montana, I joined him there as a Boone and Crockett Fellow.

One "balmy" Montana day in early February, with the thermometer reading 3 degrees Fahrenheit and the wind a mere 20 miles per hour, I picked up Dad at the Great Falls International Airport. He had flown from sunny, warm Arizona to help me get started on my own study of mule deer on the East Front in north-central Montana. The family tree was coming full circle.

Winter: A Tough Time for Mule Deer

Winter can be a harrowing time for wildlife living in northern latitudes. Consider the situation faced by ungulates such as mule deer trying to survive the winter: forage quality has declined since fall, and snow accumulation buries what remains. Deep snow also makes travel difficult, and the cold further increases the animals' energy demands. These factors combine to force mule deer into a negative energy balance for four months or more, causing physiological stress, reductions in fat and protein reserves, and sometimes death. For these animals, survival depends on accumulating enough fat reserves before winter sets in, and selecting habitats that provide adequate forage and protection from weather and predators.

Most deer select habitat based on an energy conservation strategy. An ideal winter range allows mule deer to reduce their energy loss by providing areas of shallow snow, adequate food resources, security cover, and thermal cover. Across mule deer range, these areas typically occur at low elevations with plenty of south-facing, sunny slopes and moderate shrub or tree canopy cover. Unfortunately, not all mule deer winter ranges are created equal. Instead, they vary considerably in vegetation communities, topography, and weather conditions. Depending on weather conditions

and habitat, some mule deer populations contend with energy deficits of longer or shorter duration than what deer in other areas experience. We can make general assumptions about how mule deer select habitat and use winter ranges across landscapes, but understanding how mule deer cope in specific areas requires focused research.

How mule deer select winter habitat in variable weather and forage conditions became the subject of my master's research. While a small part of my thesis research investigated where deer spent the summer, I was mostly out in the wintertime, figuring out what mule deer do when the going gets tough.

My main study area was located in north-central Montana, specifically the East Front of the Rocky Mountains at the Theodore Roosevelt Memorial Ranch, owned by the Boone and Crockett Club. This area is characterized by a diverse winter climate with high winds affecting temperature and snow cover. Arctic fronts followed by high winds bring negative temperatures and drifting snow, and at times this limits the availability of forage and cover for deer. But at other times the effect of the warmer, chinook winds is to melt snow and open up feeding areas that are lacking on other winter ranges.

The Idaho Department of Fish & Game (IDFG) shared our interest in mule deer populations, habitat, and weather conditions. Thanks to research IDFG already had going, we were able to incorporate two Idaho sites into our project, each quite different from the East Front. The Sink Creek site represented a poor-quality winter range characterized by low forage diversity and a steep topographical gradient offering deer few choices to move into low-elevation wintering areas. The Warm Springs site supported similar vegetation communities but had more moderate topography and more precipitation; these conditions provided greater foraging diversity throughout the year and enabled deer to gradually transition into their winter ranges. I compared these areas to one another and to the East Front.



Mule deer on the Theodore Roosevelt Memorial Ranch, one of the study sites.



My objectives were to better understand the processes of habitat selection in deer—how they use and move across their winter ranges in the winter—and to help wildlife managers be better able to develop and prioritize habitat improvement projects.

If This Trap's a Rockin', Don't Bother Knockin'

Getting a statistically-sound grasp of winter habitat selection requires following mule deer and observing what they do. This meant capturing deer and fitting them with VHF radio collars. I used clover traps, which are roughly 4' x 6' x 4' steel frames covered in sturdy cargo netting. Baited in by alfalfa hay and sweet feed, a hungry doe would enter the trap, set off the trap door, and be caught. Then I would go in and restrain her—except when Dad was along insisting on his part of the action. I cherish the memories of my lanky, 6-foot 6-inch father climbing into that trap, and I think he does too. Bloody noses and lumps on the head aside, we managed to fit 31 adult mule deer does with radio collars. Female mule deer in the Idaho study areas were already collared as part of a larger study, so we selected 16 from Warm Springs and 12 from Sink Creek. We were ready to begin monitoring these collared deer to study their habits.

Winter can be rough on budding wildlife biologists as well as mule deer. Even bundled up like little Randy in the film *A Christmas Story*, I'd feel the cold and be buffeted by the wind. On the other hand, I felt pretty darn lucky to be hiking around in stunning country that contains some of the best concentrations of wintering mule deer. Dad and I had a bit of a role reversal. In my youth he had taught me so much about identifying and tracking wildlife; now, I was teaching him about the plant species that Montana mule deer were feeding on.

Whenever collared mule deer were located, we recorded data on weather and group characteristics such as herd size. After the deer left an area, we moved in and recorded slope characteristics, elevation, snow depth, and the most common plant species in the general area. Then we took a closer look at vegetation. Most folks would find this phase to be about as interesting as watching cement dry on a summer day. But for a budding wildlife scientist, the close-up examination of vegetation is where the mysteries of deer biology really begin to unfold.

Getting Into the Weeds

First we used the line-intercept method to obtain an index called shrub

canopy cover. Using a deer location as a center point, we laid out a long tape measure going upslope-downslope and another one running perpendicular to it. For every shrub or tree that touched the tape, we noted species and number of centimeters it intersected with the tape. We also measured canopy cover at the center and ends of each transect. Shrub cover and canopy cover gave us an index of potential browse, hiding cover, or thermal and snow-interception cover for each location. We also estimated visual hiding cover, or how visible the deer were at their location, using a black and white barred piece of PVC pipe called a cover pole. Next, we quantified forbs (herbaceous plants) and grasses by estimating percent cover classes.

Having completed the various measurements for a deer location, we would randomly choose another location and repeat the process. The random locations provided information on habitat conditions available to deer within the landscape. Comparing that information with the data collected at deer locations allowed us to see what deer actually use versus what is available across a landscape. In other words, it sheds light on what mule deer may be selecting in their environment. Meanwhile, a technician was performing the same procedures for radio-collared does at the Sink Creek and Warm Springs sites.

Crunching the Numbers

Once we collected the data, statistical analysis could begin. I rarely saw daylight in this stage of the study, locking myself away for weeks of number crunching. This involved development of models using multivariate logistic regression to determine whether deer used habitats in proportion to their availability across the study area, or whether disproportionate use was in evidence (indicating selection or avoidance). This technique derives the relative probability of deer-use given certain variables and values for those variables. The equation is an ugly mess, but it provides predictions of this sort: "Given this much creeping juniper, deer will probably be found here."

When I emerged from my data analysis isolation, I was able to share some interesting things about mule deer and their habitats on the East Front and in Idaho. The data we had gathered from more than 500 deer-use and random locations spread over three study areas encompassed a wide range of weather conditions. The East Front presented a unique suite of characteristics for mule deer winter range. Snow depths ranged

BELOW: A December scene showing windblown range where deer can find forage to weather the tough times.



ABOVE: A cover pole used to estimate the value of hiding cover for deer.

from bare ground to around 50 cm. On some days average wind speeds reached 40 km/hr., with high winds exceeding 100 km/hr.! By redistributing snow, these winds created large snow drifts in some areas and left swaths of bare ground and accessible forage in others. Deer habitat use was consistent with an energy conservation strategy; overall, the data indicated that deer favored shallower snow depths and areas with thermal and security cover. Tree cover and percent cover of buffaloberry also increased the likelihood of deer presence, as did the abundance of creeping juniper and preferred forbs such as whitemargin phlox.

However, the importance of different habitat characteristics changed, depending on weather and subsequent exposure to



TOP: The author with a radio-collared doe on the Theodore Roosevelt Memorial Ranch.

MIDDLE: The author's father lends a hand.

ABOVE: The author, her father Dave Smith, and Montana Fish, Wildlife, and Parks biologist Gary Olson at a deer capture site.

habitat conditions. For example, during or following a snowstorm only a subset of these variables (mainly related to cover) predicted deer use. The game changed again under high wind conditions when cover, exposure to wind, and forage species were the top predictors of deer presence. Finally, some model covariates varied depending upon deer behavior. For instance, snow depth (rather, lack thereof) predicted deer feeding and moving locations, but not where deer would bed down; whereas cover availability was a better predictor of deer bedding locations.

In the Idaho study areas, mule deer were sometimes more restricted based on their habitats. At the Warm Springs site, deer had some flexibility in foraging activity and cover choices, but were not subjected to the widely-varying weather conditions of the East Front. In Sink Creek, deer-use was limited to habitats providing adequate cover; their habit of lying low through winter likely reflected a strategy for energy conservation.

Information Managers Can Use

Comparing habitat-use characteristics across multiple winter ranges in association with weather conditions provided insight into winter adaptations and how mule deer survive in winter. The topography, vegetation, and weather differences at the three study areas resulted in different patterns of mule deer habitat use. Habitat characteristics like forage quality and quantity and functional cover types determine the strategies mule deer use to survive and reproduce. On the East Front, mule deer used an energy conservation strategy to survive.

When the going gets tough, they hunker down. During easier times, they seize that opportunity to feed. The habitat diversity, or heterogeneity, on the East Front allows deer to do this. Yet it is important to understand that mule deer winter ranges are not all created equal with respect to habitat components, and information gathered on one winter range is not necessarily applicable to others. The Sink Creek and Warm Springs winter ranges are less than 100 miles apart and less than 300 miles from the East Front site. Considering the range-wide distribution of mule deer, these winter ranges were comparatively close, yet they differed enough in topography, vegetation, and weather patterns to influence habitat use.

Understanding the differences among winter ranges is useful for defining optimal patterns of mule deer use of these areas. How mule deer respond to conditions within their environment can help managers prioritize

habitats and habitat management within each winter range.

Mule deer reliance on variable topography and vegetation on the East Front indicates that maintaining overall habitat diversity is a priority, rather than emphasizing individual habitat components such as elevation (e.g., protecting either low or high elevation areas but not both), tree and shrub canopy cover (e.g., no timber thinning versus complete thinning), or south-facing aspects (e.g., where to build a road, house, or make other landscape changes). Management should ensure that mule deer can apply their survival strategies in response to varying weather conditions.

Understanding the different habitat use patterns among the study areas helps develop management priorities and strategies that can be tailored to each winter range. In areas with suboptimal forage resources like Sink Creek, management goals should focus on the abundance and quality of thermal or hiding cover and minimizing disturbance. Given the winter range limitations mule deer face in these types of areas, managing for favorable forage conditions on summer, spring, or fall ranges may better enable deer to accumulate fat reserves prior to winter or to regain their body condition more rapidly come spring. Conversely, if there were a shopping mall or energy development infrastructure that had to go somewhere, constructing it in inferior habitats would be a better option than damaging more optimal areas.

Finding out new information about mule deer was a very rewarding experience. Living on the East Front taught me a lot about mountain-prairie environments, conducting wildlife research, avoiding grizzly bear altercations, and working with local landowners and sportsmen. Sharing the experience with my father, who played such an important role in getting me here, added an irreplaceable personal dimension to my education and early professional life. Knowing he's still there to lend an ear and provide advice in my own march through this field is invaluable. Thanks Dad! You can crawl into my clover traps anytime. ■

Sonja Smith completed her master's research as a Boone and Crockett Fellow at the University of Montana under the supervision of Boone and Crockett Professor, Dr. Paul Krausman. Currently she works for Montana Fish, Wildlife & Parks as a wildlife biologist. Both of her parents, Dave and Brenda Smith, are still working as wildlife biologists, now with The U.S. Fish & Wildlife Service in Arizona.