

SMALL GRANT RESEARCH
UTILIZATION OF SCENT-STATION SURVEYS
TO DETERMINE PREDATOR ABUNDANCE AND SPATIAL USE
ON CARIBOU RANCH OPEN SPACE

(Baseline for Response to Recreation)



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Cover Photo: Coyote (*Canis latrans*) hunting voles, by Bill Given

ABSTRACT

Boulder County Parks and Open Space (BCPOS) management seeks a balance between recreation and the protection of wildlife habitats and other natural resources. Determining the response of predators to recreational activities is difficult due to the secretive nature and vast area used by most predators. The scent-station survey method has been widely used to detect predators and to estimate trends in carnivore abundance. During the 2000 field season scent-station surveys were conducted at carefully selected control (non-recreational) and experimental (existing and proposed recreational) areas on the Heil Valley Ranch Open Space (Given 2001). Abundance indices were developed for each species of predator in the area from the data collected and the resulting indices corresponded with expected densities of predators demonstrating that this detection method is effective. Because the Caribou Ranch is not currently open to the public the site provides the perfect situation to establish predator use prior to recreation and thus determine a response to recreation once the property becomes open to the public. An established baseline of use will allow comparisons of indices to determine if there is a response by different species in the use of areas containing recreation. The development of abundance indices will also provide a useful measure to evaluate the effects of future management practices.

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INTRODUCTION

This study follows efforts implemented on the Heil Valley Ranch Open Space begun in 2000 using a widely accepted and cost effective method for evaluating the abundance of predatory species, and applying the results to a new and important function, use of habitat in relation to recreational use. The objectives in the first year of this study were to develop relative abundance indices for predatory species on the Caribou Ranch Open Space property and determine spatial use. Efforts in years prior to recreation will establish the baseline knowledge necessary to determine any response predators have to recreation on the Caribou Ranch when it becomes open to the public.

The abundance indices and spatial use patterns of predators will provide BCPOS managers with tools to track population trends for individual predatory species, and a useful measure to evaluate the effects of future management practices upon predators. Furthermore, the derivation of abundance indices while the property is not yet open for recreation creates a unique research opportunity to determine responses by predators to recreation when public use begins. The organization will be able to make more informed decisions for both current and future recreational activities in relation to desired management of predatory species.

Literature Review

Recreational activities are widespread, yet our understanding of their effects on wildlife is rudimentary. Although numerous studies of recreational impacts have been conducted, the knowledge gained is disparate and seldom definitive (Knight and Gutzwiller 1995). Numerous research papers have been published on the response of birds and ungulate species to recreation, however predators tend to be more difficult to study. Most available literature regarding predators and recreation focuses on bears, as well as mountain lions and wolves to a lesser extent. Virtually all of these papers are comprised of anecdotal material or information derived through the use of radio-collared subjects. There was no published literature focused on the response of mesopredators to recreation. However, there is a large amount of literature that suggests that scent-stations can be utilized to detect carnivores and estimate relative abundances for many species, including all those known to occur in Boulder County. The attached references section lists the literature and papers reviewed to develop this study and will be appropriately referenced throughout the methods section.

METHODS

Scent-station surveys were conducted to record the presence of predators during the 2002 field season. Four scent-station survey sites were established (in consultation with Dave Hoerath) to provide the best spatial coverage of the property. The four sites are as follows (see map in the appendix for locations): Delonde Gulch (control), Boulder Diversion (control), Road Loop (proposed recreation), and House Loop (proposed recreation). Scent-station survey sites consist of one transect for each site.

The goal was for each transect to contain ten stations. However, due to spacing and topographic limitations two transects contain eight stations while the other two contain ten. Each station consisted of approximately one square meter of backyard sand that is raked smooth before being baited and each station is spaced approximately 0.32 km apart (Connor et al. 1983) (Nottingham et al. 1989). Stations were baited with one fatty acid scent (FAS) tablet, a commercially available standardized predator scent attractant manufactured by the U.S. Department of Agriculture. One FAS tablet was placed in the center of the station during the day and checked for visitation the following day with a visit defined as one track or more of a species/station (Connor et al. 1983). Tracks were measured and identified using *Tracking Mammals* by James Halfpenny as a definitive reference. If weather rendered the survey line inoperative the procedure would be repeated. Each line was operated for one night/month from June through November (Brady 1981) (Roughton and Sweeny 1982). It was intended that the study would be conducted from May through October but the U.S. Forest Service closure of Rainbow Lakes Road delayed the survey until mid-June. The relative abundance index for each species is calculated as: total visits by a species, divided by the total operative station nights, times 1,000 (index = total visits by a species/total operative station nights X 1,000) as developed by Linhart and Knowlton (1975) and widely accepted as the standard for calculating scent-station abundance indices.

RESULTS

Seven predator species were detected on the Caribou Ranch Open Space during this study. The relative abundance index for each species (labeled as Caribou Ranch Abundance) is calculated as: total visits by a species, divided by the total operative station nights, times 1,000 (index = total visits by a species/total operative station nights X 1,000). Furthermore, the relative abundance index for each species at each of the sites is calculated in the same manner using only the data from that site to show spatial tendencies. The abundance results by species are as follows:

Coyote (*Canis latrans*)

Caribou Ranch Abundance = 50.93 (11 visits/216 operative stations X 1000)

Road Loop Abundance = 100.00 (6 visits/60 operative stations X 1000)

Delonde Gulch Abundance = 41.67 (2 visits/48 operative stations X 1000)

House Loop Abundance = 41.67 (2 visits/48 operative stations X 1000)

Boulder Diversion Abundance = 16.67 (1 visit/60 operative stations X 1000)

Gray fox (*Urocyon cinereoargenteus*)

Caribou Ranch Abundance = 55.56 (12 visits/216 operative stations X 1000)

Road Loop Abundance = 00.00 (0 visits/60 operative stations X 1000)

Delonde Gulch Abundance = 41.67 (2 visits/48 operative stations X 1000)

House Loop Abundance = 41.67 (2 visits/48 operative stations X 1000)

Boulder Diversion Abundance = 133.33 (8 visits/60 operative stations X 1000)

Black bear (*Ursus americanus*)

Caribou Ranch Abundance = 41.67 (9 visits/216 operative stations X 1000)

Road Loop Abundance = 00.00 (0 visits/60 operative stations X 1000)

Delonde Gulch Abundance = 104.17 (5 visits/48 operative stations X 1000)

House Loop Abundance = 20.83 (1 visit/48 operative stations X 1000)

Boulder Diversion Abundance = 50.0 (3 visits/60 operative stations X 1000)

American marten or pine marten (*Martes americana*)

Caribou Ranch Abundance = 27.78 (6 visits/216 operative stations X 1000)

Road Loop Abundance = 00.00 (0 visits/60 operative stations X 1000)

Delonde Gulch Abundance = 41.67 (2 visits/48 operative stations X 1000)

House Loop Abundance = 00.00 (0 visits/48 operative stations X 1000)

Boulder Diversion Abundance = 66.67 (4 visits/60 operative stations X 1000)

Long-tailed and Short-tailed weasel (*Mustela frenata or erminea*)

Caribou Ranch Abundance = 74.07 (16 visits/216 operative stations X 1000)

Road Loop Abundance = 133.33 (8 visits/60 operative stations X 1000)

Delonde Gulch Abundance = 41.67 (2 visits/48 operative stations X 1000)

House Loop Abundance = 00.00 (0 visits/48 operative stations X 1000)

Boulder Diversion Abundance = 100.0 (6 visits/60 operative stations X 1000)

Mountain lion (*Felis concolor*)

Caribou Ranch Abundance = 9.26 (2 visits/216 operative stations X 1000)

Road Loop Abundance = 00.00 (0 visits/60 operative stations X 1000)

Delonde Gulch Abundance = 41.67 (2 visits/48 operative stations X 1000)

House Loop Abundance = 00.00 (0 visits/48 operative stations X 1000)

Boulder Diversion Abundance = 00.00 (0 visits/60 operative stations X 1000)

Bobcat (*Lynx rufus*)

Caribou Ranch Abundance = 18.52 (4 visits/216 operative stations X 1000)

Road Loop Abundance = 33.33 (2 visits/60 operative stations X 1000)

Delonde Gulch Abundance = 00.00 (0 visits/48 operative stations X 1000)

House Loop Abundance = 41.67 (2 visits/48 operative stations X 1000)

Boulder Diversion Abundance = 00.00 (0 visits/60 operative stations X 1000)

DISCUSSION OF RESULTS

Results of this study are discussed by species accounts with a review of how the results may apply to natural resource and future visitor management of the Caribou Ranch.

Species Accounts

Seven naturally occurring predator species were detected utilizing the scent-station method. As expected weasels and canids were the most numerous by detection, while the felids that normally require much larger ranges were found to be present but with much less frequency. Black bears and martens fell somewhere in the middle for frequency. A brief synopsis for each species detected will follow, including population estimates based on research of home ranges. It should be noted that the entire acreage of the Caribou Ranch may not provide appropriate habitat and there are many other variable factors so such estimates should be considered loose guidelines, with very detailed research required to refine them.

Coyote (*Canis latrans*)

Coyotes were observed on the Caribou Ranch three times while on the property, and both tracks and scat were frequently sighted. Home ranges are known to vary widely for coyotes from as little as 4 to 5 square kilometers to as large as 143 square kilometers (Voigt and Berg 1987). Mean annual home range in southeastern Colorado was 11.3 square kilometers for residents (Gese et al. 1988). Based on the Colorado data, and depending on ranges falling partially on adjacent lands the Caribou Ranch probably supports one to two pairs of coyotes, their associated offspring until dispersal, and

occasional transient individuals. Coyotes were detected in all four sites although 55% of the coyotes detected in the study were along the road loop transect that has extensive meadows in the vicinity of many of the stations. All coyote sightings also occurred in this area. This road loop area is likely to be greatly impacted when the property is opened for recreation, so it will be interesting to see how the coyotes respond. Coyotes were the third most commonly detected species behind weasels and gray foxes.

Gray fox (*Urocyon cinereoargenteus*)

The gray fox was the second most abundant predator in the study to the weasels. Home ranges averaged 30 to 200 ha in Utah (Trapp 1978). Exclusive areas of occupancy are established and dens are thought to often be in the vicinity of water. Based on the Utah home range data the Caribou Ranch could likely carry twenty or more adult gray foxes and their associated young. Almost 67% of the detections occurred in the Boulder Diversion area. The Road Loop (which has the least access to water) was the only site that did not detect foxes. It was somewhat surprising that the gray fox was so prevalent in the area, as it is not known to be a resident of higher elevations. Caribou is probably near the upper edge of its range, however, the open drainage areas provide the necessary habitat.

Black bear (*Ursus americanus*)

Black bears were detected in every month except for November and found in each site except for the Road Loop. Generally there appeared to be at least two different bears, one in the Delonde Gulch area and the other on the north part of the property in the vicinity of the Boulder Creek diversion. All the tracks would appear to be from boars

and it is likely that two boars have ranges on Caribou. The annual home range of a male in Colorado varied from 31 to 145 square kilometers (Beck 1991), thus it is likely that the ranges are either only partially on Caribou or have some overlap. It is unlikely that the Caribou Ranch supports more than two boars and possibly two sows with their young.

American marten or pine marten (*Martes americana*)

Martens are generally associated with older growth and mixed-age stands of spruce-fir and lodgepole pine (Fitzgerald, Meaney, and Armstrong, 1994). Six martens were detected and all occurred in either Delonde Gulch or the Boulder Diversion site. The other two sites generally lack appropriate habitat. Home ranges for this species vary greatly. A study in Wyoming found average home ranges for males of 2.0 to 3.2 square kilometers and females to be 0.8 sq. km (T. Clark et al. 1989). However, as the species is quite transient and also frequently shares territories it is too difficult to extrapolate a population estimate. Considering their more specialized habitat requirements it is not surprising that the species had the lowest overall abundance index other than the felids. In the appropriate habitat areas the abundance index was much closer to the more abundant canids.

Long-tailed and Short-tailed weasel (*Mustela frenata or erminea*)

Utilizing more sophisticated tracking methods, such as stride and straddle measurements these two species can be differentiated, however, reliable measurements require good trails rather than just the random tracks often found at scent-stations, so tracks were simply recorded as weasel although most are likely to be the long-tailed variety. The weasels were the most common species recorded in the study and they

visited stations frequently in both the Road Loop and Boulder Diversion sites as well as a couple on the House Loop site. Home ranges for both weasels range anywhere from 10 to 25 ha (Fitzgerald, Meaney, and Armstrong 1994). Based on those range estimates there could be anywhere from 350 to 875 individual weasels on the Caribou Ranch if suitable habitat was uniformly distributed. As expected, the weasel was found to be the most abundant predator.

Mountain lion (*Felis concolor*)

Mountain lions have a behavioral intolerance of their own kind and require large home ranges, with maximum density estimated to be one lion per 25 to 50 square kilometers (Currier 1976). Depending on how territories fall within adjacent lands the Caribou Ranch probably falls within the home range of one to two males perhaps overlapping with one to two females, and there may be an occasional transient on the move through. Both detections occurred in the rugged and varied habitat of the Delonde Gulch.

Bobcat (*Lynx rufus*)

Home ranges in the West vary from 22 to over 80 square kilometers for males and 8 to 27 square kilometers for females (McCord and Cardoza 1982, Rolley 1987). Based on these ranges the Caribou Ranch probably supports one to two males, and one to two females and their associated young. Bobcats registered four times with two detections each at the same scent-stations. As both of these stations are in areas that will likely be impacted by future recreation there is an opportunity to determine a response of this secretive cat.

Application to Natural Resource and Visitor Management

The first year of surveys has documented seven species of predators and detected all of the expected target species. This is an excellent foundation for a baseline of abundance indices on a property that is currently closed to the public. Based on this initial data there also appear to be spatial patterns that are valuable for management decision making. Two survey sites, the Road Loop and the House Loop are the most disturbed areas currently with roads, trails, and historical buildings already in place. Additionally, hay harvesting is still taking place in this vicinity. This is also the area that is most likely to be open for recreation. Currently, coyotes, weasels and bobcats are favoring this area and will most likely have to adapt the most to future recreation. These are all adaptable species with broad, general habitat requirements. The other two areas harbor the most diversity with six species detected in the Delonde Gulch and five species on the northern section of the property, the Boulder Diversion. Delonde Gulch is the least disturbed area of the property and would seem to have the most diversity of habitat and predators. It was the only location for mountain lion and had the most detections for bears. The Boulder Diversion area is more disturbed with maintenance activities and the Rainbow Lakes road. However, the water source, as well as the more dense spruce-fir and lodgepole forest, makes this area the stronghold for both the pine marten and the gray fox.

Based on the initial spatial distribution a couple of management recommendations are possible (keep in mind this is based on only one year of data):

- 1) If recreation is to occur, then the loop utilizing the current roads and trail system would impact the fewest predator species. Also the species impacted would be the ones that are best equipped to adapt successfully.
- 2) Protecting the Delonde Gulch from recreation and other impacts will conserve the greatest diversity of predators.
- 3) The Boulder Diversion area is key for conservation of pine marten and gray fox on the Caribou property and is also very diverse (5 of 7 predators were detected).

It is important to emphasize that this study was developed to compare population trends and spatial use across years, and in particular will be applicable as recreation begins at the Caribou Ranch in the future. It is difficult to make conclusive recommendations based on only one year of data and therefore all such recommendations are made cautiously with an emphasis that further research is necessary to make more meaningful determinations.

CONCLUSION

Utilizing the scent-station methodology to detect predators during the 2002 field season appears to have been very successful. In fact, predators were detected at a much higher rate than during our 2000 Survey of the Heil Valley Ranch (28% vs. 16%)(Given 2001). Species were detected in frequencies that are consistent with their expected abundances. Based on population density research, weasels should have been the most

common species followed by gray foxes and then coyotes, while black bears and mountain lions should be considerably less abundant. The relative abundance indices developed in this study found that species did in fact occur in the abundance order expected based on published research, thus lending validity to this method as a measure of predator abundance.

First year data has provided insight into spatial distribution throughout the property for each species. This is the type of baseline establishment that is necessary to determine a species response to future recreation, as we will be able to follow both population trends and movement patterns.

It is clear that one year of data at the Caribou Ranch does not provide the statistical power to suggest any definitive results as to predator abundances and spatial use. It is important to have additional surveys to firmly establish a baseline and then to examine how predators respond to recreation in the future. The results of this initial study year do confirm the success demonstrated at the Heil Valley Ranch, that the methodology is properly designed to establish predator abundance indices, spatial use patterns, and to determine a response of predators to recreation. Continued data collection over a prolonged time period is recommended to refine relative abundance indices and to more fully determine spatial use of predators.

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APPENDIX

- Map of Study Area

