

THE ROLE OF THE CAMERON PEAK MEGAFIRE IN SHAPING ALPINE SMALL MAMMAL COMMUNITIES



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PROJECT INTRODUCTION

- The Golden-mantled ground squirrel (GMGS, *Callospermophilus lateralis*) is a short-lived, asocial hibernating species that lives mostly in a high elevation sub-alpine ecosystem¹. Ground squirrels are an integral part of the ecosystem, providing food and prey items for larger predators such as coyotes, badgers, and bears, and even dispersing seeds that keep alpine meadows healthy². As such, they play key ecological roles in their ecosystem.
- The 2020 Cameron Peak Fire burned for 2 months at the end of summer and became one of Colorado's largest wildfires ever recorded, cutting into valuable foraging time GMGS utilize to gain weight and increase their chances of over-winter survival. For those who survived the fire, critical habitat may have burned or sent residents into unknown territories which could affect key behaviors such as their time spent foraging, being in a state of alertness, or running to escape potential predators^{3,4}.
- Hibernating species are already at risk due to climatic factors including changes in snowpack, precipitation, temperature, and increased disturbance^{5,6}. The impacts of fire not only affect their home range, but also affect their food supply by limiting food availability⁵. This could ultimately affect their abundance, population dynamics, and the trophic levels below and above them. It is in the best interest of the science community and the general audience to understand how these animals survive and adapt, and how to best help them survive in response to human caused disturbances driven by climate change.



Left-hand side: Cameron Peak fire scar at the CSU Mountain Campus, within the GMGS field site.
Right-hand side: picture of an ear-tagged GMGS. Photo Credit: L.M. Aubry

INTERNSHIP GOALS

Our objectives for this internship include:

- Observing the effects of the Cameron Peak Fire on GMGS behavior.
- Analyze differences in alertness and feeding behavior as it relates to distance from the fire line.
- Conduct outreach programs such as: educational programs to children (i.e. EcoWeek reached out to all 3rd graders in Larimer county), mentor/train undergraduate students on mammal studies and handling and educate the local community.
- A personal goal of mine is to gain experience and knowledge of field work as it pertains to study design, hypothesis testing, data collection, and data analysis. This is key to helping me gather experience for graduate school and beyond, in a future career.

QUESTIONS AND HYPOTHESES

Question: Is there a difference in activity budgeting in GMGS in locations close, medium, and far from the burn line?

Hypothesis: H₀: No difference in activity budgets between burned and unburned sites.

- H_{a1}: Animals spend more time alert (A2 and A4) close to the burn edge due to increased intraspecific competition due to loss of habitat and cover.
- H_{a2}: Animals spend more time foraging (F) in sites far from the burn edge due to resource availability and decreased disturbance of the surrounding vegetation.

SITE DESCRIPTION



Site Name	Distance from Burn Edge (m)	Classification
Cemetery/Hillside	19.779	Close
Cemetery	23.513	Close
North Ridge	57.032	Close
Table/Parking	127.496	Medium (Average Distance)
Table	134.590	Medium (Average Distance)
Processing Area	146.768	Medium (Average Distance)
Classrooms	176.072	Medium (Average Distance)
Dining Hall	193.795	Far
Rock Wall	215.455	Far
Cabin 74	249.376	Far

The map on the left represents the approximated points of each location given above in the table. The distances in the table above represent the perpendicular distances between the location where we made behavioral observations and the fire line.



METHODS

Site Description: the CSU Mountain Campus is a high elevation, subalpine ecosystem that hosts a variety of different large and small mammals, alpine plants, dense evergreen forests, and an influx of human workers and visitors. It is located off Pingree Park Road, south of the Highway 14 in the Poudre Canyon and borders the Roosevelt National Forest.

Data Collection: we collected morphological, demographic, and behavioral data on two species of ground squirrels. First, we used up to 34 traps across different locations around the Mountain Campus to target active burrows used by ground squirrels. We periodically checked the status of the trap (approximately every 30-45 minutes). After capture of a ground squirrel, we collected a variety of physical and demographic information about the individual, including sex, age, capture status, body measurements (hind foot, pelvic width, body length, tail length, etc.), and identification information (PIT Tags, ear tags, dye marks). The animal was released in the same location of capture after measurements were taken.

Activity Budgets: prior to conducting behavioral scans, we recorded information on the weather/time of day, location where the animal was first observed, species, and ID of the animal (from ear tags, dye marks, or PIT tags), which was often collected after the behavioral observation. If ear tags and/or dye marks were not clearly identified, capture was required to confirm ID of the given squirrel. During the actual behavioral scan, we would record the behavior using a pre-defined code based on an ethogram we had discussed *a priori*. We would denote the time as it is shown on a timer (phone time, stopwatch, etc.) spent in a given behavior. Observations lasted 3-minutes to gather enough information that accurately portrayed how the animals spent their time. Some of the main behavioral keys used within the scans were: Alert on 2 feet (A2) – standing on both feet and scanning; Alert on 4 feet (A4) – standing on all 4 feet, may be accompanied by other behaviors; Feeding (F) – In the process of eating, foraging; Grooming (G) – can include dustbathing, grooming self; Running (R) – may include short stops, and Other (O) – includes social interactions (INT), carrying grass (CG), dustbathing (D), grooming (G), scent marking (SR), or any other unknown or unidentified behaviors.

RESULTS

Key Results: we observed a small decrease in time spent alert (A2) between close (15.3%) and far (13.0%) from the fire edge, with the average distance (medium) being the most time spent alert (24.1%). We also observed that these squirrels spent more time foraging closer to the burn edge (25.9%) than far from the burn edge (18.9%), but none more than average distance from the burn edge, which was 32.4%. This supports our first hypothesis, that animals would spend more time alert close to the burn edge than far from the burn edge (Fig. 1). However, our results were not consistent with our second hypothesis that animals spend more time feeding far from the burn edge rather than near.

Ecological Interpretation: animals close to the fire edge showed different behaviors than animals medium and far from the fire. They seemed to be the most “comfortable” (feeding, grooming) in the average distance group, and more alert and on the move in the close/far regions. We expect animals were more exposed to predators from a lack of protective vegetation close to the fire line, while animals observed far from the fire line overlapped with one of their key competitor, the expanding Wyoming ground squirrel (*Urocitellus elegans*). Interspecific competition could then explain the increased running (R) followed by increased alertness while far from the fire edge, within the Wyoming ground squirrel colony. We also predict that GMGS are being pushed on “both sides”, forcing them to take refuge in the average distance site, where we observed an increase in “comfort” behaviors.

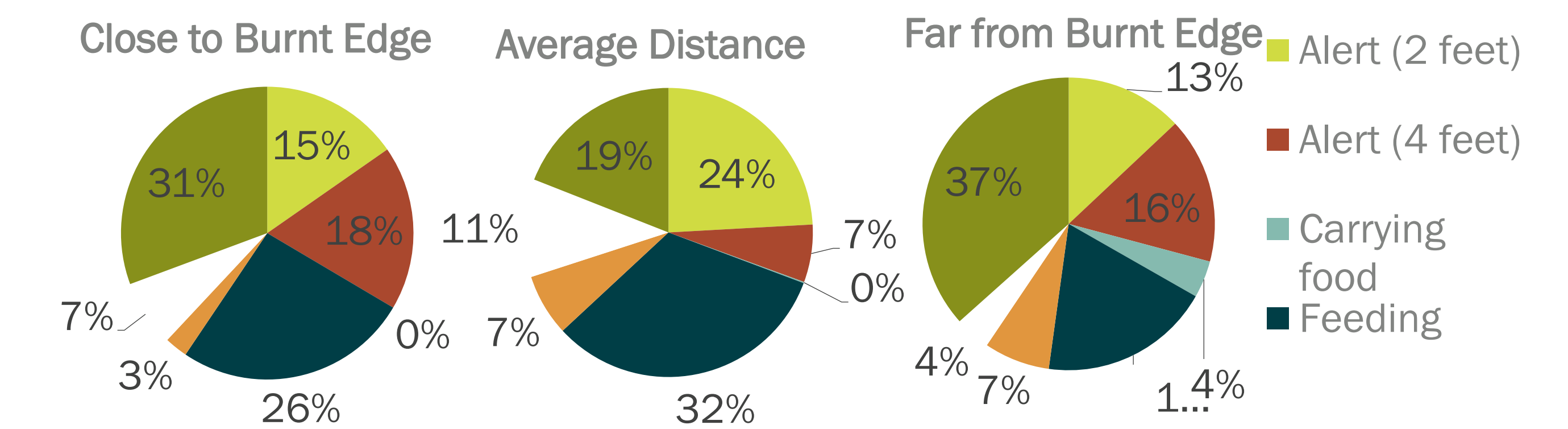


Figure 1: time spent in different behaviors (alert, carrying food, feeding, grooming, running, and other less observed behaviors) with respect to the distance to the fire line (close, average distance, or far from the burn scar.

PROJECT BENEFITS AND NEXT STEPS

- Throughout my time in this internship, I learned so much about how to apply my technical knowledge in the classroom to a field study setting. Experimental design, biological and ecological knowledge, and equipment management were all things I learned about in this internship and was able to apply to a real-world setting. I was also able to learn how to effectively communicate my knowledge and findings to the public, even in situations where the audience may not have been very interested, it was still good to use my public communication and speaking skills in that setting.
- The next steps for this project include gaining enough funding and support to identify and follow individuals throughout their lives and estimate survival and reproductive success across this population to assess the impacts of climate change on these hibernators, which include extreme events such as megafires. Studies such as this could inform scientists and the public on how climate change is affecting alpine vertebrate communities. EcoWeek is an example of how to encourage budding scientists to take part in conservation efforts and begin making changes for the benefit of our planet's future.

REFERENCES AND ACKNOWLEDGEMENTS

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