University of British Columbia Okanagan

Mountain goat response to wildfire in Cathedral Provincial Park, BC during the 2023 Crater Creek fire

A. Chhen[a,b,c], A. T. Ford[a,c], J. Thompson[a], K. Stafford[d], & M. J. Noonan[a,b,c]

BACKGROUND

British Columbia's protected areas are experiencing an abrupt, climate-induced **increase in wildfire activity** in recent years.

Fire danger is increasing for mountainous regions[2] and wildfire activity is **occurring at higher elevation**[3].

Understanding the **immediate responses of wildlife to wildfires** is critically important for ensuring individuals **can survive wildfire** events.

However, major knowledge gaps remain:

- Limited research on wildlife behavioural responses **during** a wildfire[1]
- **Direct effects** of fires on wildlife[1]

Mountain goats (*Oreamnos americanus*) occur in areas at **risk of megafires** and **are vulnerable to the effects** of climate-driven habitat change.

Given these knowledge gaps and challenges, we set out to gain insight on:

How do mountain goats respond in real-time to the progression of wildfire?

Do changing properties of the fire affect mountain goat responses?

METHODS

Cathedral Provincial Park

- Part of the unceded and ancestral territory of the Syilx Okanagan Nation
- Located in the southern interior of BC on the US-Canada border North-east region of the Cascade Mountain Range
- Size: 33,512 hectares

Crater Creek wildfire (K52125)

- Active fire period: Jul 22 - Oct 26, 2023
- Burn duration: 96 days
- Burned size: 46,504 hectares

Mountain goats

- 6 mountain goats
- Continuously GPS-tracked throughout the Crater Creek wildfire in Cathedral Provincial Park
- 6 years of GPS collar data (2019-2024)

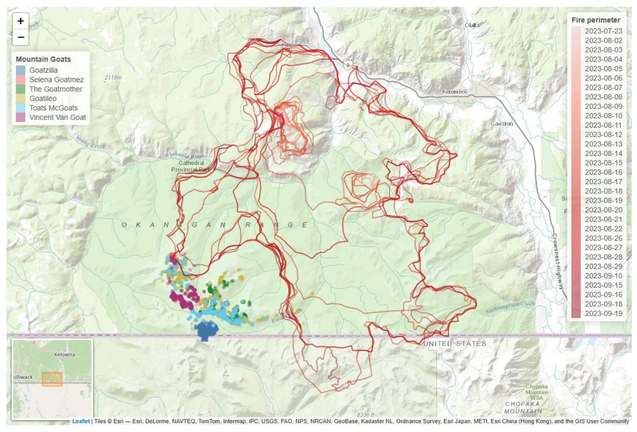

Figure 1. Map of mountain goat location in and around Cathedral Provincial Park, British Columbia. GPS locations for 6 mountain goats from July 22 to October 26, 2023, and the Crater Creek wildfire boundaries. The inconsistent dashed line marks the Canada-USA international border.

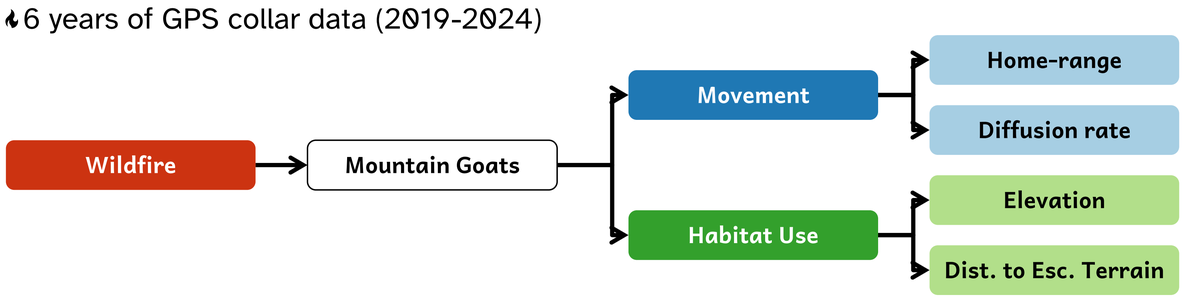

Figure 2. Project schematics of the workflow examining the response of mountain goats to wildfire. Movement (blue) was evaluated by home-range size and diffusion rate. Habitat-use (green) was investigated based on elevation and distance to escape terrain.

Figure 3. Mountain goat habitat-use from 2019 to 2024 in Cathedral Provincial Park, British Columbia. Results of a window analysis estimating individuals' mean elevation (m) across all 6 years (2019-2024). The red line indicates the year of the Crater Creek wildfire, and the grey lines are all the other years. The black dashed line represents the Crater Creek wildfire period.

COARSE-SCALE RESPONSE

Mountain goats exhibited comparable home-range sizes across all 6 years but had increased diffusion rates during the fire.

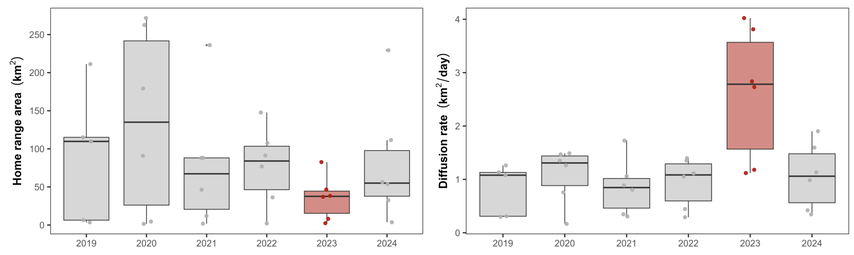

Figure 4. Mountain goat home-range and movement during the 2023 Crater Creek wildfire compared to non-fire years in Cathedral Provincial Park, British Columbia. Home-range sizes and diffusion rates during wildfire period (July 22 to October 26) across all years (2019-2024). Red indicates the fire year, and the points depict the underlying individual data.

Mountain goats exhibited similar resource selection for elevation and distance to escape terrain across all 6 years.

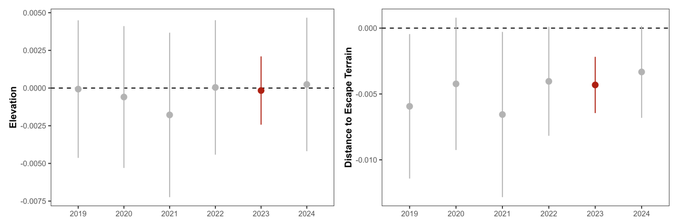

Figure 5. Mountain goat resource selection during the 2023 Crater Creek wildfire in Cathedral Provincial Park, British Columbia, compared to non-fire years. Points show resource selection function (RSF) parameter coefficient (β) estimate with 95% confidence intervals. Values above 0 indicates selection for and values below 0 suggest avoidance for the habitat p. The fire year is indicated in red and other years of the same period in grey.

FINE-SCALE RESPONSE

Mountain goats selected for higher elevation when the fire was close.

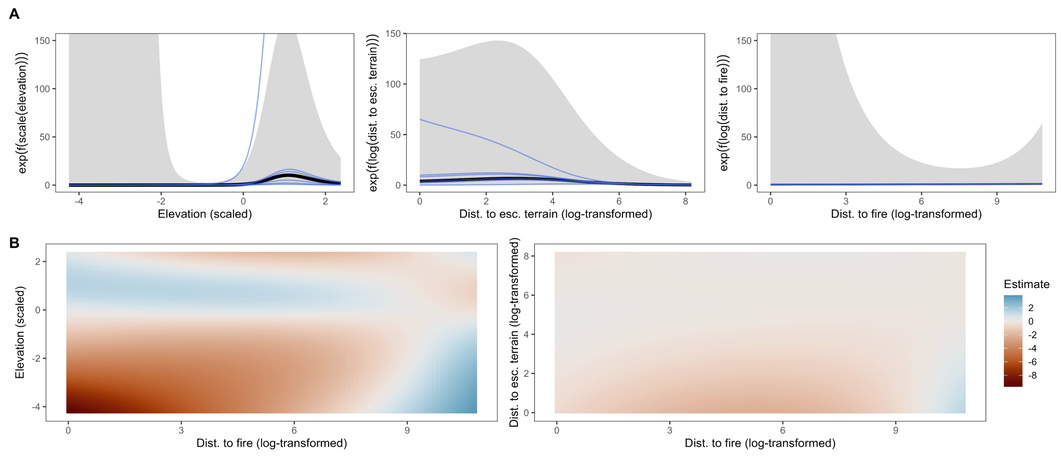

Figure 6. Mountain goat habitat selection during the 2023 Crater Creek wildfire in Cathedral Provincial Park, British Columbia based on step selection function (SSFs). Panel A) Estimated effects exp(f(β)) of the habitat parameters influencing location selection relative to other available options with population-level estimate (black lines, 95% confidence intervals in grey), and individual responses (blue lines). Panel B) Combined estimated effect of habitat parameters on the likelihood of selecting a location relative to other options available based on the mountain goats' distance to the fire. Estimated values above 0 (blue) indicates the mountain goats selected for, values below 0 (red) suggest avoidance, and 0 (white) denotes neutrality for the habitat parameter.

TAKE HOME MESSAGES

- Mountain goat **home-range sizes were not affected** by the fire, but their **movement rates increased** (*coarse-scale* findings).
- Mountain goats occupied **higher elevations** when fire was nearby *(fine-scale* results).
- Wildfire may be an **ecological trap** in mountainous areas for mountain goats.

There could be serious implications for mountain goats in the future because of fires moving upslope and occurring at higher elevations.

NEXT STEPS

- Enhance fire data resolution using fire models to reconstruct the Crater Creek wildfire progression in greater detail.
- Determine the tipping point(s) for when mountain goats alter their behaviour in response to wildfire.

a THE UNIVERSITY OF BRITISH COLUMBIA Okanagan Campus
b Quantitative Ecology Lab UBC Okanagan
c THE UNIVERSITY OF BRITISH COLUMBIA Institute for Biodiversity, Resilience, and Ecosystem Services Okanagan Campus
d BRITISH COLUMBIA BC Parks

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References & GitHub