Surveying for Rare and Elusive Carnivores in the Absaroka-Beartooth Wilderness with a focus on lynx (*Lynx canadensis*).

A bobcat (*Lynx rufus*) sniffing a natural feature near Red Lodge, MT.

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Please cite this report as:  
Introduction

Canada lynx (*Lynx canadensis*) are a species of concern for federal land managers and the public in the contiguous United States. The decline of lynx in the western United States is linked to trapping and habitat degradation – via climate change and human activity. This is especially true in Montana where trapping and hunting lynx was permitted up to March of 2000 (Ruggiero et al. 1994). In 2000, in response to this decline, lynx were listed as a threatened species under the Endangered Species Act in 16 states, including Montana (“Canada lynx” 2013). Montana ranks lynx as an S3 species meaning the species is potentially at risk (“Animal species of concern” 2013). Lynx management is also complicated by the fact that lynx are elusive and occur in low density populations thus, making them hard to document and determine if their populations are remaining stable, increasing or decreasing.

In Montana, the Absaroka-Beartooth Wilderness (ABW) contains habitat that should be suitable for lynx. Lynx habitat consists of old growth forests with dense cover and downed logs (“Montana Field Guide” 2014). Snowshoe hare (*Lepus americanus*) are the key prey species for lynx. Lynx inhabit elevations ranging from 1,650 meters to 2,400 meters (5,400 feet to 7,800 feet). The ABW has elevations of over 3,650 meters (12,000 feet) and contains a large area of dense mature spruce and subalpine fir forests with lodgepole pine also providing suitable habitat (Squires and Laurion 1999). Disturbances that have occurred within these habitats, such as fire, insect infestation, downed logs, and timber harvesting provide foraging habitat and cover for snowshoe hare. Knowledge of snowshoe hare distribution in the ABW should help researchers and managers better understand where suitable lynx habitat exists and allow more efficient surveys to occur. Despite the apparently suitable habitat conditions, only since 1999 have recent lynx observations been recorded in the ABW. There have been two additional sightings just beyond the ABW boundaries, near the town of Red Lodge, MT (Montana National Heritage Program 2013) (Figure 1). This may indicate that lynx have only recently reoccupied this area and may exist in small numbers.

The lack of data on lynx in the ABW combined with the fact that the ABW has ample habitat and prey that is suitable for lynx raises the question of whether the existing data accurately reflects the true distribution of lynx in the area. This study aims to get more data on the distribution of lynx and snowshoe hare populations in the ABW.

**Key Objectives of this Study:**

(1) Determine if traditional survey methods (which are typically used in winter) modified for deployment in a Wilderness Area and during the summer months are effective for carnivore surveys, with a special emphasis on lynx.

(2) Evaluate the distribution of carnivores with a focus on lynx in parts of the ABW identified as ‘suitable habitat’.

(3) Increase public involvement (citizen scientists) to gain additional knowledge of species distributions in the ABW.
Methods

Site Selection:

The ABW, located in the heart of south central Montana’s Beartooth and Absaroka mountain ranges, provides a large area of excellent core habitat for these species with no roads and no snowmobiling. Montana’s portion of this wilderness area contains 920,365 acres managed by the United States Forest Service (“Absaroka-Beartooth Wilderness” 1996). With limited research funds for cameras and field travel, a small area that included suitable habitat was identified. The survey area chosen for the first year of this study included about 300,000 acres (1/3 of the ABW) of the eastern portion of the ABW near Red Lodge (an area from the Line Creek Plateau to the West Rosebud drainage, approximately 290,920 acres) (Figure 1). The study area included five main areas; West Rosebud, East Rosebud, West Fork, Lake Fork, and Line Creek Plateau.

In order to identify parts of these drainages likely to harbor lynx, United States Forest Service vegetation cover types were analyzed in ArcMap with a focus on three tree species known to provide suitable lynx habitat: engelmann spruce (*Picea engelmannii*), subalpine fir (*Abies lasiocarpa*), and lodgepole pine (*Pinus contorta*). Past records of lynx in the ABW were
also taken into consideration. Based on these two sources of data, suitable areas for camera traps were identified and marked in ArcMap. Trail maps were then used to find the easiest access into these areas. Upon arrival at the potential camera sites, if suitable habitat was in fact present, cameras were placed off the trail far enough away (generally > than ¼ mile) to avoid human detection and to be sensitive to Wilderness Area ethics.

Camera Site Configuration:

Eight Reconyx 600 infrared cameras were used to target carnivores and lynx. At each site, the traditional United States Forest Service lynx survey protocols set up of a central camera station with two 200 meter long lines of hair snares was used (McDaniel et al. 2000, Zielinski & Kucera 1995). Cameras were focused on a natural feature created for animals to interact on in suitable camera range. Traditional survey protocols call for an aluminum pie plate or a compact disc suspended on a string near the station to help engage the lynx to investigate. Because this study was done in Wilderness it was decided to not use synthetic lures or bait. Instead scent lures were substituted for bait and owl feathers (placed on average, 10 meters away from the camera station) used as a visual attractant, were substituted for CDs or pie plates.

A scent mixture consisting of a 1:6 ratio of glycerin, (Minnesota Trapline Inc.), and Hawbakers Long Distance Call 600, (S. Stanley Hawbaker & Sons), was placed at the natural feature and on all hair snares. For each ounce of mixture six drops of catnip oil, (Dr. Adorable Inc.), was added to the mixture. The scent was soaked into five centimeter by five centimeter carpet pads with dried catnip, (The Natural Pet Company), sprinkled on top. The carpet pads were then suspended off a tree branch over the natural feature. Hair snare carpet pads were made by using eight centimeter by eight centimeter carpet squares with special nails (automatic nail gun nails with small wires or barbs stuck through the carpet). Two carpet pads, one with hair snares and one with scent, were nailed to tree trunks, within view of the camera, 43.18 centimeters off the ground. This height is ideal to snag hair of passing lynx (Figure 2) (McDaniel et al. 2000, McKelvey et al. 1999). The purpose of the hair snare pads is to capture hairs to help determine lynx identification through DNA testing if a photo is not discernable as a bobcat (Lynx rufus) or Canada lynx. They also help to increase the amount of scent in an area. Tree cover was visually estimated at each site by standing next to the natural feature and estimating tree cover.

Figure 2. Setup of hair snare and scent pads used near the natural feature and on scent lines.
Data Analysis:

All images recorded on cameras were retrieved and brought back to the Yellowstone River Research Center (YRRC) laboratory for analysis. Camera settings were adjusted to allow for a series of five images to be taken per camera trigger, which helped ensure positive identifications of captured animals. A capture was determined as one image of a species taken (even if there were multiple images) within a 24-hour period. Data recorded by the camera included: time, number in the series, moon phase, temperature, and camera number. With this data, species diversity and species capture success rates were calculated. Species diversity was calculated as the number of species detected per site. Species capture success rate was calculated by taking the total number of times a certain species was detected and dividing it by the total amount of hours all cameras were deployed. Forest cover data was combined from wolverine and lynx sites. Then the relationship of forest cover and snowshoe hare occurrence was analyzed.

Citizen Science:

An effort was made to work with local non-government organizations (NGOs) interested in carnivore habitat, and more specifically, in engaging the public in carnivore surveys. The Eastern Chapter of the Montana Wilderness Association, The Absaroka-Beartooth Wilderness Foundation and the Cinnabar Foundation all expressed an interest in supporting the project and raising awareness amongst their volunteer networks. In addition, a press release was issued to create broader community awareness.

Results

Species Diversity:

Thirteen different species were captured during a total of 6,264 total trap hours (Table 1). Among the 13 different species, five different predators were captured. These include: bobcat, coyote (Canis latrans), grizzly bear (Ursus arctos horribilis), American marten (Martes Americana), and American black bear (Ursus americanus) (Figure 3 and 4). Snowshoe hares were recorded 67 times at four of the eight camera stations (Figure 5). When the data from this study was combined with the wolverine camera stations four additional sites included snowshoe hares. Fifty percent of all the 16 cameras had snowshoe hare captures. Species diversity was calculated for each of the eight lynx camera stations (Figure 7). Species diversity ranged from six different species to only one species at the different camera stations.
Table 1. List of different species caught at lynx camera stations.

<table>
<thead>
<tr>
<th>Species</th>
<th>Number of Captures</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Black Bear</td>
<td>25</td>
</tr>
<tr>
<td>American Marten</td>
<td>3</td>
</tr>
<tr>
<td>American Red Squirrel</td>
<td>38</td>
</tr>
<tr>
<td>American Robin</td>
<td>1</td>
</tr>
<tr>
<td>Grouse</td>
<td>3</td>
</tr>
<tr>
<td>Bobcat</td>
<td>1</td>
</tr>
<tr>
<td>Coyote</td>
<td>1</td>
</tr>
<tr>
<td>Elk</td>
<td>3</td>
</tr>
<tr>
<td>Flying Squirrel</td>
<td>2</td>
</tr>
<tr>
<td>Grizzly Bear</td>
<td>1</td>
</tr>
<tr>
<td>Mule Deer</td>
<td>53</td>
</tr>
<tr>
<td>Porcupine</td>
<td>3</td>
</tr>
<tr>
<td>Snowshoe Hare</td>
<td>67</td>
</tr>
</tbody>
</table>

Figure 3. An American marten investigates scent at a camera station.
Figure 4. A grizzly bear rubs up against a hair snare at a camera station.

Figure 5. A snowshoe hare is caught at a camera station.
Capture Success:

Capture success was calculated for each of the species captured (Figure 7). Snowshoe hares had the highest capture success rate with 0.0107 detection rate. Mule deer (*Odocoileus hemionus*) (0.0085) and American red squirrel (*Tamiasciurus hudsonicus*) (0.0061) had the second and third highest capture success rate respectively. The American black bear was the predator with the highest capture success rate of 0.004. The bobcat, coyote, and grizzly bear all were tied with the lowest capture success rate of 0.0002 for predators.
Figure 7. The species capture success rate was recorded by taking the total number of traps for that species and dividing by the total number of camera hours deployed for all cameras.

![Species Capture Success Rate Chart]

**Tree Cover:**

Tree cover information at lynx and wolverine sites combined were analyzed to compare snowshoe hare occurrences relative to forest cover (Figure 8). Camera locations with the presence of snowshoe hare had a forest cover high of 65% and a low of 20%. Camera locations without snowshoe hare had a forest cover high of 45% and a low of 5%. Overall percent forest cover was higher at locations where snowshoe hares were observed.

Figure 8. Percent forest cover of sites with snowshoe hare presence and absence

![Forest Cover Chart]
Citizen Science

During this study 13 people joined in the survey efforts for a total of 176.25 volunteer hours. At the current Montana volunteer rate of $19.64 this equals $3,461.55 in donated time. In addition, we had several people contact the project with three new reliable records of lynx observations in the ABW. Two of these were in the Boulder River drainage and the other was on Silver Run Plateau. This is a 33% increase in new lynx records in the ABW.

Discussion

The key goal of this pilot project was to determine if traditional survey methods could be successfully modified for deployment in the ABW during the summer months. Most surveys for lynx are conducted during winter months when tracking is possible (Zielinski and Kucera 1995). The challenge of working in the ABW is that winter access to much of the habitat is challenging and limited. Hence the development of summer techniques is important. In addition, out of respect for Wilderness Area ethics it is important to develop less intrusive survey techniques. While no lynx have yet been recorded, the results from this short study indicate that a variety of species (13 total) and (five carnivores can be successfully lured to camera stations in the summer without using pie plates or bait.

The fact that lynx have not yet been recorded is not an indicator of failure. The small number of lynx records in the area indicate that the population may be small or possibly only recently locally reestablished after previous extirpations. Lynx are elusive and naturally occur in low density populations so it is logical that it is difficult to record them. A study using a larger number of cameras over a longer period of time may eventually yield lynx records. As illustrated in the above discussion of capture success rate, it takes many hours to capture less rare carnivores such as bobcats or grizzlies. However, even with a limited number of deployed cameras for a short field season a number of elusive carnivores were detected. Evidence of good habitat was also found in the areas that were surveyed. (Murphy et al. 2006). The abundance of snowshoe hare, dense forest cover, and downed logs are all present in areas where cameras were located. Further camera trapping is necessary to see how much effort it takes to attract a lynx.

Citizen Science:

Citizen scientists can be a helpful method to increase records on population and biodiversity (Schmeller 2008). This study employed direct partnerships with organizations and with media outlets to engage citizen scientists. Public engagement resulted in important new records of lynx in the ABW that can guide future survey efforts. From this study, it is clear that developing a network of citizen scientists takes time and consistency with a project so that community awareness can be developed. Involving citizen scientists takes additional work and careful communication with NGOs. The challenge is finding suitable ways to involve the volunteers. Carnivore camera trapping is not a highly technical way to survey which can lead to visible results in terms of the many photos of different species detected. This is an ideal way for the public to get involved with a research conservation effort. Even when target species are not detected it raises human interest in an area to see that near their favorite lake or hiking trail there are many species to be found. The value of public involvement should not be understated as it can lead to greater community understanding of complex issues and greater support for conservation. In just the first year this study garnered the interest of community members that submitted observations and volunteered in the field. This study relied on efforts made by citizen scientists that will continue to be assets in the years to come.
Acknowledgements

We would like to thank the Yellowstone River Research Center, United States Forest Service – Custer Gallatin National Forest, Cinnabar Foundation, Eastern Chapter of the Montana Wilderness Association and the Absaroka Beartooth Wilderness Foundation for their help and funding for this study. We would also like to thank Kalon Baughan, Wildlife Monitoring and Remote Camera Specialist, for helping with training. Thanks to all of those who helped in the field, Kayhan Ostovar, Lucas Ward, Megan Poulette, Josh Poulette, Greg Farnum, Jon Kohn, Zach Farrand, Renee Seacor, Linnea Warlack, Joe Cunningham, Michael Eggen, Alex Garcia, D’Jeane Peters, and Tyler Kethley. We would like to thank Dick Hatfield, Kim Latterall, and any other citizen scientists that gave observations of lynx or wolverine in the ABW. Thanks to the Billings Gazette for their article on our study. A final thanks to Kayhan Ostovar and Lucas Ward for their help in guiding this study and for Zach Farrand for coming up with the initial idea.

Literature Cited


