



Meeteetse Moose Project Update

Fall 2023

Project background

Over the last 20 years, many moose populations have declined, including the Meeteetse population. Disease, habitat loss, predation, and food resources can cause declines depending on the population, but one factor is common across nearly all moose populations: warming temperatures.

Moose are large, have dark fur, and cannot sweat, making them sensitive to heat. Amazingly, moose can start to overheat at just 50 degrees, which means that almost every day of the summer they have to deal with the challenge of staying cool. While a moose figures out how to stay cool, they also have to balance the rest of life's demands, like raising young, eating, mating, and avoiding predators.

To better understand how moose balance the need to stay cool with competing demands like foraging and reproducing, we initiated the Meeteetse Moose Project.

Project goals

- Understand the factors limiting populations to identify how we can support the persistence of moose.
- Measure adult and calf survival rates to assess the drivers of population numbers.
- Assess quality of thermal refuge and figure out the habitats that moose need to cope with summer heat.
- Compare males and females to make sure we are conserving important habitat for both groups.
- Study male moose ecology to better understand rutting behavior and responses to warm temperatures.





Key findings

Adult mortality of Meeteetse moose is low.

During the three years of monitoring, we observed only four mortalities that were not associated with legal harvest. Of these four deaths, three were related to malnutrition and one was caused by a vehicle collision near Willow Creek. The male that died of malnutrition was 12 years old and had reached the expected lifespan for a wild moose. This low rate of adult mortality tells us that survival of adults is high and stable, and should help maintain population persistence.

To stay cool, moose in Meeteetse need places where the soil stays wet all summer.

All moose need habitat that helps them cool off. One way they do this is by laying down on wet soil which can pull heat away from their bodies and help relieve stress quickly. Protecting and creating habitat with wet soil can help moose cool off faster and devote more time to the important things like eating, raising a calf, or growing antlers. Areas with wet soil and dense vegetation can provide a cooling effect and good nutrition to support moose.

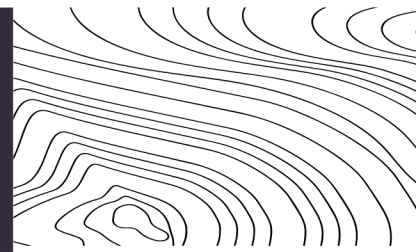
Calf survival is high, but pregnancy rates are on the lower end of normal.

Depending on the year, between 57% and 66% of pregnant females raised calves to 6 months of age. Pregnancy rates and whether mothers successfully raised calves were consistent across years. Because growing and raising a calf is incredibly costly, modest pregnancy rates (70%) tell us that nutrition of mothers may be a limiting factor. Access to high-quality browse species like shrubs, forbs, willows, and aspen could increase pregnancy rates.

Warm days during the rut limit movement in all males, but especially so for old males.

During the rut males put almost all of their available energy toward securing mates, and any time away from rutting can hurt their chances of successfully reproducing. Warm days in autumn require males to spend more time cooling off, which takes time and energy away from rutting, especially for prime-age and old males. This means that the males who are usually most successful at finding mates are also most limited by environmental conditions.

Project timeline



March 2020



The project started in March 2020 with the helicopter capture of moose in all the drainages between Gooseberry Creek and Meeteetse Creek. We studied 15 male and 15 female adults. We collected a range of samples, assessed nutritional condition, counted ticks, and checked pregnancy status in females. We also deployed GPS collars on each animal caught.

Fall 2020, 2021, & 2022



At the end of August, bull moose reach peak antler size. In the fall of 2020, 2021, and 2022, we tracked down all bulls with GPS collars and photographed their antlers. From these pictures, we assigned an antler score which we used to assess whether antler size had an effect on rutting behavior.

Summer 2021 & 2022



During the summers of 2021 and 2022, we conducted calf searches and monitored bed sites. When moose began to give birth in mid-May, we tracked down females to see if they had a live calf and we continued to monitor the calf survival throughout the summer. Then, to learn about the habitat moose choose to help them stay cool, we checked over 2,000 bed sites to assess their microclimate characteristics.

Summer 2023



Our fieldwork came to an end in May 2023 when our GPS collars, each equipped with a drop off mechanism, fell off the study animals. Project lead Rebecca Levine completed her master's degree in August 2023, wrapping up some aspects of the project. Now that we have collected all our data, we will continue to learn about the factors affecting moose populations in Meeteetse and beyond.

Notes from the field

The summer of 2022 was our final year of tracking calves, and it certainly did not disappoint. On May 19th, F10 was the first female to have a calf. Though she had spent all winter at low elevations, she made a 7-mile journey into the mountains before giving birth. We think moose do this to reduce the risk of a predator finding them when their calf is most vulnerable. As I followed her path, taking many more hours than she had, the snow got deeper and deeper. In the final half mile, I was waist deep, wishing that my legs were 5-feet-long like hers.

Finally, I saw a set of big brown ears poking up from behind a snowbank. She rose slowly and watched me. From her point of view, I was just a grey hat and a set of eyes poking out from behind a tree. She stepped forward, revealing the little orange calf, clumsily rearranging itself at her feet. I tucked back behind the tree, having seen what I needed. As quietly as I could, I backed away, staying low until I was out of sight. Like many moms, F10 stayed in that area protected from predators for two weeks while her calf gained the strength to follow her foraging movements.

Walking away from the birth site, I backtracked along F10's hoof prints. Unsurprisingly, there was much less snow on this route than the way I had gone before. Moose always seem to pick the most efficient path. About a quarter mile

down the mountain, I spooked up a yearling moose. Though we were both eager to get out of each other's way, it was a happy surprise for me: this was a familiar face. I had seen her in the hours after she was born, and I checked on her each week throughout last summer.

Of the 10 calves we checked on last summer, 7 made it this long. Each year, birthing signals another important event in for moose. As mom gets ready to give birth, she chases off last year's calf. This awkward yearling moose had probably just been chased off by F10. Smiling as I continued my trudge down the mountain, I thought back to this time last year, when I had watched what was now a yearling, as a tiny tuft of orange taking its first wobbly steps on this very slope.



Findings

Moose need cool, wet habitat.

Moose can't change their size or the fact that they can't sweat, but they can change their behavior to stay cool. One way moose do this is by choosing to bed down in places with standing water or shade.

We learned that moose chose bed sites that were cooler than surrounding areas. They also chose bed sites with denser vegetation, more canopy cover, and wetter soil than what was in the immediate vicinity. We can help moose by managing for and conserving areas that hold water all summer long and that have good shelter from the sun.

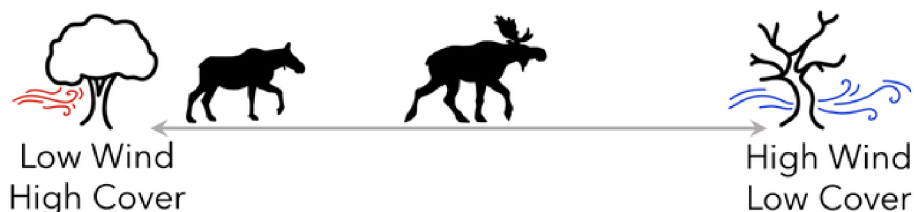


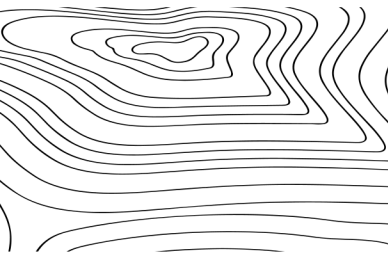
Above: A moose bed in a wet, cool patch. The device is monitoring temperature and windspeed.

Male and female moose choose different cooling habitat.

When we looked closer at how moose are choosing bed sites, we found differences between males and females. Female moose chose bed sites with more canopy cover, even though that meant slower wind speeds. Males, on the other hand, did not seek out canopy cover and that meant they had more cooling from the wind.

This difference was surprising, because moose have thick and dark coats that make cooling from wind ineffective and heat from the sun very powerful. We are still working on understanding why males seem to be making a "bad" decision when it comes to the tradeoff between wind and cover, so stayed tuned!



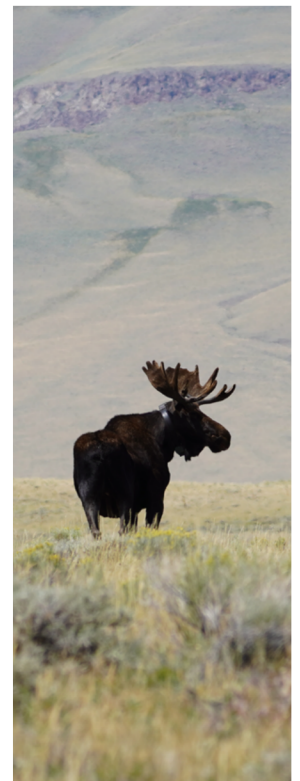
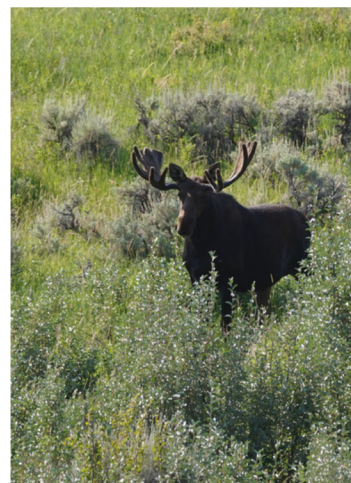


Autumn temperature and age drive mating in males.

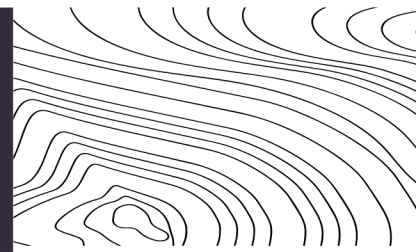
Every autumn, male moose lose their minds. Their testosterone production skyrockets, and they initiate rutting behaviors like sparring with rival males, searching desperately for females, and aggressively guarding their potential mates. Prime-age males even stop eating for up to two weeks and use almost all of the fat reserves that they built during the summer. So, if males put in too much effort to rutting, they risk not saving enough fat to survive the winter. But if they put in too little effort, they risk missing out on mating opportunities.

We learned that as male moose age, they spend less time and effort on movement, but have greater mating opportunity with females. This means that old males somehow move less but have greater mating success. There are a few possible explanations for this surprising pattern. First, it is possible that more experienced males might be able to rely on large antlers instead of movement to impress females. Or, second, older males might be matching their movements to the females they are defending, and we know that females move less.

Much like in summer, rutting males moved less on warm days than on cool days. The decline in movement became more extreme as males aged, so old males moved even less on warm days than young males did. So, with warm autumn temperatures, which are becoming more common, mating effort of male moose could be limited and especially so for old males. Since we also found that old males have the most mating opportunity, warm days could negatively influence the primary breeders in the population.



Ongoing & future work



What makes a good mom?

Moose give birth in unusual places, like out in the middle of the sagebrush, and we want to dig into whether some moms are picking safer places than others.

One of the many ways that we can understand maternal care is using GPS collars with cameras on them. From these videos, we get information about what plants moose are eating, what habitats they are in, whether their calf has disappeared, and possibly how attentive they are as mothers. The recordings give us a never-before-seen look into the life of a moose, and we are using this to figure out what helps calves grow into adulthood.



Above: Shots from camera collars that show a moose-eye view of the world.

How does hunting affect Wood River bull moose?

In Wyoming, harvesting a bull moose is often a once-in-a-lifetime opportunity and hunters do everything in their power to be successful. Because moose are large, hunters often stay near roads to make the pack out easier. In Meeteetse, this means that the Wood River can receive a disproportionate amount of hunting effort compared with the rest of the unit. Harvesting bulls out of the Wood River year after year could reduce numbers compared to neighboring drainages like the Francs Fork or Greybull that see less pressure.

Since the hunting season overlaps with the rut – when bull moose are moving all over – it's possible that harvests happening in the Wood River aren't just 'Wood River bulls.' We are going to use GPS data to figure out whether hunting is disproportionately affecting Wood River bulls. This insight will be useful in understanding if hunting pressure could affect distribution and survival of bull moose.



Project supporters



Project lead Rebecca Levine

Rebecca started working on the Meeteetse Moose Project in 2020, and she successfully completed her master's degree in August 2023. Although many of the main components of the project have wrapped up, Rebecca will continue to investigate new lines of inquiry that have popped up during the project.

Collaborators, partners, and funders

The Meeteetse Moose Project is a highly collaborative study in all aspects of development, operations, and funding. The Wyoming Game & Fish Department has offered logistical support, personnel, and indispensable local knowledge. Funders include the Wyoming Game & Fish Department, the Wyoming Governor's Big Game License Coalition, Mary and Charlie Rumsey, Anne Young, Jim Nielson, and Mark Newhouse. A special thank you to Mary Rumsey, whose passion for conservation and the well-being of moose has made this project possible. The Forest Service has been instrumental in making this work possible. Many private landowners in the Meeteetse region have supported us through land access and local knowledge. And, thank you to the Pitchfork Ranch for generously donating field housing.



