

THE ROLE OF THE CAMERON PEAK MEGAFIRE IN SHAPING ALPINE MAMMAL BEHAVIOR

PROJECT INTRODUCTION

In 2020, the Cameron Peak Fire burned 208,913 acres in Larimer County, becoming the largest wildfire in Colorado history¹. Two years after the fire, vegetation is regenerating within the burn scar, and we are interested in observing the potential behavioral plasticity of small mammalian in response to these changes.

Golden-mantled ground squirrels (*Callospermophilus lateralis*; GMGS) and Wyoming ground squirrels (*Urocitellus elegans*; WYGS) hibernate over-winter at the CSU Mountain Campus and spend their summers foraging on seeds to gain the fat stores necessary to survive the long winter^{2,3}. Both species are an important trophic link in the high elevation, subalpine ecosystem because they provide a crucial food source for larger predators such as badgers, coyotes, raptors, and foxes⁴. Additionally, ground squirrels keep mountain prairies healthy by aerating the soils through burrowing and dispersing seeds⁵.

Megafires like the Cameron Peak fire can alter not only GMGS and WYGS home ranges, but also their access to quality forage⁶. This can impact their behavior, survival, and abundance, which in turn impacts the ecosystem⁶.

In 2021, CSU Extension intern Ryan Black determined that GMGS exhibit different behaviors with respect to distance to the burn scar, likely due to interspecific competition with WYGS and lack of cover⁷. In this project, we investigate whether GMGS demonstrate more resilient behavior as vegetation regenerates, and we compare the behavior of short-lived, asocial GMGS close to the fire to the behavior of longer-lived, colonial WYGS further from the fire line.



Figure 1: A Wyoming ground squirrel at the mouth of a burrow (left). A Golden-mantled ground squirrel with a Monel ear tag used for individual identification (right).

INTERNSHIP GOALS

1. Observe trends in GMGS & WYGS behavior with respect to the CPF burn scar. Specifically, compare 2022 to 2021 results to determine similarities or differences in GMGS behavior as early succession plants recolonize the Cameron Peak burn scar, and further compare to WYGS activity budgets.
2. Gain experience in data collection, behavioral analysis, and statistical analysis from the field.
3. Provide guidance and support for field mammalogy undergraduate students as well as conduct community outreach to visiting K-12 kids' camps.

RESEARCH QUESTION & HYPOTHESES

Question: Do GMGS exhibit different behaviors than WYGS, and do they demonstrate more comfort behaviors this year than they did in 2021 close to the fire line?

Null Hypotheses: There is no difference in squirrel species behavior. There is no difference in comfort behavior in GMGS between 2022 and 2021.

Alternative Hypotheses:

1. GMGS demonstrate more alert behaviors than WYGS.
2. WYGS further from the fire line demonstrate more comfort behaviors than GMGS do close to the fire line.
3. GMGS demonstrate more comfort behaviors close to the fire line than they did in 2021.



Figure 2: (top right) map of the observed GMGS (cemetery) and WYGS colonies (Gazebo/Rockwall) in relation to the fire line. The cemetery is 19.779 m from the burn scar, which we categorize as "close⁷." The gazebo/rockwall is 215.455 m from the fire line, which we categorize as "far⁷." (Bottom right) regrowth within the Cameron Peak Fire burn scar

METHODS

Site Description: Data and behavioral observations were collected at the CSU Mountain Campus, which is located at 9,000 feet of elevation in Pingree Park. This is a subalpine ecosystem with evergreen forest, mountain prairie, and riparian valley communities.

Data Collection: As many as 30 baited Tomahawk traps were placed at squirrel burrows around campus two times per day at early morning and late afternoon. These traps were checked every 15-30 minutes for two species of ground squirrels. Once squirrels were captured,, cheek cell, fecal, and hair samples were collected, and morphological measurements were taken. Sex and reproductive status were also noted and identifying information such as ear tags and pit tags were documented or deployed. Captured animals were then released back to their burrows.

Behavioral Observations: Focal animals were selected and observed for three-minute intervals. During this time, the duration of certain behaviors were timed and recorded based on a pre-determined ethogram. These behaviors were: Alert on 2 feet (A2) – standing on both feet and scanning; Alert on 4 feet (A4) – standing on all 4 feet; Feeding (F) – In the process of eating or foraging; Grooming (G) – grooming self; Running (R) – may include short stops; social interactions (INT); carrying grass (CG), dustbathing (D); scent marking (SR), and other unknown or unidentified behaviors (O). Before starting the timer, weather conditions, temperature, time of day, and location was recorded.

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RESULTS

Key Results: In 2021, Ryan Black found that GMGS in the cemetery, demonstrated more alert (33%) and running (31%) behaviors than "comfortable" behaviors such as feeding (26%) and grooming (3%)⁷. In 2022, GMGS spent slightly more time alert (36%) and less time grooming (3%) in the same colony. However, they spent more time feeding (35%) and less time running (16%) this year. They also performed comfort behaviors not observed last year such as dustbathing (2%), interacting with one another (7%), and scent-marking (1%). In contrast, WYGS at the gazebo spent more time alert (54%), slightly more time feeding (38%), and less time running (4%) than the GMGS.

Ecological Interpretation: GMGS spent more time feeding and less time running this year, which could indicate that there is increased forage opportunity or increased cover that allows for more protection. They spent about the same time alert as in 2021, possibly due to the incomplete regeneration of the burn scar. The increase in comfort behaviors like dustbathing and interacting could indicate resilience to the fire, but the increase in interaction behaviors could also result from an earlier emergence of pups in 2022. Despite being further from the fire line, WYGS spent much more time alert than GMGS did. This is likely because there is more human activity by the gazebo/rockwall than by the cemetery. It is surprising that we did not observe more interaction behaviors in the more social WYGS, however they may spend more time interacting underground.

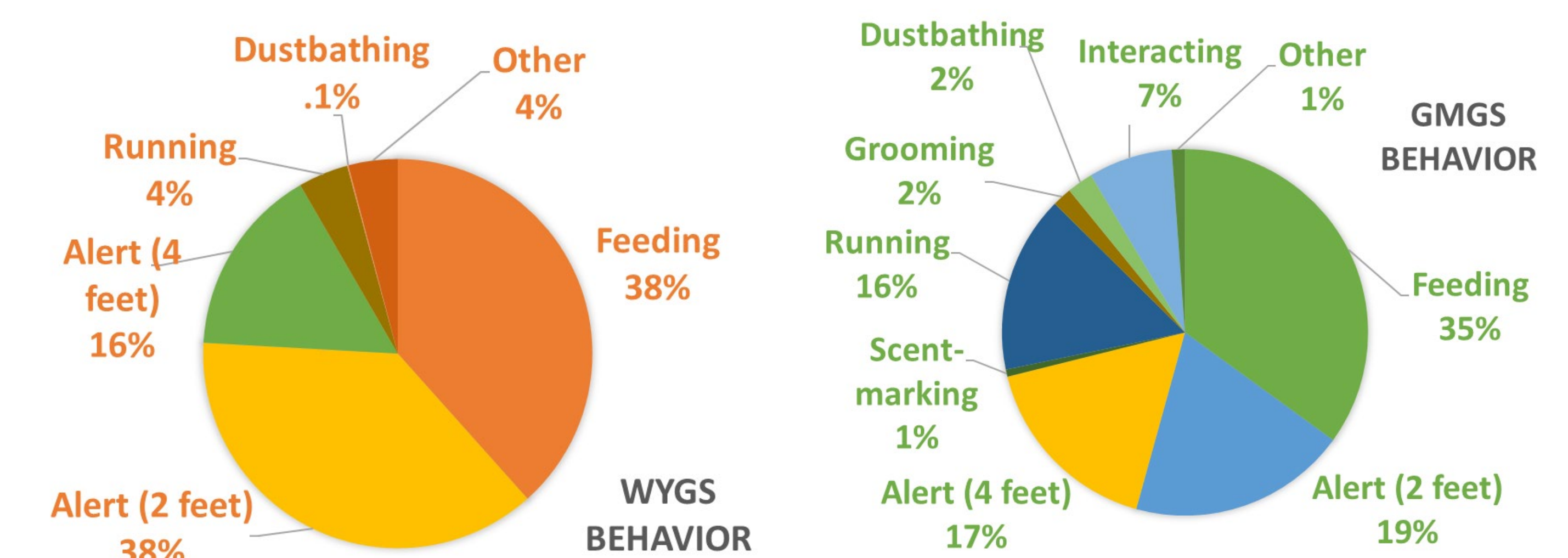


Figure 3: Time spent in different behaviors (feeding, alert, running, interacting, and other behaviors) for two species of hibernating ground squirrels, *U. elegans* (left) and *C. lateralis* (right).

NEXT STEPS

This internship taught me how to apply classroom knowledge in the field and how to make science more fun and accessible to the visiting and local communities. Going forward, it will be beneficial to study behavioral plasticity in individual squirrels rather than whole colonies. More lasting dye marks could be used to connect behavioral observations with pit tagged individuals to tell us more about how males, females, and pups respond differently to environmental change. This will help us understand how megafires impact population dynamics.

References

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⁶Goldberg, A.R. and Conway, C.J. (2021). *J. Mammalogy*, 102: 574-587.
⁷Black, R. (2021). *CSU Extension*, Poster.

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