Estimating Mountain Goat Abundance in an Alpine Transboundary Protected Area Using Genetic Data, Community Science, and Spatial Capture-Recapture

Rob Found, Parks Canada, Waterton, AB
Clinton Epps, Oregon State University, Corvallis
Rachel Crowhurst, Oregon State University, Corvallis
Jami Belt, National Park Service, West Glacier
Mark Biel, National Park Service, West Glacier
Tabitha Graves, U.S. Geological Survey, West Glacier
William Janousek*, U.S. Geological Survey, Missoula

*Indicates Presenter

**Indicates Student Presentation

Alpine ecosystems are among the most climate-sensitive environments, yet monitoring wildlife in these remote landscapes remains challenging. Mountain goats (*Oreamnos americanus*), an iconic alpine species, inhabit rugged terrain within the Waterton–Glacier International Peace Park (WGIPP), a transboundary protected area spanning the U.S.–Canada border. Long-term citizen science surveys indicate ~45% declines in goat numbers since 2008, but absolute abundance estimates have been lacking. We integrated noninvasive genetic sampling with spatial capture–recapture (SCR) modeling to estimate population size and spatial distribution while accounting for imperfect detection. Fecal samples (n=556) were collected in 2022 by U.S. Geological Survey, National Park Service, Parks Canada staff, and trained volunteers, with 32% of samples contributed by citizen scientists. Genotyping identified 174 unique goats, with an average recapture rate of 2.8 and 57% spatial recaptures. Detection probability was positively influenced by search effort and habitat suitability and negatively by forest cover. We estimated 1,715 goats (95% CRI: 1,254–2,280) across the state space, including 1,188 in Glacier and 138 in Waterton. Abundance was strongly associated with human habituation and proximity to mineral licks, and negatively with hiking trail density, suggesting complex interactions between resource availability and human use. Our findings highlight the feasibility of large-scale genetic monitoring in alpine environments and underscore the value of citizen science for expanding spatial coverage. Spatially explicit abundance estimates provide actionable insights for managing mineral resources, trail networks, and human–wildlife interactions in transboundary alpine landscapes under accelerating environmental change.