2022 WY-TWS Graduate Student Scholarship Reports

Mitch Brunet – MSc Student, University of Wyoming

Project: Space use and interactions between predators (coyotes and mountain lions) and ungulate prey

During my first field season in Wyoming, while working to evaluate mountain lion kill sites and capture and collar neonate mule deer, I saw first-hand the unique positioning of coyotes as predator, prey, and scavenger. These experiences led me down the path of evaluating how coyotes fit into the trophic pathway of a high-desert, sagebrush-steppe ecosystem.

It was no surprise that we found evidence of scavenging by coyotes at many mountain lion kill sites—what we didn't expect was the rate at which mountain lions killed coyotes. We asked ourselves the question, how might coyotes navigate the risk imposed by mountain lions while also attempting to access the carrion resources left at mountain lion kills? We found that coyotes primarily avoided the habitat occupied by mountain lions, likely minimizing the chance of risky encounters with the larger predator. Occasionally coyotes identified a mountain lion kill site and demonstrated clear patterns of scavenging while they accessed those resources. Coyotes were rarely killed while scavenging, likely taking advantage of temporal variation in use, among other factors, to reduce their risk of being killed. In most cases, coyotes appear to be killed during chance encounters with mountain lions, and during encounters in the absence of scavengeable resources, coyotes seemingly fail to respond to the presence of the apex predator.

At the opposite end of the trophic pathway, in response to indicators that coyotes were one of the primary predators of our GPS-collared neonate mule deer, we questioned the factors that would lead to predation events. Personal observations, corroborated by WGFD harvest data, indicated that cottontail rabbits, the primary prey of coyotes, experienced a major decline in abundance throughout the duration of our study. We expected that coyotes would respond spatially to the decrease in rabbit abundance, shifting to overlap and target neonate mule deer. Instead, what we found was that selection for mule deer and rabbit habitat mirrored patterns in spatial and temporal access to rabbits—coyotes were decreasing selection for rabbits during the decrease in abundance but were not shifting to target mule deer. Subsequent analyses suggest that coyotes use mule deer habitat in proportion to its availability. Encounters between coyotes and neonate mule deer are facilitated by overlap with rabbit habitat, and coyotes can respond to the presence of mule deer regardless of the habitat in which encounters occur. Despite evidence that coyotes respond to encounters, neonate mule deer were rarely killed during encounter events, supporting previous research which indicated adult female mule deer are often successful in deterring coyotes from attacking neonates.

At all stages of the research process, our work studying the positioning of coyotes within the larger wildlife community required substantial investments into field work efforts. Funding from the Wyoming Chapter of The Wildlife Society has made purchasing field equipment possible and has allowed me to pursue these unique questions without financial strain. Thank you to the WY-TWS and its members for helping to make my research possible.



Photos (left to right): Radio collared coyote (photo credit: Tayler LaSharr), Mitch Brunet catching and radio collaring mule deer fawns with a smile, and hidden mule deer fawn with a view.

Emily Burkholder – MSc Student, University of Wyoming

Project: Assessing the spatial ecology and diet of the montane red fox in relation to recreation activity in Grand Teton National Park

Working in direct collaboration with Grand Teton National Park (hereafter Grand Teton), my research aims to address how extreme disproportionate use of national parks could cause strong temporal differences in human-related impacts to wildlife, specifically surrounding anthropogenic food provisioning which has become a major concern for wildlife managers within national parks. More specifically, we hope to

(1) Characterize seasonal variation in the trophic ecology of Rocky Mountain red fox (*Vulpes vulpes macroura*) in Grand Teton National Park, and evaluate how human food subsidies influence the dietary niche of foxes using stable isotope analyses (δ13C and δ15N).

(2) Assess seasonal variation in space use of Rocky Mountain red fox, as well as variation in habitat use and selection in response to fluctuating human activity using GPS collar data.

We have been fortunate to be able to leverage both substantial previous investments made by Grand Teton staff as well as conduct an additional winter trapping season in 2021 to try to address these goals. Altogether, we were able to accumulate a sample size of 40 individual foxes for stable isotope analysis and 20 individual foxes for space use analysis. COVID-19 funding cuts, however, meant re-allocating funds previously reserved for stable isotope lab costs. Without the generous 2022 graduate student scholarship from the Wyoming Chapter of The Wildlife Society, we would not have been able to analyze our lab samples for stable isotope analysis. The WY-TWS graduate student scholarship also helped me personally compensate for some of the unexpected financial burden and costs associated with COVID-19 and the 2021 winter trapping season, allowing me to attend the 2022 WY-TWS conference this past April. Overall, our work hopes to not only advance our understanding of human-mediated impacts to wildlife within natural areas, but also provide essential missing ecological information for an understudied species and inform recreation management actions to limit human-wildlife conflict.

Photos (left to right): Emily Burkholder with captured red fox in Grand Teton National Park, released red fox (Andrew White, NPS).

Molly Caldwell – PhD Student, University of Wyoming

Project: How individual movements shape multispecies interactions and community dynamics in Yellowstone National Park ungulates

For my graduate research, I am investigating how individual movements shape multispecies interactions and community dynamics in Yellowstone National Park (YNP) ungulates. YNP harbors the greatest diversity of large herbivores outside of Africa, with seven coexisting species: American bison (*Bison bison*), mule deer (*Odocoileus hemionus*), pronghorn (*Antilocapra americana*), elk (*Cervus canadensis*), moose (*Alces alces*), mountain goats (*Oreamnos americanus*), and bighorn sheep (*Ovis canadensis*). Despite this high diversity, how ungulates interact and share space and resources in the park has not been well described and understanding how they coexist helps clarify ecosystem functioning.

My study uses GPS collar data collected by collaborators (Chris Geremia, Daniel Stahler, Daniel MacNulty, and Douglas Smith) on 5 ungulate species in the northern range of YNP during the same time frame. I am using these data to determine individual movement and social behaviors and how these behaviors impact species' interactions as well as overlap in their space and resource use. My preliminary analyses suggest that while the species are using many of the same areas and habitats within the park, there are patterns of finer-scale spatial and temporal partitioning that are likely contributing to their coexistence.

Currently, I am in my second year of the PhD in ecology program at the University of Wyoming and am excited to continue developing my research questions and analyzing the GPS collar data. The WY-TWS 2022 Graduate Student Scholarship award helped supplement my graduate funding and allowed me to continue with my research activities and start a pilot camera study in YNP this past summer. I collected preliminary camera data on how groups of different species utilize bison grazing areas and am hoping to continue this investigation in summer 2023 with a more detailed camera study.



Photos (left to right): Molly Caldwell at Yellowstone National Park, using telemetry to listen for bison GPS collars (photo by Lauren McGarvey). Bison in Lamar Valley captured by summer 2022 pilot bison grazing area camera study. Pronghorn in Lamar Valley captured by pilot study cameras.

Katherine Gura – PhD Candidate, University of Wyoming

Project: Variation in seasonal movements, habitat selection, and demography of the Great Gray Owl

Conducting long-term field research is essential to understand wildlife ecology and strengthen conservation, particularly for species that exhibit high variation in behavioral and demographic patterns. I am excited to share that in September of 2022, I completed my 10th field season studying Great Gray Owls (*Strix nebulosa*) in Wyoming, as well as my fifth and final summer of data collection related to this species as a graduate student in the Wyoming Cooperative Fish and Wildlife Research Unit at the University of Wyoming. Despite being of Wyoming's most iconic and charismatic birds, the Great Gray Owl is extremely secretive and remains a Species of Greatest Conservation Need in Wyoming as well as one of the least-studied raptors in North America. However, through our research in collaboration with Teton Raptor Center, our understanding of the Great Gray Owl has increased multi-fold in recent years as we filled in knowledge gaps related to this species, including its habitat, movement patterns, reproductive performance, diet, and ecological stressors, all of which can vary across time.

To study all of these facets of Great Gray Owl ecology has required intensive and extensive fieldwork, which I only was able to do thanks to many incredible supporters, including the WY-TWS Graduate Student Scholarship program. For my graduate research, we outfitted 45 adult Great Gray Owls with GPS transmitters over the past five years, which has illuminated how these birds move across the landscape and what comprises their critical habitat. For example, Great Gray Owls appear to be faithful to breeding territories, as we observed all individuals but one consistently return to their breeding ranges. Key breeding habitat includes mature forests containing wetland meadows that are utilized for foraging for small mammals, primarily Northern Pocket Gophers (*Thomomys talpoides*). Non-breeding-season movements are much more variable, as we observed owls remaining on breeding ranges throughout the winter, migrating to discrete winter ranges, repeating back and forth movements from breeding to other ranges multiple times over the course of a winter, altitudinal migrations, as well as nomadic movements. Likewise, although Great Gray Owl breeding-range fidelity and occupancy remained relatively high across years, we observed high variation in annual nest initiation, nest success, and productivity rates.

These findings underscore how important it is to study wildlife across years, as the nuances of this variation in movement behavior and reproductive performance simply would not be identified in a short-term study. My next step is to identify the mechanisms determining these patterns. Specifically, I will be testing whether primary prey abundance and/or snow conditions (which may limit access to subnivean prey) influence the movement behavior and reproduction of this species. This information can strengthen understanding of overall population trends for Great Gray Owls in Wyoming as well as inform management actions including habitat conservation and species monitoring programs.

Photos: Katherine Gura and Steve Poole outfitting an adult female Great Gray Owl with a transmitter; Gura evaluating the wing molt of an adult female Great Gray Owl; An adult male Great Gray Owl with unique light plumage; A perched adult male Great Gray Owl.

Jeff Wagner – MSc Student, University of Wyoming

Project: Development of an optimal sampling design for monitoring moose in the Bighorn National Forest

The year was 2020, and I had set out to tackle a question that often crosses our minds as wildlife ecologists: how many animals are in my study population? This question is simple on its surface, but deceptively so, as wildlife populations are dynamic, and surveys must overcome issues such as imperfect detection and efficiency at large scales. This is especially true for my study species, moose (*Alces alces*), because they are patchily distributed across the landscape. Detection rates from aerial surveys are often unknown, and the cover provided by preferred habitats makes some animals unavailable to survey. This poses a challenge that is not unique to moose, but one that has fundamental implications across the board for wildlife populations. If we don't know the size of the population, how can we manage it or examine more specific ecological questions?

Numerous methods have been proposed to address these challenges including the use of aerial sightablity correction factors, distance-sampling, and non-invasive mark-recapture via camera trap arrays or genetic sampling. My graduate research has focused on developing a practical, optimized genetic mark-recapture framework for estimating moose populations. I spent the winters of 2020 and 2021 on skis and snowshoes in the Bighorn Mountains, visiting hundreds of 1 km^2 sites to look for signs of moose (animals, tracks, beds) and intensively survey heavily used sites for genetic samples (feces and hair). I collected nearly 800 samples, which are currently under genetic analysis to identify the individual moose that they came from. I will use this data to build a multi-level model of moose abundance which will integrate information about where and when moose occurred and were absent during my survey, level of intensity of use, and individual detection histories from genetic sampling. The goal is to identify the relationship between intensity of use, number of individuals, and habitat characteristics, which can then be used to predict animal abundance at large spatial scales.

This work has been challenging physically, logistically, and academically, not least because of the damper COVID-19 put on my first field season and lab supply chains. However, I am fortunate to be a part of the wonderful group of humans at WY-TWS, who have provided much support through community and their Graduate Student Scholarship and Student Travel Grant programs. As a recipient of these 2022 awards programs, I was able to conduct additional fieldwork beyond the initial scope of my project and attend the 2022 WY-TWS conference in Jackson to present my methods and preliminary findings. I have been a member of TWS for over five years and I al- ways look forward to connecting with the diverse group of members in a collaborative, non-threatening environment. The Alaska Chapter fostered my interest during my undergraduate studies and their support was key to my success in my early professional years. TWS is a special organization and I look forward to engaging more with the Wyoming Chapter as I round out my graduate studies.

Photos (left to right): Collecting fecal samples in 2020 (image: Dave Christianson), a bull moose in the conifers in Bighorn National Forest (image: Jeff Wagner), meme credit: Jeff Wagner, imgflip.com (above).