North Coast and Cascades Network

Inventory and Monitoring Program

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A Survey of Forest Carnivore Species Composition and Distribution in North Cascades National Park Service Complex, Washington

National Park Service
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North Cascades National Park Service Complex, comprising North Cascades National Park, Ross Lake National Recreation Area, and Lake Chelan National Recreation Area, was established in October, 1968 and is located in northwestern Washington. North Cascades National Park was established to preserve certain majestic mountain scenery, snow fields, glaciers, alpine meadows, and other unique natural features in the North Cascades mountains for the benefit, use, and inspiration of present and future generations. Ross Lake and Lake Chelan National Recreation Areas were established to provide for outdoor recreation use and enjoyment and to conserve scenic, scientific, historic, and other values contributing to public enjoyment of these lands and waters.

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EXECUTIVE SUMMARY

Little is known about the presence and distribution of forest carnivore populations in North Cascades National Park Service Complex, Washington. Concerns over declining numbers of some species such as American marten (*Martes americana*), fisher (*Martes pennanti*), wolverine (*Gulo gulo*) and Canada lynx (*Lynx canadensis*) have prompted the need to better understand their population status. We investigated the potential occurrence of these species using remotely triggered cameras during the months of late January through mid-May of 2003 and 2004. Sampling units consisted of 4 mi^2 blocks with two camera stations per block, with each camera separated by a minimum of one mile. A total of 39 blocks were sampled. Each camera was left installed until a 28-night sampling period was achieved. We obtained 1,734 photographs of 13 mammal and five bird species. American marten (*Martes americana*) and spotted skunk (*Spilogale gracilis*) were the most frequently recorded carnivore species comprising 64.9% (1,125 of 1,734) and 18.0% (313 of 1,734) of the total photos respectively. Martens were recorded at 64.1% (25 of the 39) of the sampling blocks, by far the most common and widely distributed carnivore species detected. Other forest carnivore species detected included coyote (*Canis latrans*, 15.4% of blocks), short-tailed weasel (*Mustela erminea*,12.8%), bobcat (*Lynx rufus*, 10.3%), American black bear (*Ursus americanus*, 5.1%) and cougar (*Puma concolor*, 2.6%). Cameras also documented black-tailed deer (*Odocoileus hemionus*), snowshoe hare (*Lepus americanus*), field mouse (*Peromyscus sp*.), northern flying squirrel (*Glaucomys sabrinus*), Douglas squirrel (*Tamiasciurus douglasii*), Townsend's chipmunk (*Tamias townsendii*), red-tailed hawk (*Buteo jamaicensis*), turkey vulture (*Cathartes aura*), Steller's jay (*Cyanocitta stelleri*), gray jay (*Perisoreus canadensis*) and common raven (*Corvus corax*). We did not detect fisher, wolverine or lynx. Safety constraints and the difficulty of gaining access to the best quality fisher, wolverine and lynx habitat in the winter may have limited our ability to detect these more elusive and rare carnivore species.

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INTRODUCTION

Apparent declines in abundances and distributions of American marten (*Martes americana*), fisher (*Martes pennanti*), wolverine (*Gulo gulo*) and Canada lynx (*Lynx canadensis*) throughout western North America have raised conservation concerns (Maj and Garton 1994). In the Pacific Northwest and elsewhere, forest carnivores pose difficult challenges to conservation and management for at least five reasons. (1) They occur at low densities making their populations vulnerable to overtrapping, habitat loss, or natural disturbances. (2) Their reproductive rates are low, leading to at best, slow population increases following declines induced by the above. (3) They require unusually large areas of remote habitat, which makes them prone to extirpation from all but the largest wildlands. (4) Several forest carnivore species avoid large forest openings, which have become increasingly common in fragmented western landscapes. (5) Most forest carnivores are associated with old growth forests or remote areas, which have declined markedly in recent decades due to timber harvesting, mineral resource extraction, and real estate development. In sum, both carnivore populations and their associated habitats are rare and increase slowly once depleted.

Researchers and natural resource managers have recognized a great need for basic and applied research on forest carnivores, particularly marten, fisher, wolverine, and lynx (Ruggiero, et al. 1994). Two major knowledge gaps limit development of effective management strategies for these species. First, little is known about forest carnivore habitat relationships at the landscape scale (Ruggiero et al. 1994). Second, the relative importance of habitat characteristics at various scales (e.g., stand vs. landscape) is unknown (Bissonette and Broekhuizen 1995). If management priorities are to be set appropriately, these two gaps must be filled. The first step toward addressing this need is determining carnivore distributions. This step was completed by the mid-1990s in most potential forest carnivore habitat in Washington (Lewis and Stinson 1998), with Olympic National Park (OLYM), Mount Rainier National Park (MORA), and North Cascades National Park Service Complex (NOCA) remaining as the largest unsampled areas.

The National Park Service Natural Resource Challenge, a strategic plan aimed at preserving natural resources in parks for this and future generations and improving management of natural resources through improved reliance on scientific knowledge, has provided funding to initiate vertebrate species inventories in parks since 2000. The North Coast and Cascades Network (NCCN) Inventory and Monitoring Technical Committee identified forest carnivores as among the highest priority taxa lacking information needed to aid in developing conservation plans to protect these rare and vulnerable species (NCCN 2001). In NOCA, determining carnivore distributions is strategically important for two reasons. First, NOCA lies at the core of one of the largest areas of suitable forest carnivore habitat in the Northwest. Second, NOCA lands may function as a vital link between reservoir populations in British Columbia and populations to the south that may be more vulnerable to extinction.

Seventeen species of mustelids, canids, felids, and ursids reside in the Pacific Northwest (Table 1). While these carnivore species have widely differing status in Washington State, fisher, wolverine, lynx and the coastal population of marten have been given or are being considered for designated protection under the Endangered Species Act (Table 1). To underscore their rarity, in the large wilderness parks of the NCCN, some carnivore species have not been documented for over 40 years and several are suspected to be extirpated in some or all three parks.

Table 1. Common and scientific names of forest carnivores thought to occur in NOCA (Johnson and Cassidy 1997), along with their respective protective status.

Common Name	Scientific Name	Federal/State Status
Weasels		
American Marten	*Martes Americana*	None, None
Fisher	*Martes pennanti*	FC, E
Wolverine	*Gulo gulo*	None, SC
Ermine	*Mustela erminea*	None, None
Long-tailed weasel	*Mustela frenata*	None, None
Mink	*Mustela vison*	None, None
Western spotted skunk	*Spilogale gracilis*	None, None
River otter	*Lutra Canadensis*	None, None
Felids		
Canada lynx	*Lynx canadensis*	T, T
Bobcat	*Lynx rufus*	None, None
Cougar	*Puma concolor*	None, None
Canids		
Coyote	*Canis latrans*	None, None
Gray wolf	*Canis lupus*	E, E
Red fox	*Vulpes vulpes*	None, None
Ursids		
Black bear	*Ursus americanus*	None, None
Grizzly bear	*Ursus arctos*	T, E
Racoon		
Racoon	*Procyon lotor*	None, None

E=Endangered
T=Threatened
FC=Federal Candidate Species
SC=State Candidate
None=Not Listed

Only recently have effective survey methods been developed to census forest carnivores in remote settings. Prior to this study, no systematic surveys had been conducted in the large national parks of Washington. In and near NOCA, only selected drainages have been surveyed and usually in conjunction with other studies (Kuntz and Glesne 1993; Spencer and Negri 1996; H. Dodd, Northwest Ecosystem Alliance, pers. comm. 2005; S. Fitkin, Washington Department of Fish and Wildlife, pers. comm. 2005; K. Bondi, Washington Department of Fish and Wildlife, pers. comm. 2005). Kuntz and Glesne (1993) documented marten in the Stehekin River drainage using remote cameras during a baseline vertebrate inventory. During the winter of 1996, a cooperative study between the Washington Department of Fish and Wildlife and neighboring Mt. Baker Snoqualmie National Forest set remote camera stations in select drainages west of NOCA, resulting in detections of cougar, bobcat and several marten photos (Spencer and Negri 1996). Camera surveys conducted throughout the North Cascades ecosystem during the summers of 2000-2004 by Northwest Ecosystem Alliance (H. Dodd, pers. comm. 2005) identified the presence of wolverine on one occasion east of the Cascades crest on the Okanagon National Forest. Their efforts also documented, on at least two occasions, the presence of lynx adjacent to NOCA's eastern boundary. Also adjacent to NOCA's eastern boundary, a wolverine and probable natal den site was documented during 2002 winter aerial surveys (S. Fitkin, pers. comm. 2005). And, using DNA analysis, lynx was documented in 2000 near Crater Mountain along the northeastern border of NOCA (K. Bondi, pers. comm. 2005).

To address the need for additional information about forest carnivore distributions, each park conducted a 2-year inventory: MORA in the winters of 2001 and 2002, OLYM in 2002 and 2003, and NOCA in 2003 and 2004. By staggering the timing of surveys each park could then share equipment and other resources. Also, as the surveys progressed, the sampling protocol could be refined if necessary. Sampling procedures were standardized in each park so that results would be comparable. This report summarizes forest carnivore surveys conducted in NOCA during the winter months of 2003 and 2004. The objectives of the NOCA study on which we report were to:

1. Document forest carnivore species presence in NOCA, targeting wolverine, lynx, fisher and marten.
2. Describe the distribution of forest carnivore species detected in NOCA.

STUDY AREA

NOCA is located in northwestern Washington and includes North Cascades National Park, Lake Chelan National Recreation Area, and Ross Lake National Recreation Area (Figure 1). NOCA, also referred to as the 'park complex', lies within two very different biogeographic zones: the temperate marine on the west side of the Cascade crest and the semi-arid continental east of the crest (Franklin and Dyrness 1973). Elevation gradients are extreme and range from 119 m in the low elevation forested valleys to 2,806 m at high elevation glaciated mountain peaks. Total land area of this extensive mountainous terrain encompasses 276,815 ha, of which approximately 93% is designated wilderness.

A seasonally wet maritime climate is representative of the region west of the Cascade crest. Here, summers are relatively dry and typically cool with the majority of precipitation falling during the mild wet winters. Average annual precipitation on the west-slope ranges from 203-897 cm (Sumioka et al. 1998). As characterized by Agee and Kertis (1986), the Douglas-fir (*Pseudotsuga menziesii*), western hemlock (*Tsuga heterophylla*) and western red cedar (*Thuja plicata*) cover types dominate west-side forested habitat below 1,220 m. Above 1,220 m, forested habitat west of the crest is dominated by Pacific silver fir (*Abies amabilis*), interspersed with mountain hemlock (*Tsuga mertensiana*) and Alaska yellowcedar (*Chamaecyparis nootkantensis*) cover types (Agee and Kertis 1986).

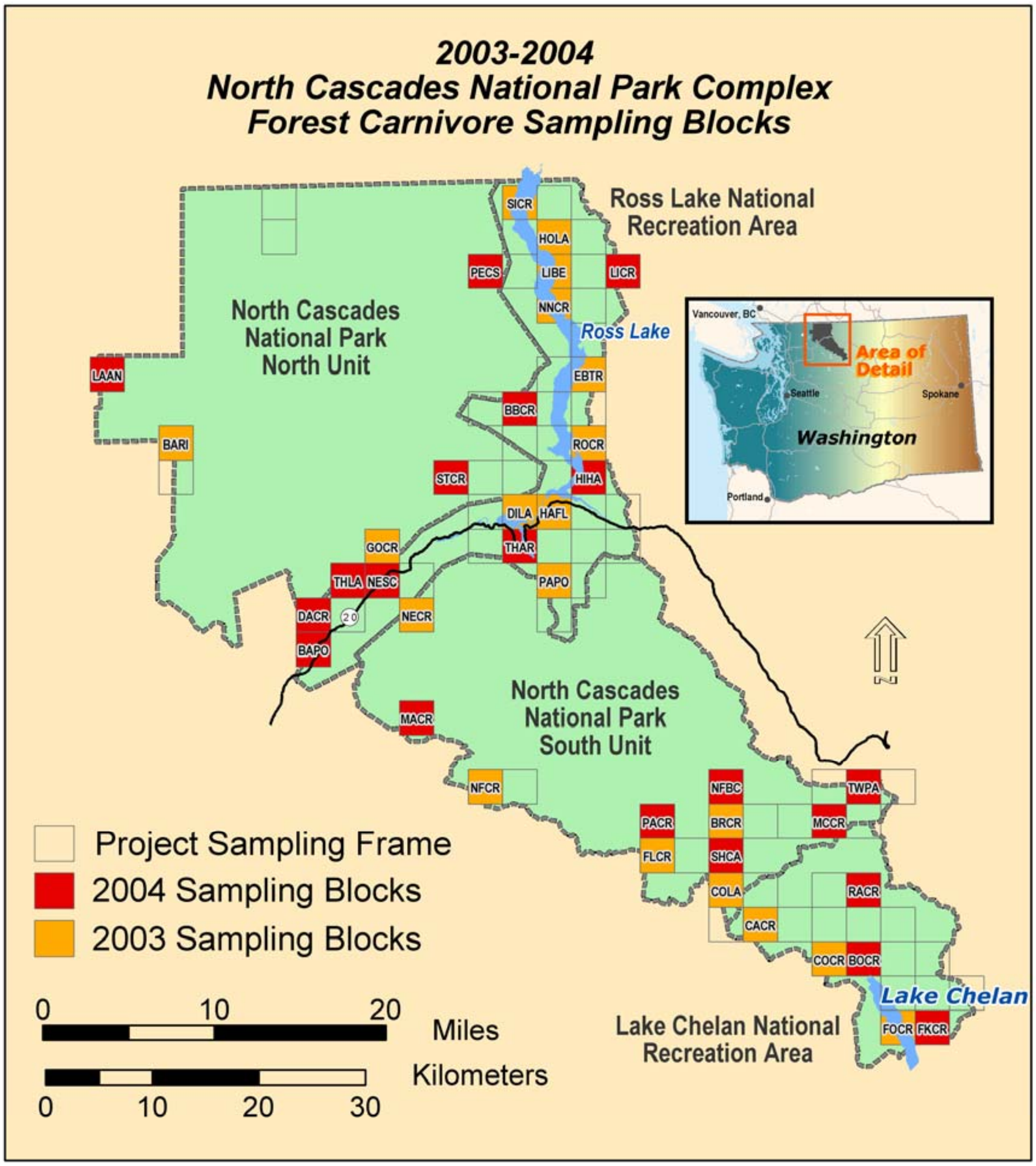

Figure 1. Study area and location of forest carnivore sampling blocks, NOCA 2003-2004.

The Cascade crest creates a rain shadow effect to the east and a climate that is much more influenced by continental air masses. As a result, east-slope conditions consist of cold winters and warm dry summers, with average annual precipitation measuring from 76 cm in the lower Stehekin Valley to 897 cm along the Cascade crest (Sumioka et al. 1998). Forested habitat below 1, 220 m is dominated by the Douglas-fir cover type with lodgepole pine (*Pinus contorta*) and ponderosa pine (*Pinus ponderosa*) commonly found as significant components, while forests above 1,220 m are dominated by subalpine fir (*Abies lasiocarpa*), interspersed with mountain hemolock and Englemann spruce (*Picea engelmannii*) cover types (Agee and Kertis 1986).

METHODS

Sampling Scheme

Field surveys were conducted for two seasons from late January through mid-May 2003 and 2004. We used standard forest carnivore survey techniques and protocols that are non-intrusive, cost effective and amenable to a wilderness environment (Aubry 1997, Zielinski and Kucera 1995). These methods have been implemented successfully throughout western states and are consistent with those selected by the NCCN wildlife group. Detailed field procedures and forms are included in Appendix A.

Sampling occurred across a wide range of precipitation gradients and habitat types, both east and west of the Cascade crest. Elevation of sample sites ranged from 119 m to nearly 1,890 m. However, the majority of sampling sites were located at low to mid elevations (<1,100 m) due to the logistics of winter access and safety of personnel. We recognized from the onset that access and safety were major constraints in the winter and would likely influence our ability to document some species.

We used a Geographical Information Systems (GIS) to develop a parkwide grid of 4 mi^2 sampling blocks. The 4 mi^2 sampling block size was chosen because it encompasses the home range of the smallest sized primary target species, the American marten (Zielinski and Kucera 1995). We then narrowed our coverage to accessible areas based on the following criteria: slopes less than 25 degrees, along trails within 7 km of trailheads, and off-trail areas within 100-1500 m of a road, trail, or reservoir. These criteria were selected to represent what we thought field crews could accomplish safely as a day trip. Exceptions were made when we could utilize a backcountry cabin as a base camp. In these cases base camps were treated like trailheads and our distance criteria were applied from there.

We identified 87 blocks, or 32.6% of NOCA’s land mass, that met our sampling criteria and was included in our sampling universe (Figure 1). We systematically selected every other block to sample, alternating between each selected block to allocate our 2003 and 2004 samples. There were a few exceptions to this pattern where we had to substitute with the next available block because of time commitments or accessibility issues to the previously selected block. This process left us with about 40 blocks to sample over the 2-year period or 20 blocks per year as a target. Sampling blocks were then divided into three main geographic areas to include Ross Lake watershed, State Route 20 corridor, and the Stehekin River watershed. To increase sampling efficiency, we sampled at least half of the blocks in each of the three geographic zones simultaneously. This approach gave us an evenly distributed sampling scheme from the north to south ends of the park complex for both years. It also minimized our travel time, a major logistical concern affecting sample size.

Each selected block was then divided into four equally-sized quadrants. Two quadrants from each block were randomly selected for placement of a remotely triggered camera station. GIS applications were used to randomly select Universal Transverse Mercator (UTM) coordinates, one in each of the two selected quadrants to define approximate locations of the camera setup points. A minimum distance of one mile separated each camera station.

Topographic maps containing the point locations and the UTM coordinates were produced for each block. We located stations on the ground as closely as possible to the projected point (within 200 m) using a hand-held Garmin® Global Positioning System (GPS) unit (see Appendix J for field UTM's). Actual selection of the station in the field required some flexibility in determining optimal site characteristics that would best accommodate camera placement. Site conditions were ideal when we could locate two trees (one slightly larger than the other) in a north-south orientation spaced about 3-4 m apart on fairly level ground. The camera and sensor would be placed on the south tree (smaller of the two) and the bait would be attached to the north tree (larger). This configuration would leave the camera pointing to the north, therefore decreasing the likelihood of glare from the sun making for easier photo identification and lessening the chances of solar heat interference that might inadvertently trip the camera.

Detection Method

Camera stations consisted of a dual-sensor remote camera system, which includes an automatic 35-mm camera connected to a Trailmaster 550® infrared trail monitor. A microwave motion and passive infrared heat sensor triggers the camera as an animal enters the field of view (Zielinski and Kucera 1995). Camera stations were consistently baited with a whole feathered chicken and a can of tuna placed above it on the bait tree. Above the tuna can we placed an approximate 4" x 8" masonite placard with the appropriate 5-letter acronym used to identify the site. The area was then scented with three commercial trapping lures including skunk essence, which we mixed with lanolin to form a gelled paste, a commercial marten lure and anise oil. Two different companies were used, depending on product availability, when procuring the scent lures (Appendix B). An 8-inch aluminum pie tin was attached with fishing line and a swivel and then suspended from a nearby branch as an attractant for felids. Camera stations were left installed for a minimum 28-night sampling period per protocol procedures (Kucera et al. 1995). To account for occasional equipment malfunctions it became necessary to keep some camera stations installed beyond the 28-night period in order to meet the minimum required sampling effort. Camera stations were set up and maintained by two crews of two people each on an approximate 14-day interval. Having the two teams usually allowed us to install or check two blocks (4 cameras) per day. Barring any technical problems that would require additional visits, each station was visited three times (installation, check, and removal). As a standard, if the chicken was missing when checking a station, we still considered the station operational providing the tuna can and scent were present. We acknowledge there may have been some sampling bias when the chicken bait was not present, but without having the film developed immediately, there was no way to be certain when the bait became missing and how many additional sample nights would be needed. All cameras were removed by mid-May to minimize the risk of bears interfering with sampling equipment and posing a threat to visitors.

Habitat Sampling

We used a 50 m radius circular plot, with the bait tree as the center point, to broadly characterize the vegetation composition and structure of the forest stand at each camera station. We did not measure each individual tree or downed log in the plot, but rather measured a few to describe the overall condition of the stand by categorizing the desired components into various size classes (Appendix A, page 3 of field forms). Variables collected included average diameter at breast height (dbh) of live trees, average spacing between trees, percent of dead trees, average dbh of dead trees, category of fuel load from dead and downed woody debris, average dbh of dead and downed woody debris, percent canopy closure and the three most common tree species in the canopy. A crown densiometer was used to measure canopy cover at five points: the plot center and points on the circle perimeter 50 m from center in the four cardinal directions. The five recorded values were then averaged and applied to the appropriate percent canopy closure category listed on the field form. Topographic variables included slope, aspect, topographic position of the camera station relevant to the overall slope and distance to water.

Data Management

We used the term ‘block’ when referencing the 4 mi^2 grid cell. This would collectively include both camera stations within a given block. When individual stations were referenced we used the term ‘sub-block’ or ‘camera station’. Only one of the two cameras in a block needed to be operational for the full 28-night sampling period in order for that block to be considered sampled. Likewise, if only one of the two cameras within a block detected an animal species, then that block was considered occupied. In order to maintain equal sampling effort, every attempt was made to keep both camera stations within a block installed for the minimum 28-night sampling period. Of the 78 camera stations installed, only one camera station (operational for just 22 nights), did not meet the sampling protocol of 28 nights.

Inoperative station nights, defined as those days in which the film was depleted, all bait lures were consumed, or when other extraneous factors interfered with continuous monitoring, were not counted as survey effort. If a station appeared to be inoperative then the date and time of the last photo taken could be determined by scrolling through the event data logged within the Trailmaster sensor. Once that was determined, station sampling was extended as necessary to achieve the protocol standard of 28 nights. Missed sampling time was generally made up with one or sometimes two additional visits to the site.

We used 36-exposure, 400-ASA-slide film. Immediately after pulling film from the camera we labeled the film roll with the date it was pulled, the roll number, and the five letter station acronym. This served as a tremendous aid in keeping the film organized with the site it was taken from. Film was developed locally within one week of being removed from the camera. After development each photographic slide was examined in the lab and identified to species. We referenced Maser (1998) as a field guide for mammals and Sibley (2000) for bird identification. Each slide was systematically labeled with site name, species name, event number, frame number, and date and time the photo was taken according to the sensor data. Occasionally the camera was tripped by unknown causes such as a mechanical malfunction or an animal that may have escaped before being photographed. These photos were subsequently classified as ‘no animal observed’. Photos in which we could see an animal but were unable to discern exactly what it was (usually due to a fog-covered lens) were classified as ‘unknown animal’. Photos that were taken to check the camera’s operational status when arriving or departing a camera station were classified as ‘test photos’. Those photos that fell into any of these three categories were not included in the ‘total identifiable animal photos’ count or subsequent analysis (Appendix C). Photos that had any degree of uncertainty in species identification were examined by multiple experienced staff for quality control. All slides were placed in plastic slide pages and stored in 3-ring binders in chronological order from date sampling occurred. For each camera station the slides in the binder are preceded by the completed field forms and printed copies of event data from the Trailmaster data logger.

Statistical Analysis

StatPack software Version 2000.1212.8 was used to download and organize the Trailmaster event data (Goodson and Associates, Inc. 2000). Field data were entered into a relational MS Access database Version 2002. Queries for detection frequency, number of photos for each species by block and sub-block, and vegetation characteristics were extracted from the database and then imported into a MS Excel spreadsheet Version 2002 for further workup.

Because habitats, climate, and other factors differ east and west of the Cascade crest, we evaluated hypotheses that carnivore detection rates might differ across the crest also. First, we considered differences in species composition by including detections of all carnivore species. Then we addressed species-specific differences in detection rates. Prior to analysis, we assigned sample blocks to east-side or west-side categories based on geographic position relative to the Cascade crest. We included blocks on the east side of Ross Lake in the east-side category because habitat conditions there are similar to those found east of the crest (Franklin and Dyrness 1973). We limited our analysis to carnivores detected in at least four survey blocks. We used the Log-Likelihood ratio test because mean expected frequency was less than 6 (Zar 1999). We analyzed east-side vs. west-side differences in detection rates for individual species using Fisher’s exact test. All statistical tests were run using S-plus software Version 3.4.

RESULTS

Survey Effort

We sampled to protocol 39 blocks in late winter-spring of 2003 and 2004. All camera stations (n=78) were sampled the minimum 28 camera nights, with the exception of one which was sampled for only 22 camera nights. This represents 2,178 operable camera nights. From this effort, we recorded 1,734 identifiable animal photos (Table 2) of 13 mammal and five bird species (Table 3). All species recorded (18), were detected in each of the two years.

Camera Operation

Although all but one sub-block was sampled to protocol, 27 of the 78 sub-blocks encountered some sort of problem that rendered the site non-operational for a period of time. These problems were associated with the film being depleted prematurely, dead batteries in the sensor or camera, and a severed sensor cable that was chewed by a small mammal. In all cases these problems were discovered and remedied within the 14-day check interval, thus minimizing inoperative time for most stations. Extended sampling to make up for lost time ranged from 1-33 camera nights per station, with a mean of six nights per station.

Table 2. Counts of pictures taken, frequency of detections and number of total species and carnivore species detected in NOCA during 2003 and 2004.

Year of Survey	**2003**	**2004**	**Total**
Number of Sample Blocks	**(n=19)**	**(n=20)**	**(n=39)**
Number of Pictures (excludes test photos)	974	1135	2109
Number of Animal Pictures	803	931	1734
Number of No Animal Pictures (includes unknowns)	171	204	375
% Animal Pictures	82	82	82
Frequency of Species Detections[1] mean (range)	2.7 (0-5)	2.2 (0-4)	2.4 (0-5)
Frequency of Carnivore Detections[2] mean (range)	1.6 (0-3)	1.1 (0-2)	1.3 (0-3)
Total Number of Species Detected	18	18	18
Number of Forest Carnivores Detected	7	7	7

[1]Mean number of animal species detected summed across blocks (species that had multiple pictures in a block were counted only once).
[2]Mean number of carnivore species detected in each block summed across blocks (species that had multiple pictures in a block were counted only once).

Table 3. Animal species detected and percent of sample blocks and sub-blocks species detected in using remotely triggered cameras, NOCA 2003-2004.

Species Common Name	**Sample blocks (n=39) Number (% of blocks)**	**Sample sub-blocks (n=78) Number (% of sub-blocks)**
Forest Carnivores		
American marten	25 (64.1)	34 (43.6)
Spotted skunk	9 (23.1)	9 (11.5)
Coyote	6 (15.4)	6 (7.7)
Short-tailed weasel	5 (12.8)	5 (6.4)
Bobcat	4 (10.3)	4 (5.1)
American black bear	2 (5.1)	2 (2.6)
Cougar	1 (2.6)	1 (1.3)
Misc. Mammals		
Mule deer	9 (23.1)	12 (15.4)
Douglas squirrel	8 (20.5)	9 (11.5)
Field Mouse[1]	6 (15.4)	7 (9.0)
Northern flying squirrel	3 (7.7)	3 (3.8)
Townsend’s chipmunk	1 (2.6)	1 (1.3)
Snowshoe hare	1 (2.6)	1 (1.3)
Birds		
Steller’s jay	6 (15.4)	7 (9.0)
Gray jay	5 (12.8)	5 (6.4)
Common raven	2 (5.1)	2 (2.6)
Red-tailed hawk	1 (2.6)	1 (1.3)
Turkey vulture	1 (2.6)	1 (1.3)

[1]Unable to identify to species level from photo.

Forest Carnivores Detected

Martens were by far the most widely detected species and occurred both east and west of the Cascade crest and across the greatest elevation gradients, ranging from 445 m at Newhalem Creek to 1,892 m at the Twisp Pass sites (see Appendix D for marten distribution map). Mean elevation of marten detections was 895.4 m, compared to a mean elevation of 629.0 m for all survey sites. There was high variability in the number of photos taken at camera stations where martens were present, ranging from 1-158 photos with a mean of 31.8 photos per camera station. The number of nights that martens visited individual camera stations within the 28 night sampling period ranged from 1-17 with a mean of 5.3 camera nights per station. Martens appeared most frequently east of the Cascades crest in the Stehekin River drainage where they were detected at 85.7% (12 of 14) of the sampling blocks in that region. The two remaining blocks east of the crest with no marten detections were both located near the southern end of the Chelan National Recreation Area. Site conditions in these blocks are much drier with sparser and more patchily distributed forest stand conditions and may represent habitat characteristics unsuitable for marten use.

Elsewhere, marten were found extensively in the Ross Lake watershed above Ross Dam at 80% (8 of 10) of the sampling blocks. They appeared less prevalent in the lower Skagit River drainage where they were detected at only 27% (3 of 11) of the blocks. There was very little difference when comparing the number of sampling blocks with marten detections found in 2003 and those reported in 2004, 68% (13 of 19) and 60% (12 of 20) of blocks respectively.

Though not a target species, spotted skunk was the second most frequently detected species, accounting for 18% (313 of 1,734) of the total animal photos taken (Figure 2). They were found at nine blocks, all west of the crest, although two blocks were east of Ross Lake in areas more similar to east-side habitats (see Appendix F for distribution map). Spotted skunks were found at elevations ranging from 86 to 859 m. At locations where they were found, they generally were photographed several times, often the culprit of exposing a roll of film in a matter of only a few days. Detections at individual camera stations where spotted skunks were found ranged from 3-72, with a mean of 34.8 detections per individual site. The number of nights that spotted skunks visited a station within the 28 night sampling period ranged from 3-27 with a mean of 8.7 camera nights.

Of the remaining five carnivore species documented (Table 3), detection rates were very low for all five species. They were found at few sampling blocks and each comprised a very small percentage of the total photographs taken. Cougar, for example, was detected at only one block and comprised a mere 1.3% (23 of 1,734) of the total animal photos. This block is located in the rain shadowed area just east of Ross Lake where cougar have been observed in the past (NOCA wildlife observation database).

Bobcats were detected at four of the sampling blocks and comprised 1.2% (20 of 1,734) of the total animal photos. Interestingly, they were only detected west of the Cascade crest at elevations ranging from 274 to 1,053 m. However, tracks were identified both east and west of the crest in areas where we had cameras installed less than 400 m away, yet they managed to avoid photographic detection in those places.

Short-tailed weasels were detected at five blocks and accounted for 1.7% (30 of 1,734) of the total photos. Eighty percent (4 of 5) of blocks with weasel detections were west-side locations. All four of those sites showed overlap with spotted skunk detections. Elevations ranged from 86 to 671 m.

Coyote were found at six blocks and comprised 0.4% (7 of 1,734) of the total photos. There were generally only one or two photos taken at each site where they were detected. All blocks where coyotes were detected occurred at east-side camera stations. Elevations ranged from 643 to 1,208 m.

Although we tried to avoid encounters with black bears, they were detected at two blocks and accounted for 0.3% (5 of 1,734) of the total animal photos. They were detected late in the sampling period (early May) and only at the southern edge of the Lake Chelan National Recreation Area where spring and den emergence comes earlier.

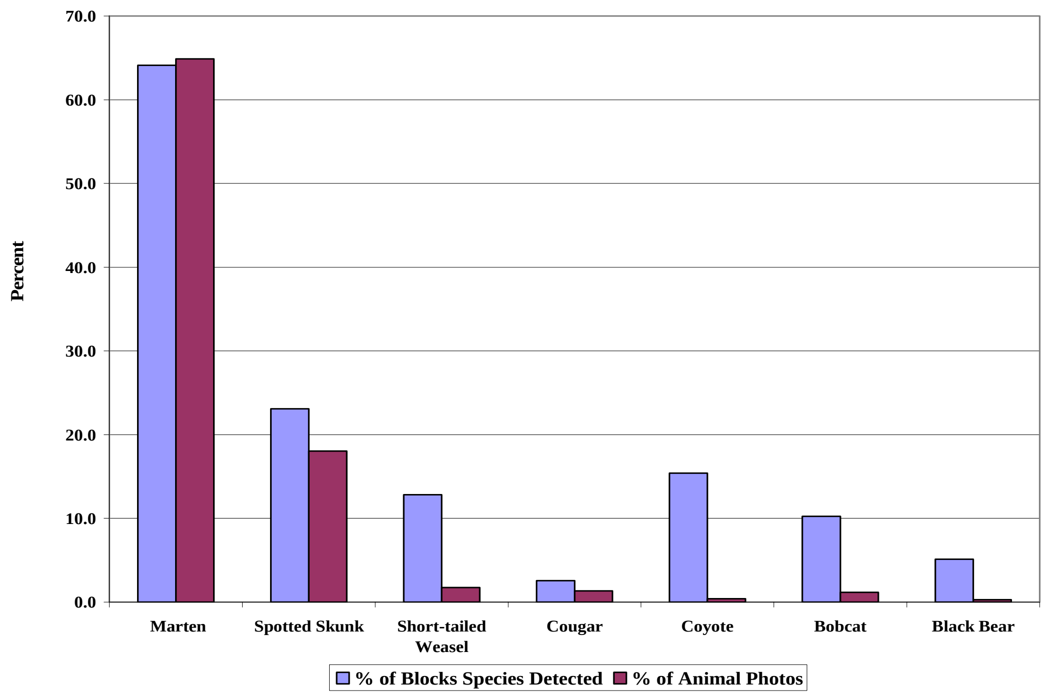

Figure 2. Species of carnivores detected shown as percent of sampling blocks with detections and percent of total animal photos for each species.

The composition of carnivore species detected differed between east-side and west-side blocks (Log-Likelihood ratio test, G = 10.35, df = 4, P = 0.035). These analyses (Table 4) found that detection rates of martens and coyotes were greater east of the crest. Detection rates for the other three species may be greater west of the crest, but our detection frequencies for these species were too low to conclude such with confidence.

Table 4. Comparison of detection rates of carnivores in west-side vs. east-side habitat zones. The table does not include species detected in fewer than four sample blocks. Fisher's exact test was used to test the null hypothesis that detection rates for each species were equal in west-side and east-side habitat zones.

	Detection rate (blocks detected/blocks surveyed)		
Species	West-side habitats	East-side habitats	P-value
American Marten	0.35	0.86	0.0019
Spotted Skunk	0.35	0.14	0.14
Short-tailed Weasel	0.18	0.09	0.64
Coyote	0	0.38	0.027
Bobcat	0.18	0.05	0.30

Other Animal Detections

In addition, we recorded photos of other mammals (Figure 3), including mule deer (*Odocoileus hemionus*), field mouse (*Peromyscus sp.*), Douglas squirrel (*Tamiasciurus douglasii*), northern flying squirrel (*Glaucomys sabrinus*), Townsend's chipmunk (*Tamias townsendii*) and snowshoe hare (*Lepus americanus*). Mule deer and Douglas squirrel were the most frequent guests in this group and were found at 23% (9 of 39) and 21% (8 of 39) of the blocks, respectively. Douglas squirrels comprised only 1.4% (24 of 1,734) of the total animal photos. All nine blocks with Douglas squirrel detections also had overlap with marten presence. Mule deer also made up a mere 1.4% (24 of 1,734) of the total photos and appeared to be just passing through the camera's field of view while getting their picture taken once or twice in the background before moving on. Snowshoe hare detections were few, located at only one east-side station, accounting for 0.06% (1 of 1,734) of the total

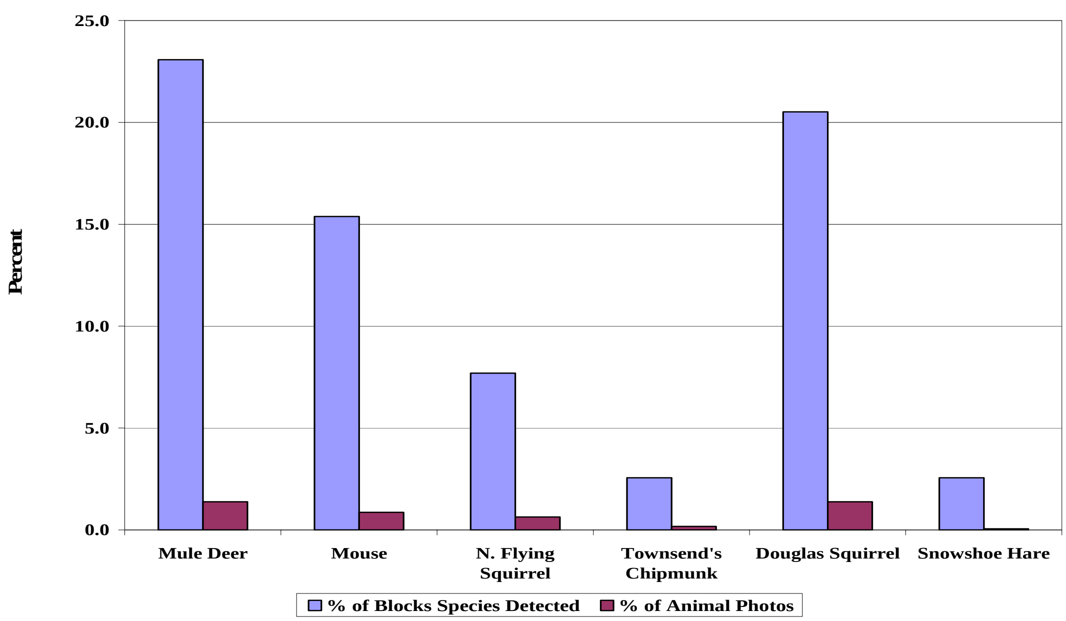

Figure 3. Species of other mammals detected shown as percent of sampling blocks with detections and percent of total animal photos for each species.

animal photos. However, hare tracks were seen on several occasions and almost always on the drier east-side slopes and along the rain shadow area east of Ross Lake.

Several bird species were also detected including red-tailed hawk (*Buteo jamaicensis*), turkey vulture (*Cathartes aura*), Steller's jay (*Cyanocitta stelleri*), gray jay (*Perisoreus Canadensis*) and common raven (*Corvus corax*) (Figure 4). Stellar's jay and gray jay were rather frequent visitors, found at six (41 of 1,734 photos) and five (31 of 1,734 photos) blocks, respectively. Ravens were the next most common bird species, found at two blocks and making up for 3.4% (59 of 1,734 photos) of the total photos. Red-tailed hawk and turkey vulture were found at one block each, comprising 0.06% (1 of 1,734 photos) of total animal photos for each species.

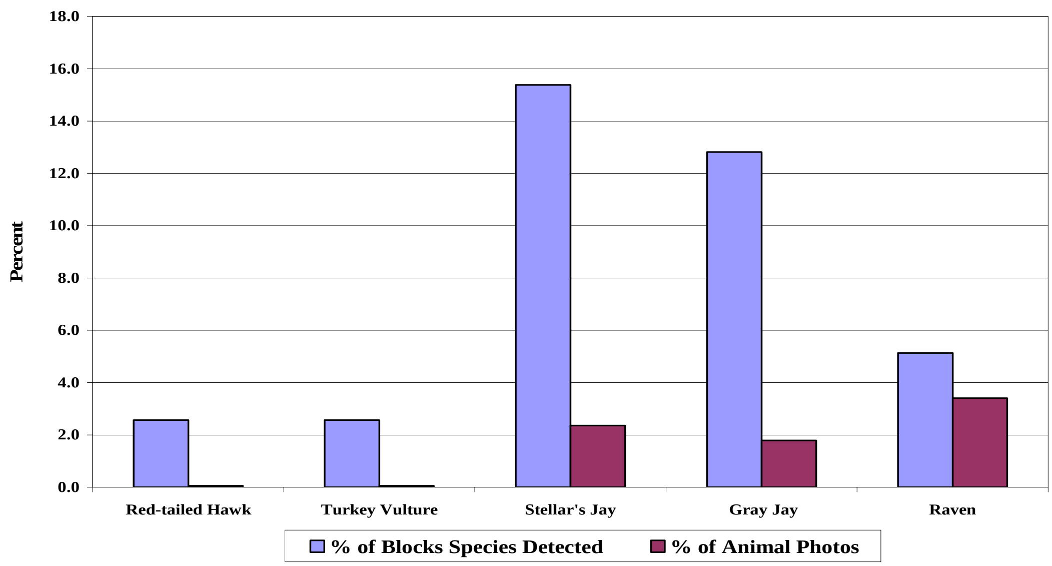

Figure 4. Species of birds detected shown as percent of sampling blocks with detections and percent of total animal photos for each species.

Vegetation Assessment

Vegetation characteristics for each camera station were compiled and reported in Appendix G-I. Some data for woody debris and fuel load classifications are missing due to excessive snow depth at the time stations were visited. Since martens were the most frequently detected carnivore species, we were interested in determining if there were any discernable patterns of habitat preference in proportion to what was available. The vegetation data from all 78 stations were included as 'total available' and from that we extracted the number of sampling stations where martens were found and referenced that as 'marten use'. The results are presented in chart format for six of the major variables collected (Figure 5).

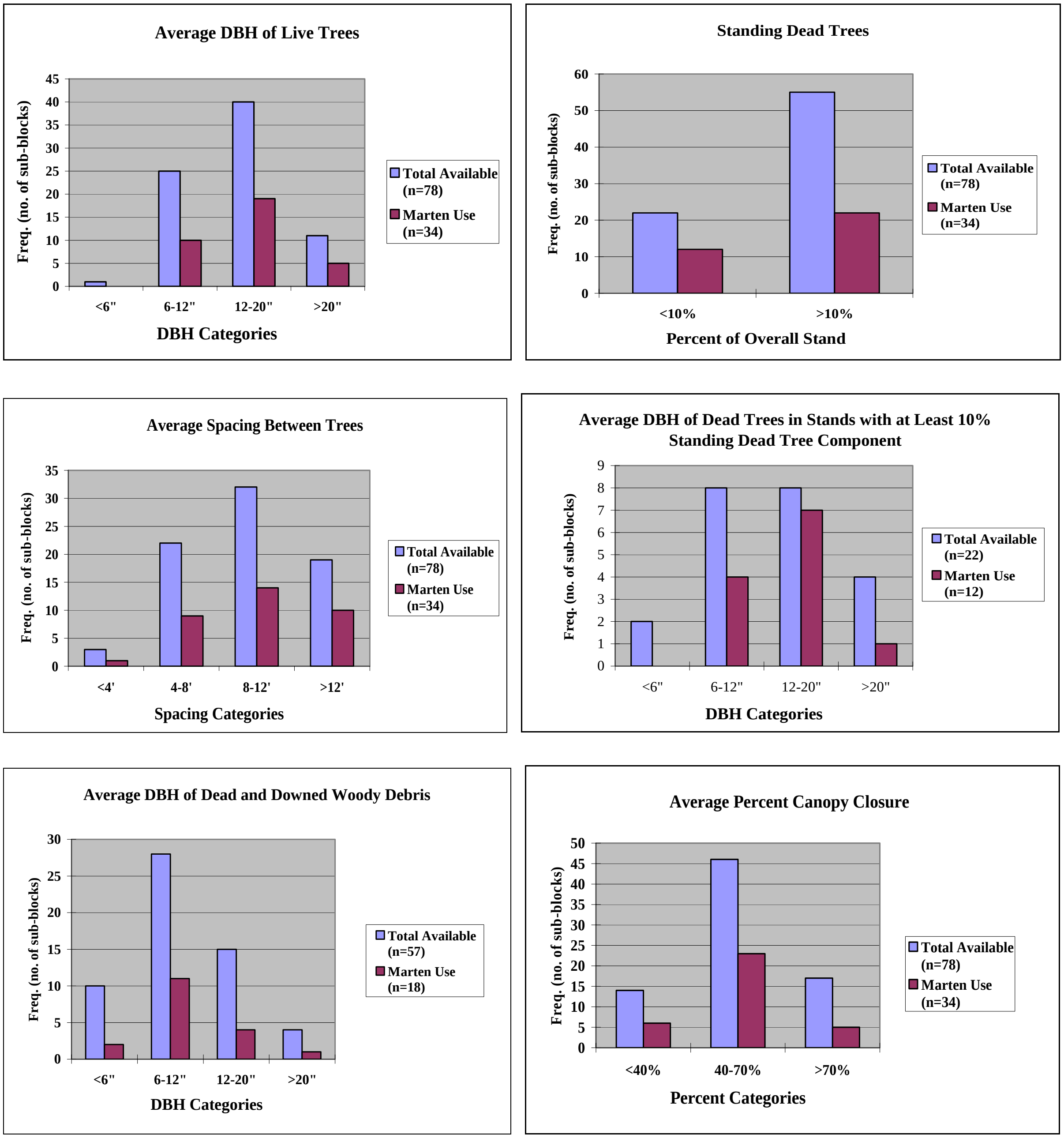

Figure 5. Vegetation assessment showing habitat characteristics found at all sampled sub-blocks and those where marten detections occurred. Frequency is reported as number of sub-blocks. For 'average dbh of dead trees' and 'average dbh of dead and downed woody debris' there was missing data at some blocks due to deep snow coverage at the time the stations were visited.

DISCUSSION

Of the four carnivore species targeted in our inventory, only marten were commonly detected. We did not detect wolverine, fisher or lynx in this inventory. Our results show that marten are distributed throughout much of the NOCA study area. Marten were also detected widely at MORA. With detections in 70% (14 of 20) of sampling blocks at MORA, it was the most frequently detected species there (J. Schaberl, unpublished data). Similarly, marten were detected in 28% (46 of 162) of blocks sampled in montane forests throughout Washington during 1996-1998 (Lewis and Stinson 1998). By contrast, marten were not detected in any of the 26 blocks sampled in OLYM (Happe et al. 2005). Non-detection of marten does not necessarily indicate that the species is absent from OLYM. Rather, marten could occupy areas not sampled, or they may occur in sampled blocks, but avoided detection during the OLYM survey. Neither of these explanations is very plausible, however. The OLYM survey design included random sampling of suitable and accessible habitats in order to prevent biasing the study away from sites potentially occupied by marten. The likelihood of marten consistently avoiding detection in sampled blocks is even more remote. Detection/non-detection results are appropriately described with a binomial distribution, P(x, p, n), in which x detections are obtained in n sample blocks, each of which has p chance of obtaining a detection. If marten were as widely distributed in OLYM as they were found to be in NOCA and MORA, then the probability of obtaining zero detections from 26 sample blocks is less than one in a trillion [P(0, 0.661, 26) < 10^-12; where 0.661 is the mean per-block detection probability in NOCA and MORA, weighted by sample size.] Hence, we must conclude that if marten exist in OLYM at all, they must be considerably rarer than they are in NOCA and MORA.

We found detection rates for marten were higher in east-side habitats. In NOCA, the Stehekin River drainage had the highest frequency of occupied marten blocks of all areas sampled, suggesting there may be a higher density of martens in this watershed. Reasons for this are unknown. In some instances the cameras did provide information on presence of important prey species for marten, such as field mice, snowshoe hare and Douglas squirrels (Buskirk and Ruggiero 1994). Interestingly, at all blocks where Douglas squirrels were found, there were also marten detections. This may suggest a similar relationship that Buskirk (1984) and Bull and Heater (2000) reported, whereas the presence of squirrels and their middens provide marten with important prey and resting sites during the critical energy strain of winter.

We presented figures showing vegetation characteristics where martens were detected. We acknowledge through the use of scent lures that we attracted these animals from a larger range to the plots where habitat characteristics were collected. Although this may present potential for sampling bias, the attributes collected were likely similar to surrounding areas by virtue of the study area being largely comprised of designated wilderness or National Recreation land with protected old-growth habitat. However, it is important to note that our data only show the existence of an animal in a particular environment at one point in time. In addition, we may have only been examining what might be considered foraging habitat for marten in the winter, recognizing that at different times of the year activities may take place in other habitat types (Buskirk and Ruggiero 1994). Nevertheless, it is not known whether habitats marten select for foraging differ from habitats they use for resting or denning (Buskirk and Powell 1994). An approach to characterize habitat at the scale needed for individual or population requirements necessary for long-term survival is far beyond the scope of our objectives for this study.

Wolverine, lynx and fisher were not detected in any of the three large parks. The results of surveys in these parks strengthen some of the same conclusions drawn from previous survey data of forest carnivores in Washington (Lewis and Stinson 1998). It appears these species are indeed very rare, elusive or completely absent from historical ranges. However, it is worth noting that the lack of detections does not necessarily equate to a lack of presence. Recent credible, but unconfirmed sightings over the past decade suggest that a small number of these species do inhabit NOCA. Nonetheless, it remains uncertain whether there are actually viable populations remaining in the park complex or if the occasional observation is linked to dispersing young or transient individuals from a nearby population source outside of park boundaries. For example, one of the largest lynx population centers in the lower 48 states occurs in north-central Washington with density estimates of 2.4 lynx/100 km^2 (Brittell et al. 1989) and 2.6 lynx/100 km^2 (Koehler 1990) reported. This is likely a source population for possible dispersing lynx observed in and around the eastern part of the park complex. Likewise, population estimates for wolverine in all of B.C. exceed 5,000 animals (Hummel et al. 1991.), suggesting that this may be a possible population source of occasional individuals observed in and adjacent to the park complex. Long dispersal distances have been reported for both lynx (Mech 1977) and wolverine (Gardner et al. 1986), suggesting that NOCA is within reach of adjacent populations of these species.

This study was part of a greater NCCN effort to inventory forest carnivores in the three large parks. NOCA was the last of these parks to implement this effort, which allowed us to build on the other park's achievements and problem-solving ideas. By and large, we experienced great success with the TM-550 camera system. There were however, a few minor reoccurring problems that required us to explore new techniques in camera setups and make modifications accordingly to correct those problem areas. One of the most common situations that happened on several accounts was an animal honing in on the bait and over a three or four day period exposing the entire roll of film. We were unable to resolve this issue. Another situation involved the animal (presumably marten based on photos) chewing a large hole through the poultry wire used in securing the bait to the tree and then stealing the bait. This was soon remedied by fortifying the existing poultry wire with a thicker gauge square patterned hardware wire when securing the bait to the tree. In one instance the animal (again, presumably marten) chewed its way through the back side of a snag that had the bait attached, which in turn allowed access to the bait and eventually it was stolen. This was a good lesson in being more attentive and not under-estimating the potential of these predators when selecting the bait tree. We had one incident where a small mammal had chewed through the connector cable. This situation was corrected by reinforcing the cable with duct tape. Condensation of the camera lens occurred on at least two occasions resulting in a sequence of photos that were blurry and unidentifiable. Dead batteries, usually the C-cell batteries operating the TM-550, accounted for some down time at stations, but this happened relatively few times. By always carrying an extra sensor, spare batteries and a battery tester we were normally able to correct or intercept these potential problems before they happened. We used L-shaped metal brackets for mounting the camera to the tree which provided a solid attachment, thus eliminating any misalignment issues.

Maintaining a regimented schedule that included two-week intervals between camera checks was key in reducing the number of missed camera nights that required the site to be operational beyond the 28- night required sampling period. Only in one instance were we unable to meet this minimum. In this case there was a spotted skunk exposing the film within a few days of repeatedly replacing the film. It soon became cost prohibitive to continue additional visits to this remote site, so we pulled the station prematurely. It may be advisable in the future to merely move the camera station far enough away to avoid repetitive visits from a habituated animal, rather than having it completely removed.

We demonstrated that non-invasive sampling can be used to measure presence and distribution of some forest carnivores. However, one major limitation is remotely triggered camera surveys provide little opportunity to determine reliable abundance numbers. The methods used do not allow for an estimation of population size because individuals cannot be identified when there are multiple visits to the camera station by the same species (Raphael 1994, Zielinski and Kucera 1995). However, they can be useful in attaining an index of relative abundance and comparisons of detection frequency made between sampling sites. In cases where surveys can be repeated multiple (e.g., five) times, abundance can be estimated using new methods (Royle and Nichols 2003). Completing multiple carnivore surveys would prove difficult under current funding constraints.

There are some underlying assumptions that may affect interpretation of results. One major assumption is that all animals would be equally detectable. To our knowledge little work has been done that evaluates the probability of detection for different carnivore species. It may be that felids, for example, are much more difficult to draw in to the camera station, given their large home ranges and possibly reduced chance of coming into contact with the scents and lures used. This may, in part, help explain our relatively low detection numbers for cougar and bobcat. Some species may be more or less attracted to a particular scent. Yet, some animals may simply be more wary than others and were more clever in avoiding detection altogether. For example, we often saw fresh identifiable bobcat tracks along the approaches to camera stations, yet we only detected them with the cameras at a few sites. Environmental factors, such as snow depth and for how long it remained, may also have an effect on the detectability of some species.

We recognize, as in all surveys of this kind, sampling effectiveness may differ among species. As suggested, the probability of detecting a species at a site depends on several factors, including: the presence of the species at the site, attractiveness of the baits and scents to the species, attenuation of visual and olfactory stimuli due to habitat density and climate, and presence of other (competing or predatory) species. We were interested primarily in the first factor, but detection data are confounded with the remaining factors, which potentially differ among species. Hence, differences in distributions or abundances among species cannot be inferred from differences in detection rates without addressing confounding factors.

Despite these limitations, it appears bait/scent stations using remote camera sampling (when compared to track plates, snow tracking or hair snares) remains the method of choice for surveying at the presence/not detected level of intensity (Foresman and Pearson 1998). This method is relatively inexpensive, user friendly and effective in producing accurate identifications. The necessary field equipment needed to establish a sampling block is reasonably manageable for two people to backpack into remote sites. This type of systematic survey also allowed us to simultaneously sample multiple species and added a means of locating populations that may be patchily distributed or that may have gone undetected by other methods.

RECOMMENDATIONS

Our sampling frame was severely restricted due to the difficulty of winter access and personnel safety concerns. Consequently, less than 20% of the park complex was actually surveyed. Three of the four primary target species (lynx, wolverine and fisher) were not detected during this inventory. In part, we believe this is related to not having sampled much of the better quality habitat for these species. Therefore, we recommend augmenting completed surveys with additional summer-time surveys when accessibility to preferred habitat is more reasonable. We believe the greatest potential for detecting the more elusive forest carnivores would be in remote settings that would favor east-side habitat, where unconfirmed sightings of wolverine, lynx and fisher have all been reported in the recent past. Other camera surveys conducted in the summer have been successful in detecting wolverine and lynx adjacent to the eastern boundary of NOCA (H. Dodd, pers. comm. 2005; M. Skatrud, unpublished data 2002). Surveys conducted during the summer months would include the use of scent lures only, therefore eliminating the use of bait which would otherwise tend to attract non-target species, such as bears, which could create cumulative adverse impacts to sampling equipment, visitor safety and ultimately safety to the animal itself.

A more comprehensive survey would also offer an excellent opportunity to build upon the existing data collected from this inventory. We expect additional surveys completed at higher elevations and deeper into some of the drainages will allow us to more accurately describe the current distribution of more common carnivore species, such as marten. Additional information on other carnivore species that appear to be less common, such as weasels, bobcats and cougars would also be valuable.

This study was part of a National Park Service effort to document to the 90% level those undocumented vertebrae taxa thought to currently have distribution ranges within park boundaries. While we were unsuccessful in documenting three of the four primary target species, our survey did establish a baseline of understanding about the presence and distribution of other carnivore species that may not currently be threatened, but could potentially be in the future. It appears marten are widely distributed in NOCA and current management policies that protect its old-growth habitat requirements seem to be effective. Future surveys to document changes in distribution of carnivores, marten in particular, could provide valuable data on the effects of increased recreational use, changes in fire management activities, or other landscape management activities occurring in NOCA.

We recognize the scale of our surveys is not necessarily commensurate with the scale at which many of the threats to these wide-ranging carnivore species are imposed. Recognizing our limits and the scope of this project, we do however, agree with Jones and Garton (1994) that a greater emphasis for management of mid-level forest carnivores be conducted on a landscape scale and provide for a variety of forested habitat conditions across the landscape. This approach needs to include partnering with adjacent land-use agencies when managing forested ecosystems for these species. Forested travel corridors with sufficient canopy cover, for example, are essential for populations to seek mates for breeding and dispersal of young to new territories of their own and to increase genetic variability. This becomes especially important when considering the far-ranging needs of most forest carnivores.

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APPENDICES

Appendix A. Field Procedures.

As prepared by Jim Petterson (MORA) and modified as needed by and NOCA (in italics).

Camera Operation and Trailmaster System Settings

Carefully read the chapter by Kucera, Soukkala, and Zielinski on Photographic Bait Stations in the detection manual by Zielinski and Kucera (1995. American marten, fisher, lynx, and wolverine: survey methods for their detection. USDA For. Serv. Gen. Tech. Rep. PSW-GTR-157) several times before beginning the surveys. We will be using only Trailmaster TM550 infrared monitor systems in this survey, with Yashica T4 cameras. Detailed instructions for establishing the stations and operating the system units are included in both the detection manual and the Trailmaster TM550 system manual, and won't be repeated here. However, do read the manuals for both the TM550 and camera to review the procedures for configuring the stations and operating each unit before going out in the field, and practice setting up stations as often as possible before going out in the sample units. With snow on the ground, and only about 9-10 hours of daylight, it will probably take an entire day to set up the 2 cameras in each sample unit. Thus, it will probably take at least 2 weeks to get all the cameras set up.

Set-up Procedures

1 Before going out in the field, set each camera back to record Month/Day/Year and set it for today's date and the correct time. The Yashica cameras are powered by the single CR-123A lithium battery, which are rated to last 3 years under "normal" use. We will need to periodically check the voltage however, due to the extreme demands we will put on these cameras.

2 In the field, set the flash on the Yashica cameras for "Flash On"; in this mode, the flash will always function, regardless of ambient light conditions.

3 Always carry a copy of the Trailmaster TM550 system and camera manual with you in the field.

4 Set the sensitivity of the system: **"P"=3.0**; **"Pt"=3.5**. If you obtain a lot of false exposures or pictures of non-target species, especially birds, which tend to move in and out of the sensor beam, increase the sensitivity setting to 5.

5 Set the camera delay ("cd" setting on the display, which is the number of minutes between photos)
to **cd= 5**.

6 Camera Time Zone (CTZ). Make sure the system is set to operate 24 hours a day. Set "ON TIME" to: **[0:on][on:0]** and "OFF TIME" to: **[--: of]**

7 Try to find a bait tree that is positioned to the north of the tree where the TM550 and camera are attached. By pointing the camera so that it is pointing to the north, odds will be reduced that the TM550 will be inadvertently triggered by sunlight striking the front lens of the unit during midday hours.

Appendix A (continued). Field Procedures.

Other considerations:

8 We will be using ASA 400 slide film. With this speed of film, the flash on the Yashicas are rated at about 1.5 to 21 ft. To ensure that the flash provides sufficient illumination to identify all animals photographed, set the camera 8-12 feet from the bait to maximize the likelihood of getting a good exposure.

9 Make sure that the cord that plugs into the camera does not pass in front of the lens.

10 Always carry extra camera cables with you into the field. Corrosion of the plug into the camera and bad connections due to animals chewing through the cables are some of the more common problems that have been encountered previously. If you replace a cable, make sure to discard the old one, so it won't get re-used.

12 Whenever you open a camera back to remove film use rubbing alcohol and a cotton swab to clean the rubber gasket before replacing the film to ensure that the seal remains intact and moisture does not get into the camera.

13 Another problem that has been encountered are pictures that are completely obscured by fogging of the camera lens. Carry a "no-fog" cloth with you in the field and clean the camera lens and automatic exposure window each time you check the station.

Choosing Locations for Camera Stations

Lynx and fisher prefer different habitat types and attempts will be made to locate stations throughout the park in a range of habitats to maximize the chances at detecting either species. In Mt. Rainier N.P., lynx would generally prefer higher elevation habitats that accumulate more snow than fisher would. Situations to key in on for locating stations in lower elevation fisher habitat include: late-successional forest with fairly dense canopy cover and lots of structural diversity for ameliorating snow depths and providing access to prey; riparian corridors, especially in old-growth forest conditions; upland strips of mid- to late-successional forest connecting larger patches of similar habitat; and saddles on ridges. Fishers do move thru many different habitat types, however, especially when they are foraging, so there are no hard and fast rules about where to locate stations. Stand-scale characteristics are probably more important for determining where fishers may occur than are physiographic or landscape-scale characteristics. Probably the single most important consideration for locating stations will be to find areas that provide both habitat for prey and access to them by fishers. This mainly means sites that do not accumulate dense snowpacks that completely cover the ground--fishers simply cannot hunt effectively under these conditions. So, once you have located the general area by referring to the target UTM coordinates, look in the immediate vicinity (about a 50 m radius) for a large diameter tree for attaching the bait. By selecting a large tree, the animal must pass in front of the camera for a larger distance to reach the bait, thus increasing the odds that a picture will be taken. Try to find bait trees in forest stands with good canopy cover for intercepting snow and reducing the depth of snow accumulating under the canopy, and those that have a lot of structural diversity

at or near the ground. Stands that have a lot of large coarse woody debris sticking up thru the snow, branches low to the ground that intercept snow, and tree wells where snow has not accumulated around the bole of large trees provide cover for prey and at the same time provide opportunities for fishers to effectively hunt them. Track evidence showing that either marten, fisher, lynx or their prey species such as grouse, snowshoe hare, Douglas' squirrels, etc. have been active in a stand is a good sign that this may be a place that fishers or lynx will eventually forage in. However, the fact that you don't see tracks of mustelids or cats does not necessarily mean it is not a good site. Sometimes, you will just have to use your professional judgement and your intuition. To minimize the probability that the station will be found and vandalized, use flagging sparingly, but do use enough of them to be able to quickly re-locate the station.

Numbering System for Identifying Stations

At each station, we will mount a white placard made of kitchen flooring material (masonite with a white, shiny surface on one side) directly above the bait using nails or screws, making sure the numbers can be read in the photo. Angle the placard slightly away from the focal plane of the camera so that the flash will not be reflected directly back to the camera. Each station will be numbered on the placard with a grease pencil according to the following system: Site name and 5 letter acronym that differentiates between camera stations within the sample unit. For example, the first camera station located in a sample unit situated in the White River could read on the placard: WHRI-1 .

Batteries

C-cells: The 4 C-cells in the Trailmaster 550 units should last anywhere from 12-16 weeks, depending on ambient temperatures. Because C-cells are relatively inexpensive, we will replace all 4 C-cells after the first 12 weeks of operation.

Lithium Batteries: In a field trial of photographic bait stations in Montana, Foresman and Pearson (1995. Testing of proposed survey methods for the detection of wolverine, lynx, fisher, and American marten in Bitterroot National Forest. Unpubl. Final Rep. USDA Forest Service Agreement INT-94918, Intermountain Research Station, Missoula, MT) found that in the very cold temperatures they encountered in the Bitterroot Mountains in Montana, the lithium batteries were often depleted in a week. Because the CR-123A lithium battery powers the flash, the life span of the battery is directly related to the number of pictures taken as well as to how cold ambient temperatures have been during the survey. Thus, the lithium batteries may be depleted in a week or they may last the entire survey period. It would be prohibitively expensive to replace the lithium batteries each time we check the camera. Consequently, we will test them with a battery tester each time we remove film from the camera. We will take a slightly less restrictive approach than the one recommended by Foresman and Pearson, and replace the lithium batteries only if the voltage reading falls **below** 2.8 volts. When turning off the camera when removing film, checking frame number, or testing batteries, **carefully** unplug the cable at the camera, since this is a weak point in the system, and the less plugging and unplugging we do there, the better. This will prevent the Trailmasters from triggering any photos when you are gathering data from the sensors, removing film, or checking the camera batteries.

Appendix A (continued). Field Procedures.

Bait and Lures

To the extent possible, we will standardize both the bait and scent lure used at each station in both study areas. To bait each station, we will make chicken wire pouches about 16" square and insert a whole, feathered chicken into the pouch and use wire to "sew" the open end closed. The wire pouch will then be nailed to the bait tree using fencing staples and/or nails (*NOCA used 14 gauge fencing wire*). The TM550 should be directed towards the bait tree 8 to 12 inches below the bait and about 5 feet from the ground. Fish is especially attractive to mustelids, so we will also nail a can of tuna to the tree next to the chicken (*NOCA screwed the tuna in above the chicken using a two inch long dry wall screw and then severed the can in a few places along the top and bottom so the liquids and scent would emerge*). Make sure you bring extra bait along each time you check the stations in case the bait has been taken. If there is still plenty of bait present, but it is starting to rot, leave it where it is; there is no need to replace rotting bait with fresh meat. If anything, rotting bait is likely to be more attractive to forest carnivores than fresh meat. If the bait is getting small, however, just add fresh meat to whatever rotting meat is still at the station.

Each station will be scented with skunk essence, cat lure, and the lynx nail pads will have a catnip/castor oil solution applied to the carpet *(NOCA omitted the use of lynx pads*). The purpose of the scent or lure is to get animals to come into the vicinity of the bait station; not to get them to come to the bait itself--the scent of the bait serves that purpose. So, do not place the lure directly on or near the bait. Find a spot nearby that will get the scent into the wind (a conifer branch, a small tree trunk in the bottom of a drainage or on a little saddle, etc.). Take a stick and pick up a small blob of the scent, then smear it on a nearby tree branch or trunk. If you return to a station in a week and can't smell the scent, don't worry about it; carnivores will smell it even if you can't. Re-scent the station about every 2 weeks, or after a heavy rain.

The lynx carpet pads will be nailed to a tree about 2 feet above the ground, and a pie plate will be hung from a tree branch of the same tree. In a manner analogous to the olfactory scent cues, the pie plate is a visual cue used to attract the animal to the general area, where it will then come closer to the bait and hopefully have its picture taken or rub against the carpet pad.

Re-checking Stations

Downloading Data

1. Upon arriving at the site, approach the TM550 unit and camera from behind and to the side of the unit to avoid accidentally triggering the camera.
2. Observe what the event counter reads on the TM550. If it reads "1" or the same event number as when the TM550 was read on the last visit, then immediately go and stand at the base of the bait tree to try to get the camera to trigger. If the camera does not trigger, this indicates that the TM550-camera system has not been functioning properly since the last visit. If the camera does trip, it means that the system is

3 operational and that there have simply not been any visitors that have tripped the unit since the last visit.

4 Remove the camera cable connector from the TM550 unit. Do not unplug the cable at the camera end, since the connector is so fragile on the camera housing itself and prone to corrosion if it is repeatedly unplugged.

5 Attach the TM Data Collector to the TM550 by using the gray end connector and plugging it into the Data Collector on the bottom of the unit and then plug the ¼" phono plug end into the "Printer" port in the bottom of the TM550.

6 Turn the Data Collector switch "ON" and press the "Coll Data" button on the front of the unit until "col!" is displayed. Then press the "Set-up" button on the TM550 until the screen reads' "Snd?" At this point, press the "R/O" advance button on the TM550 until "Snd!" is displayed. After the data is sent the TM550 display will change to "thru" and the Data Collector display will read "cnf!". Then press "Set-up" again on the TM550 and "R/O" advance to resend the data. At this point "snd!" will again be displayed at first, followed by "thru". The Data Collector will indicate that data has successfully been resent and checked against the first download by the display reading "done."

7 Disconnect the Data Collector from the TM550 and turn off the TM550 by simultaneously pressing "Time-Set" and "Set-up." This will prevent additional events from being recorded while you are checking the bait and moving in the vicinity.

7 Check the data that has just been downloaded from the TM550 by pressing the "Coll data" on the Data Collector until "16:un" or another similar display is read. Then scroll through using the "R/O" advance button until "un:01" is displayed and continue pressing the "R/O" button until you see the associated event number/time/date information flashing on the screen. A dot preceeding the event number (e.g. **. 10**) indicates that a picture has been taken.

8 While scrolling through the event data, record the times and event numbers that are associated with the correct camera frames on the datasheet. It is also possible to scroll through the event data directly by pressing "R/O" on the TM550 prior to turning it off before checking the bait on the bait tree.

9 Fill out the back of the datasheet for the appropriate check # and indicate if you put more bait out, reapplied scent, etc.

10 Unscrew the camera bolt and check to see what the camera counter reads and to make sure that the flash on lightning bolt is still set correctly. Do not turn off the camera or unplug the cable connection at the camera end. If all is well, set the camera back onto the L-bracket, put the shroud back on, tighten the bolt, and re-position the camera so that it points at the base of the bait tree.

11 After you have completed all the tasks at the site, the last thing to do is plug the camera cable back into the bottom of the TM550 and take a test photo. Be sure to plug the cable into the "camera" port and not the "printer" port on the TM550. Turn the TM550 back on by pressing the Time Set and Set up buttons simultaneously, and wait for the display to stop flashing until it reads the same event number you

observed when you first arrived at the site during this visit. Then walk to the base of the bait tree and watch to see if the flash goes off and the event number increments. Be sure to quickly back up out of the TM550 range so that no more events are recorded. Finally, write down the new event number and the correct frame number from the camera counter on the back of the datasheet.

12 When back in the office, be sure to put the datasheets back into the blue 3-ring binder, write the date checked on the correct tally sheet, and return the maps to the folder in the file cabinet.

Schedule for Checking Stations

Once they are all deployed, the goal will be to check the cameras once per week. Do the best you can and keep me informed of your progress. If it turns out that we have greatly underestimated the time it will take to maintain 20 cameras, then we will probably have to reduce the numbers deployed or check them less frequently. Zielinski and Kucera's protocol calls for a 28-day sample. Thus, if the systems are removed on the 28th day, they would have been out for 27 sample-nights. It is not necessary that both cameras be operating for a 24-hr period in order to obtain a sample-night. We will add days onto the total sampling period only if both cameras in a unit were not operating at any time between the hours of 6 p.m. and 6 a.m. If both cameras are down during all or part of this period due to technical failures or because the film had been fully exposed prior to your arrival at the station, then add a day onto the sampling period.

I am anticipating that each time you check a station, there will be unexposed film in the camera. However, if all of the film has been exposed, then you will need to determine when the last photo was taken (this information is part of what you will be reviewing on the sensor units and recording on the data sheet each time you check a station) because the day that the last picture was taken is the last day that the station was actively sampling.

Deciding Whether to Remove the Film from Cameras in the Middle of a Survey

The rolls of film we will be using are 24-exposure rolls (Ektachrome color slide film, ASA 400) (*NOCA used 36 exposure rolls*). In most cases, this will mean 24 or 25 pictures per roll (at least one frame will be used to test the integrity of the system after set-up and at each check). If you check a station and there are 10 or more frames that have been exposed on a roll of film, remove the film from the camera and replace it with a fresh roll. If, however, you come up to a station and see what you think are either fisher or lynx tracks around the station, pull the film regardless of how many pictures were taken. Make sure that you write the station identification number on the film canister with the fine point Sharpie as soon as you remove the film from the camera. This will enable us to identify the station location of the photos, even if the placard is not legible in the photo.

Film Processing

We will expedite film development by using a developing service at Kirk's Pharmacy in Eatonville. They generally produced developed slides in 2 business days. (*NOCA developed* *film at Thrifty Foods in Sedro Woolley with an approximate one week turn around*). Upon deciding to pull film from a camera, using the criteria described above, make a photocopy of the data sheet(s) that goes with that roll of film. Put the originals in the datasheet 3-ring binder in the office and the copies in the other folder in the file cabinet. Within 2 days after the slides have been developed and received, use the light table or slide projector to examine the slides and record the matching Species information with the associated frame numbers on the datasheets. This will enable crewmembers to quickly get feedback on whether stations have recorded target species and evaluate how each station is working and make adjustments, if necessary.

The Data Sheet

We will use a separate data sheet for each roll of film. If you pull the film and replace it with a fresh roll, start a new datasheet and record all pertinent information. Record the Roll # for each station whenever you replace the film and start a new datasheet. The front of the data sheet is shown on the next page; fill it out as follows:

FRONT OF DATA SHEET

Station ID: The same number you put on the placard identifying the 5 letter acronym of the camera station, e.g., WHRI-2.

Station Name: The name of the camera station that includes the 3rd or 4th order stream that is in closest proximity, e.g. WHITE RIVER - LOWER. (*NOCA used a nearby geographic feature to identify with the station; eg creek, mountain, drainage. The most northern station was identified as sub-block-1 and the southern station was sub-block-2*).

TM550 ID No: Record the identifying number of the Trailmaster passive monitor that has been put on the masking tape on the unit (e.g. T-1).
Appendix A (continued). Field procedures, as prepared by Jim Petterson (MORA) and modified as needed by NOCA (in italics).

Camera Type and NPS Number: Record the camera unit's identifying name and NPS property number (i.e., Yashica - 14456).

UTM: Identify the actual UTM location of the camera station to the nearest 10 m once you reach the site.

Date Station Installed: Put down the date that you install the system; do not use numbers and slashes (e.g., 1/6/01), records dates with the day first, the 3 or 4 letter abbreviation of the month, and the year using all 4 digits; e.g., 6 Jan 2001.

Date Station Removed: Record the date the station was removed only on the last data sheet in each set. Thus, if you used 2 data sheets at a station, put N/A in this space on the first data sheet and record the date on the second data sheet.

Appendix A (continued). Field Procedures.

Roll No.: When you replace film and start a new data sheet, record which roll of film it is for this particular station.

Date Film Installed in Camera: Record when the film was put into the camera.

Initial Frame No.: Record the frame number left on the camera when the initial set up is completed. This should be at least 2, since you need to take at least one test picture when setting up the station. **and Initial Event No.:** Record the Event No. left on the Trailmaster sensor when the initial set up is completed. Note that events don't automatically advance the way frames on the camera does, so if there has been 1 event, the sensor will read 1.

Date Film Removed from the Camera: If you remove film from the camera, record the date in this space regardless of whether you are pulling the film in the middle of the sampling period or at the end.

Columns: Date, Event, Time, Species: The data lines in the main part of the data sheet are only filled out when pictures are taken. As you scroll through the sensor output, events which resulted in a picture being taken will have a dot next to the event number. When you see this, record the **Date**, the **Event** on which a picture was taken, and the **Time**. Leave the **Species** column blank; this will be filled out after the film is developed. Ignore events for which no picture was taken, except for recording the last event shown when you remove a roll of film (this information is recorded on the back of the data sheet). At the end of each check, make a mark to the left of the columns indicating the last frame exposed. For example, if on check 1 there have been 5 frames exposed, write Check 1 in the left hand margin next to Frame 5.

BACK OF DATA SHEET:

<u>**Box 1: Setup/New Roll**</u>**:** Circle setup or new roll depending on whether it is the initial setup or a new roll of film.

Date: Record the date when the setup occurred or the new roll was installed (which ever is appropriate).

Sensitivity, Camera Delay, Bait, and Scent: Record the settings for the sensitivity (P and Pt) of the TM550 sensor and the camera delay, and record the type of bait(s) and scent lure(s) used.

Snow: Snow and Snow Condition are self-explanatory, the 3 Snow Depth measurements are taken in representative areas within 5 m of the bait station.

Comments: Write down any comments you think may be of interest, including a brief description of the site, the presence of tracks, the proximity of a creek, etc.

Appendix A (continued). Field Procedures.

Boxes 2-4: Checks #1, 2 3, and 4

Date and Last Event: Record the date you check the station, and the last event shown on the sensor when you arrive at the station; this will enable us to determine how many events there have been since the last picture was taken.

Snow Conditions and Comments: Describe snow conditions and put down any pertinent information on the condition of the site when you found it, the condition of the bait, whether you re-scented the station, the presence of tracks, whether or not you changed the batteries, if you adjusted the sensitivity or camera delay, and anything else that may be of interest.

Left on Frame No.: Record the frame number left on the camera when you leave the station. This should be at least 1 higher than the last frame shown on the front of the data sheet, since you will again need to take a test picture when you reset the system. **and Event No.:** Record the event number left on the Trailmaster sensor when you finish re-setting the system and leave the station.

Volt Meter Reading: Record the volt meter reading for the lithium camera battery.

Appendix A (continued). Page 1 of Field Data Forms.

Station Name ________________________________ Camera Name/ NPS No. _____________

Station ID No. ________________________________ TM550 ID No. _____________________

UTMs: N __________________________________ E __________________________________

Date Station Installed ___________________ Date Station Removed ____________________

Roll No. ________ Date Film Installed in Camera _____________________

Initial Frame No. _____and Initial Event No. ______ Date Film Removed from Camera ______

	Date	Event#	Frame	Time Species
		1		
		2		
		3		
		4		
		5		
		6		
		7		
		8		
		9		
		10		
		11		
		12		
		13		
		14		
		15		
		16		
		17		
		18		
		19		
		20		
		21		
		22		
		23		
		24		
		25		
		26		

Appendix A (continued). Page 2 of Field Data Forms.

Setup/New Roll: Date: ___________ Sensitivity (P/Pt):_____________ Camera Delay: __________
Bait(s) _________________________________ Scent(s)___________________________________
Snow (circle one): None, Patchy, Complete Cover
Snow Condition (circle one): Crusty, Powdery, Wet/Packy, Powder on Crust
Snow Depth (average of 3 measurements in cm): ____________________________
Comments: ____
____
____
____
____

Check #1: Date:__________________ Last Event: ______________________
Snow (circle one): None, Patchy, Complete Cover
Snow Condition (circle one): Crusty, Powdery, Wet/Packy, Powder on Crust
Snow Depth (average of 3 measurements in cm): ____________________________
Comments (condition of site and bait, batteries, tracks, etc): __________________________________
____
____
____
Left on Frame # ___________ and Event # __________ Volt Meter Reading: _________________

Check #2: Date:__________________ Last Event: ______________________
Snow (circle one): None, Patchy, Complete Cover
Snow Condition (circle one): Crusty, Powdery, Wet/Packy, Powder on Crust
Snow Depth (average of 3 measurements in cm): ____________________________
Comments (condition of site and bait, batteries, tracks, etc): __________________________________
____
____
____
Left on Frame # ___________ and Event # __________ Volt Meter Reading: _________________

Check #3: Date:__________________ Last Event: ______________________
Snow (circle one): None, Patchy, Complete Cover
Snow Condition (circle one): Crusty, Powdery, Wet/Packy, Powder on Crust
Snow Depth (average of 3 measurements in cm): ____________________________
Comments (condition of site and bait, batteries, tracks, etc): __________________________________
____
____
____
Left on Frame # ___________ and Event # __________ Volt Meter Reading: _________________

Check #4: Date:__________________ Last Event: ______________________
Snow (circle one): None, Patchy, Complete Cover
Snow Condition (circle one): Crusty, Powdery, Wet/Packy, Powder on Crust
Snow Depth (average of 3 measurements in cm): ____________________________
Comments (condition of site and bait, batteries, tracks, etc): __________________________________
____
____
____
Left on Frame # ___________ and Event # __________ Volt Meter Reading: _________________

Appendix A (continued). Page 3 of Field Data Forms.

HABITAT INFORMATION – Site Name ________________________________

Describe the overall condition of the stand where the camera station is located.

Average DBH of live Trees: < 6” 6-12” 12-20” > 20”

Average Spacing Between Trees: <4’ 4-8’ 8-12’ > 12’

Do standing dead trees comprise 10% or more of the overall stand? Yes No

If Yes, average DBH of dead trees: < 6” 6-12” 12-20” >20”

Would you categorize the fuel load of dead and downed woody debris as: L M H

The average DBH of dead and downed woody debris: < 6” 6-12” 12-20” >20”

Three most common tree species in Canopy: 1. 2. 3.

Average percent canopy closure of the stand (Ocular Estimate)
40-70% > 70% < 40%

Elevation (ft., m)__________

Topographic Position of camera station:
Riparian (<50m to stream/river) Valley Bottom Lower 1/3 slope
Mid 1/3 slope Upper 1/3 slope Ridge top

Tracks Observed at Station

Species Date Observed

	Date	Initials	CAMERA OPERATIONAL	CAMERA MALFUNCTION	CAMERA STOLEN	FILM DEPLETED	FILM REPLACED	BATTERIES DEAD	BATTERIES REPLACED
Camera Station Established:									
Station Checked:									
Station Checked:									
Station Checked:									
Station Checked/Removed:									

Appendix A (continued). Page 4 of Field Data Forms.

CAMERA SITE MAPS

Draw two detailed maps, one a general map showing how to find the site and the other that demonstrates how the camera, bait, and lynx pads are set out on the site itself.

Overview map

Site map

Appendix B. Equipment List and Contacts.

Camera Kit – Camera
Camera cable
Weather hood/milk jug
L bracket, bolt and washers
Trailmaster sensor
Film 400 ASA slide

Batteries 3V lithium for camera
'C' batteries for Trailmaster
' AA' for headlamps, GPS unit

Bait Kit Chicken
Scents
Tuna fish
Masonite placard
Fencing wire
Chicken wire
Hardware cloth wire
Pie plate
Monofilament line
Snap swivels
Dry bags for bait and scent

Manuals Kit Camera
Trailmaster
Downloader
Protocol
Data sheets
Map
Notebook
Clipboard

Misc. - Flagging
Drywall screws
Screwdriver Ratchet type
Grease pencil
Extra film
Duct tape
Leatherman pliers
Rubbing alcohol
Qtips
Kimwipes
Latex gloves
Electrical tape
Garbage bags
Extra screws for
backof Trailmaster
Extra Trailmaster
Spare camera cable
Spare webbing
Spare 'L' bracket
Spare bolt/washers
Radio
First Aid
Data downloader
Downloader cable
Battery tester
GPS unit

The address for Trailmaster is:
Trailmaster
10614 Widmer
Lenexa Kansas, 66215
(913) 345-8555

Chickens were donated by:
Draper Valley Farms, Inc.
1000 Jason Ln.
Mount Vernon, WA 98273
(360) 424-7947

Scent lures were ordered from:
M&M Furs, Inc.
P.O. Box 15
Bridgewater, SD 57319
Phone: (605) 729-2535
and
Rocky Mountain Fur
15007 Willis Road
Caldwell, ID. 83607
(208) 459-6894

Appendix C. Animal species detected and number of visits from each species, by block NOCA 2003-2004.

Block No.	Station Name	Site Acronym	Total Photos Taken	Unknown animal	No Animal Observed	Marten	Spotted Skunk	Short-tailed Weasel	Cougar	Coyote	Bobcat	Black Bear	Mule Deer	Mouse	N. Flying Squirrel	Townsend's Chipmunk	Douglas Squirrel	Snowshoe Hare	Red-tailed Hawk	Turkey Vulture	Stellar's Jay	Gray Jay	Raven	Total Identifiable Animal Photos
34	Diablo Lake	DILA	33	0	10	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23
50	Newhalem Creek	NECR	57	0	6	17	32	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	51
54	North Fork Cascade River	NFCR	106	9	21	1	66	5	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0	76
35	Happy Flats	HAFL	3	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	2
26	Roland Creek	ROCR	26	2	12	1	0	0	0	0	0	0	5	2	0	3	0	0	0	0	0	1	0	12
13	No Name Creek	NNCR	107	0	24	0	49	9	23	0	0	0	0	2	0	0	0	0	0	0	0	0	0	83
18	East Bank Trail	EBTR	112	5	6	1	72	0	0	0	0	0	0	0	3	0	0	0	0	0	0	25	0	101
66	Flat Creek	FLCR	33	1	3	25	0	0	0	1	0	0	0	0	0	0	3	0	0	0	0	0	0	29
61	Bridge Creek	BRCR	141	0	3	138	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	138
69	Coon Lake	COLA	74	2	10	59	0	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	62
23	Baker River	BARI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	Goodell Creek	GOCR	43	0	36	0	5	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	7
10	Little Beaver/Ross Confluence	LIBE	36	0	0	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	36
2	Silver Creek	SICR	67	0	5	58	3	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	62
6	Hozomeen Lake	HOLA	6	0	0	2	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	2	6
46	Panther Potholes	PAPO	17	0	1	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	16
79	Company Creek	COCR	91	0	1	73	0	0	0	0	0	3	3	0	0	0	11	0	0	0	0	0	0	90
86	Four Mile Creek	FOCR	7	0	2	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	5
74	Cabin Creek	CACR	15	0	11	3	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	4
44	Newhalem Spawning Channels	NESC	19	0	3	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	14	0	0	16
52	Bacon Point	BAPO	95	0	18	0	67	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	77
48	Damnation Creek	DACR	7	0	0	0	5	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	7
53	Marble Creek	MACR	44	0	16	0	14	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28
60	Park Creek	PACR	188	0	4	169	0	0	0	0	0	0	0	0	0	0	1	0	0	0	12	2	0	184
56	North Fork Bridge Creek	NFBC	96	0	8	83	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	2	0	88
68	Shady Camp	SHCA	295	0	28	260	0	0	0	0	0	0	0	0	0	0	4	0	0	0	3	0	0	267
64	McAllister Creek	MCCR	60	0	0	58	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	60
28	Stetattle Creek	STCR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	Thunder Arm	THAR	59	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	57	57
20	Big Beaver Creek	BBCR	12	1	3	1	0	1	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	8
12	Lightning Creek	LICR	12	0	1	1	0	0	0	0	2	0	0	1	7	0	0	0	0	0	0	0	0	11
8	Perry Creek Shelter	PECS	7	4	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	3
32	Hidden Hand Pass	HIHA	23	0	0	23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23
72	Rainbow Creek	RACR	12	1	0	10	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	11
80	Boulder Creek	BOCR	39	0	0	38	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39
87	Flick Creek	FKCR	6	0	0	0	0	0	0	0	0	2	3	0	0	0	0	0	0	1	0	0	0	6
15	Lake Anne	LAAN	5	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
58	Twisp Pass	TWPA	142	0	111	31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31
43	Thornton Lakes	THLA	14	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14
	Total	**39 blocks**	**2109**	**28**	**347**	**1125**	**313**	**30**	**23**	**7**	**20**	**5**	**24**	**15**	**11**	**3**	**24**	**1**	**1**	**1**	**41**	**31**	**59**	**1734**

Appendix D. Animal species detected and number of visits from each species, by sub-block NOCA 2003-2004.

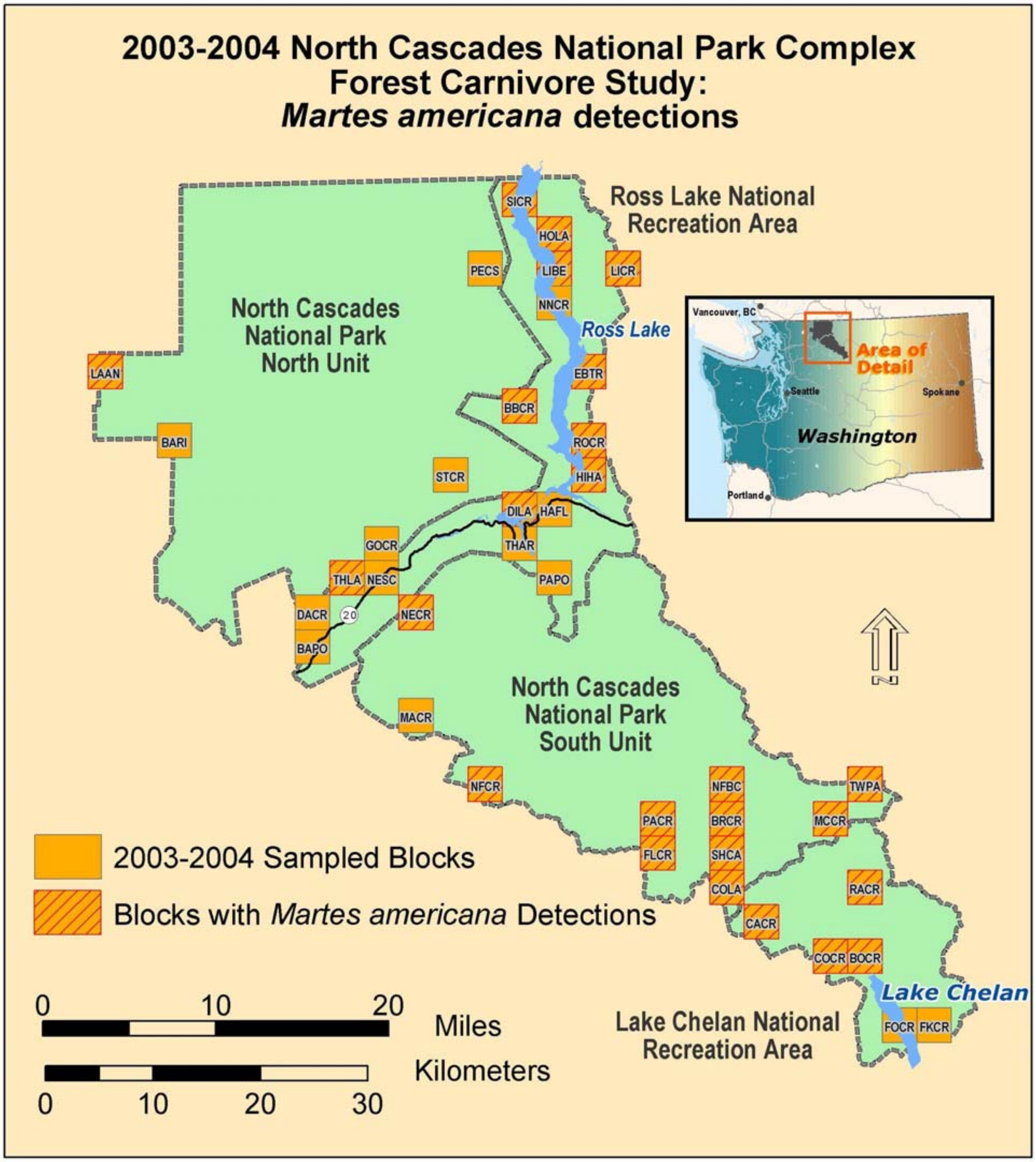
Block No.	Station Name	Site Acronym	Total Photos Taken	Unknown	No Animal Observe	Marten	Spotted Skunk	Short tail Weasel	Cougar	Coyote	Bobcat	Black Bear	Mule Deer	Mouse	N. Flying Squirrel	Town's. Chipmunk	Douglas Squirrel	Snowshoe Hare	Red-tailed Hawk	Turkey Vulture	Stellar's Jay	Gray Jay	Raven	Total Identifiable Animal Photos
34	Diablo Lake	DILA-1	33		10	23																		23
		DILA-2																						
50	Newhalem Creek	NECR-1	55		5	17	32														1			50
		NECR-2	2		1												1							1
54	North Fork Cascade River	NFCR-1	84	2	8		66	5						3										74
		NFCR-2	22	7	13	1									1									2
35	Happy Flats	HAFL-1	2		1								1											1
		HAFL-2	1								1													1
26	Roland Creek	ROCR-1	14		7	1							5	1										7
		ROCR-2	12	2	5									1		3						1		5
13	No Name Creek	NNCR-1	2		2																			
		NNCR-2	105		22		49	9	23					2										83
18	East Bank Trail[1]	EBTR-1	108	4	6	1	72															25		98
		EBTR-2	4	1											3									3
66	Flat Creek	FLCR-1	21		2	16											3							19
		FLCR-2	12	1	1	9				1														10
61	Bridge Creek	BRCR-1	72			72																		72
		BRCR-2	69		3	66																		66
69	Coon Lake	COLA-1	35	1	1	32											1							33
		COLA-2	39	1	9	27				1							1							29
23	Baker River	BARI-1																						
		BARI-2																						
38	Goodell Creek	GOCR-1	37		36									1										1
		GOCR-2	6				5				1													6
10	Little Beaver/Ross Confluence	LIBE-1	36			35																1		36
		LIBE-2																						
2	Silver Creek	SICR-1	63		4	58							1											59
		SICR-2	4		1		3																	3
6	Hozomeen Lake	HOLA-1	3														1						2	3
		HOLA-2	3			2				1														3
46	Panther Potholes	PAPO-1	17		1						16													16
		PAPO-2																						
79	Company Creek	COCR-1	36			36																		36
		COCR-2	55		1	37						3	3				11							54
86	Four Mile Creek	FOCR-1	2		1								1											1
		FOCR-2	5		1								4											4
74	Cabin Creek	CACR-1	9		9																			
		CACR-2	6		2	3				1														4

[1] EBTR-1 was operable for only 22 nights.

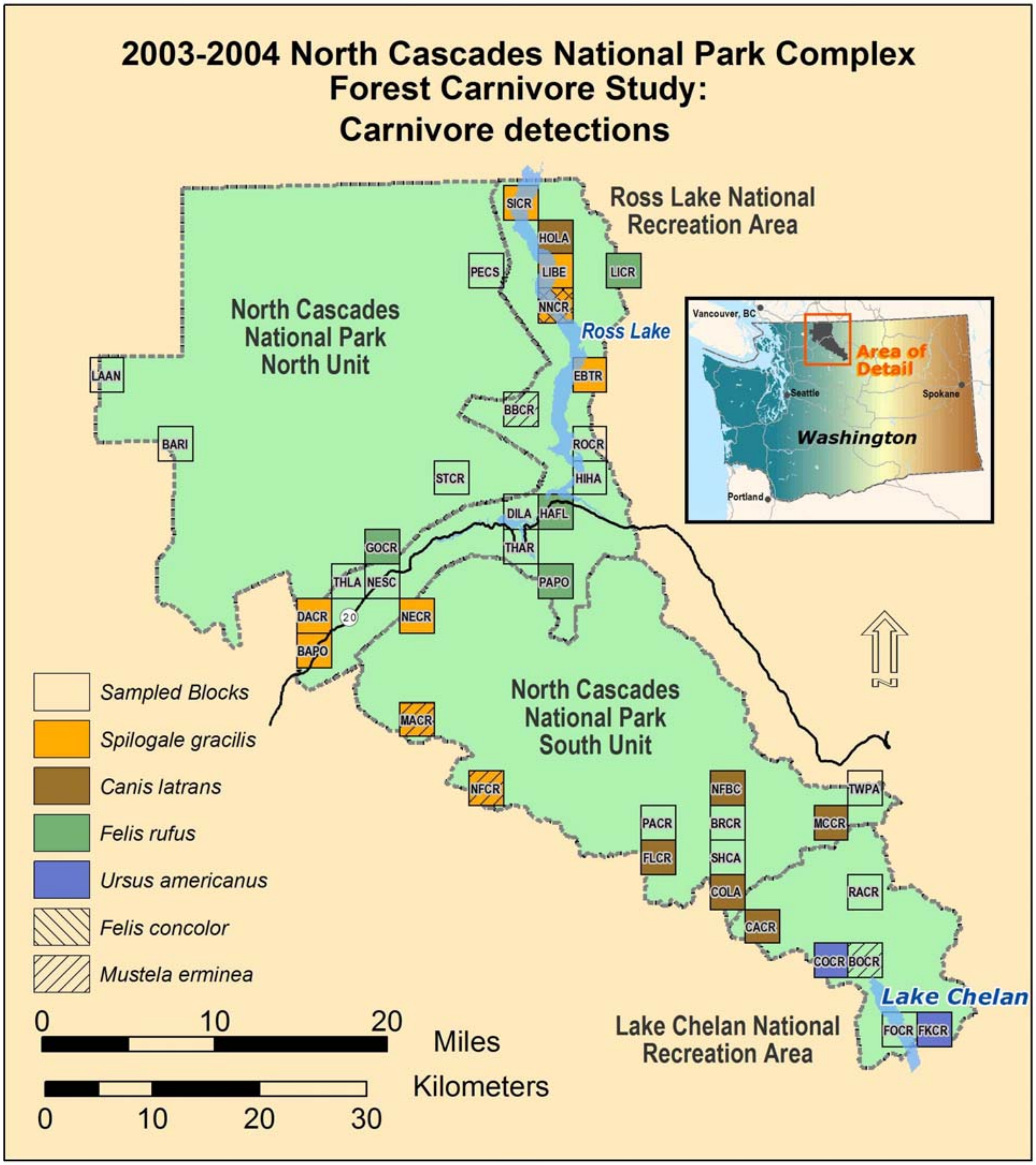
Appendix D (continued). Animal species detected and number of visits from each species, by sub-block NOCA 2003-2004.

Block No.	Station Name	Site Acronym	Photos taken	Unknown	No animal observe	Marten	Spotted Skunk	Short tail Weasel	Cougar	Coyote	Bobcat	Black Bear	Mule Deer	Mouse	N. Flying Squirrel	Town's. Chipmunk	Douglas Squirrel	Snowshoe Hare	Red-tailed Hawk	Turkey Vulture	Stellar's Jay	Gray Jay	Raven	Total Identifiable Animal Photos
44	Newhalem Spawning Channels	NESC-1	1										1											1
		NESC-2	18		3														1		14			15
52	Bacon Point	BAPO-1	19		18																1			1
		BAPO-2	76				67														9			76
48	Damnation Creek	DACR-1	1										1											1
		DACR-2	6				5						1											6
53	Marble Creek	MACR-1	15		1			14																14
		MACR-2	29		15		14																	14
60	Park Creek	PACR-1	73			73																		73
		PACR-2	115		4	96											1				12	2		111
56	North Fork Bridge Creek	NFBC-1	14		2	11												1						12
		NFBC-2	82		6	72				2												2		76
68	Shady Camp	SHCA-1	185		27	158																		158
		SHCA-2	110		1	102											4				3			109
64	McAllister Creek	MCCR-1	25			24				1														25
		MCCR-2	35			34															1			35
28	Stetattle Creek	STCR-1																						
		STCR-2																						
40	Thunder Arm	THAR-1	59		2																		57	57
		THAR-2																						
20	Big Beaver Creek	BBCR-1	1	1																				
		BBCR-2	11		3	1		1						6										8
12	Lightning Creek	LICR-1	9		1									1	7									8
		LICR-2	3			1					2													3
8	Perry Creek Shelter	PECS-1	5	4									1											1
		PECS-2	2										2											2
32	Hidden Hand Pass	HIHA-1	23			23																		23
		HIHA-2																						
72	Rainbow Creek	RACR-1	8	1		6											1							7
		RACR-2	4			4																		4
80	Boulder Creek	BOCR-1	38			38																		38
		BOCR-2	1					1																1
87	Flick Creek	FKCR-1																						
		FKCR-2	6									2	3							1				6
15	Lake Anne	LAAN-1	2		1	1																		1
		LAAN-2	3	3																				
58	Twisp Pass	TWPA-1	72		59	13																		13
		TWPA-2	70		52	18																		18
43	Thornton Lakes	THLA-1	14			14																		14
		THLA-2																						
	TOTALS		**2109**	**28**	**347**	**1125**	**313**	**30**	**23**	**7**	**20**	**5**	**24**	**15**	**11**	**3**	**24**	**1**	**1**	**1**	**41**	**31**	**59**	**1734**

Appendix E. Sample blocks with marten detections, NOCA, 2003-2004.



Appendix F. Sample blocks with 'other' carnivore detections, NOCA, 2003-2004.



Appendix G. Vegetation characteristics of sample stations with 'marten' detections, NOCA 2003-2004.

Block	Site Acronym	Stn. ID	Common Canopy Tree1	Common Canopy Tree2	Common Canopy Tree3	Pct Canopy Cover	DBH Live Trees (inches)	Average Spacing Live Trees (feet)	Dead Trees >10% of Stand	Average DBH Dead Trees (inches)	DBH Woody Debris (inches)	Fuel Load
2	SICR-1	85	Thuja plicata	Pseudotsuga menziesii		40-70%	6-12	8-12'	yes	>20	6-12	M
6	HOLA-2	87	Pseudotsuga menziesii	Thuja plicata	Tsuga heterophylla	>70%	12-20	4-8'	no			
10	LIBE-1	89	Pseudotsuga menziesii	Thuja plicata	Pinus contorta	40-70%	12-20	4-8'	no		12-20	M
26	ROCR-1	95	Pseudotsuga menziesii	Tsuga heterophylla	Acer circinatum	>70%	12-20	>12'	no		6-12	L
34	DILA-1	97	Pseudotsuga menziesii	Alnus rubra	Tsuga heterophylla	<40%	>20	>12'	no		6-12	L
50	NECR-1	105	Tsuga heterophylla	Abies amabilis	Thuja plicata	40-70%	12-20	8-12'	yes	12-20	12-20	H
54	NFCR-2	108	Abies amabilis	Tsuga heterophylla	Thuja plicata	40-70%	12-20	8-12'	no		12-20	L
61	BRCR-1	109	Pseudotsuga menziesii	Pinus ponderosa		40-70%	12-20	>12'	no			L
61	BRCR-2	110	Pseudotsuga menziesii	Abies amabilis	Pinus ponderosa	40-70%	12-20	>12'	yes	6-12		
66	FLCR-1	111	Pseudotsuga menziesii	Thuja plicata	Tsuga heterophylla	>70%	>20	4-8'	no			L
66	FLCR-2	112	Pseudotsuga menziesii	Abies amabilis	Tsuga heterophylla	40-70%	>20	>12'	yes	12-20		
74	CACR-1	113	Pseudotsuga menziesii	Pinus ponderosa		40-70%	12-20	>12'	no		6-12	H
74	CACR-2	114	Pseudotsuga menziesii	Pinus ponderosa		40-70%	12-20	>12'	no		6-12	H
79	COCR-1	115	Pseudotsuga menziesii	Pinus ponderosa		40-70%	6-12	4-8'	no		<6	M
79	COCR-2	116	Pinus ponderosa	Pseudotsuga menziesii		<40%	6-12	8-12'	yes	6-12	6-12	H
69	COLA-1	119	Thuja plicata	Pseudotsuga menziesii	Tsuga heterophylla	>70%	>20	8-12'	no		>20	H
69	COLA-2	120	Pseudotsuga menziesii	Pinus ponderosa		<40%	12-20	8-12'	no			L
60	PACR-1	138	Abies amabilis	Pseudotsuga menziesii	Tsuga heterophylla	40-70%	12-20	8-12'	yes	12-20		L
60	PACR-2	139	Pseudotsuga menziesii	Acer macrophyllum	Tsuga heterophylla	40-70%	12-20	4-8'	no		<6	L
56	NFBC-1	140	Abies amabilis	Picea englemannii	Pseudotsuga menziesii	40-70%	12-20	8-12'	no			
56	NFBC-2	141	Pinus contorta	Abies amabilis		40-70%	6-12	4-8'	yes	6-12		
68	SHCA-1	142	Pseudotsuga menziesii	Abies amabilis	Pinus ponderosa	40-70%	12-20	8-12'	yes	12-20	6-12	H
68	SHCA-2	143	Abies amabilis	Abies procera	Acer macrophyllum	<40%	6-12	>12'	no		6-12	H
64	MCCR-1	144	Abies amabilis			40-70%	12-20	4-8'	no			M
64	MCCR-2	145	Abies amabilis	Pseudotsuga menziesii		40-70%	12-20	8-12'	yes	12-20		L
80	BOCR-1	150	Pseudotsuga menziesii	Acer circinatum		40-70%	12-20	8-12'	no		6-12	M
43	THLA-1	152	Tsuga heterophylla	Thuja plicata	Pseudotsuga menziesii	40-70%	6-12	8-12'	no		12-20	L
72	RACR-1	154	Picea englemannii	Pseudotsuga menziesii		40-70%	6-12	8-12'	no			
72	RACR-2	155	Pinus contorta	Pseudotsuga menziesii	Pinus monticola	40-70%	12-20	8-12'	no			
20	BBCR-2	159	Pseudotsuga menziesii	Thuja plicata	Acer macrophyllum	40-70%	12-20	<4'	yes	12-20	6-12	H
12	LICR-2	161	Tsuga heterophylla	Pseudotsuga menziesii	Thuja plicata	>70%	6-12	4-8'	no		6-12	M
32	HIHA-1	164	Pseudotsuga menziesii	Betula papyrifera	Thuja plicata	40-70%	12-20	>12'	yes	6-12	6-12	M
58	TWPA-1	166	Abies lasiocarpa	Larix occidentalis	Tsuga mertensiana	<40%	6-12	>12'	no			L
58	TWPA-2	167	Larix occidentalis	Abies lasiocarpa	Tsuga mertensiana	<40%	6-12	>12'	no			L
15	LAAN-1	168	Tsuga mertensiana	Abies amabilis	Abies lasiocarpa	40-70%	>20	4-8'	yes	12-20		

Appendix H. Vegetation characteristics of sample stations with ‘other animal’ detections, NOCA 2003-2004.

Block	Site Acronym	Stn. ID	Common Canopy Tree1	Common Canopy Tree2	Common Canopy Tree3	Pct Canopy Cover	DBH Live Trees (inches)	Average Spacing Live Trees (feet)	Dead Trees >10% of Stand	Average DBH Dead Trees (inches)	DBH Woody Debris (inches)	Fuel Load
6	HOLA-1	86	Thuja plicata	Abies amabilis	Tsuga heterophylla	>70%	>20	8-12'	no		12-20	H
2	SICR-2	88	Pseudotsuga menziesii	Tsuga heterophylla	Thuja plicata	40-70%	6-12	8-12'	no		6-12	M
10	LIBE-2	90	Pseudotsuga menziesii	Thuja plicata	Pinus ponderosa	40-70%	12-20	8-12'	no		<6	M
18	EBTR-1	91	Pseudotsuga menziesii	Tsuga heterophylla	Thuja plicata	<40%	6-12	8-12'	no		<6	M
18	EBTR-2	92	Pseudotsuga menziesii	Pinus contorta	Thuja plicata	40-70%	6-12	4-8'	no		<6	M
26	ROCR-2	96	Pseudotsuga menziesii	Tsuga heterophylla	Betula papyrifera	<40%	6-12	<4'	yes	12-20	6-12	M
35	HAFL-1	99	Pseudotsuga menziesii	Thuja plicata	Pinus contorta	<40%	6-12	8-12'	no		6-12	H
35	HAFL-2	100	Pseudotsuga menziesii	Thuja plicata		40-70%	12-20	8-12'	no		6-12	H
38	GOCR-2	102	Pseudotsuga menziesii	Thuja plicata	Tsuga heterophylla	>70%	12-20	8-12'	no		12-20	H
46	PAPO-1	103	Pseudotsuga menziesii	Tsuga heterophylla	Thuja plicata	40-70%	12-20	4-8'	no			
54	NFCR-1	107	Tsuga heterophylla	Thuja plicata	Abies amabilis	40-70%	>20	4-8'	yes	6-12	6-12	H
86	FOCR-1	117	Pseudotsuga menziesii	Acer macrophyllum	Pinus ponderosa	40-70%	12-20	8-12'	no		12-20	H
86	FOCR-2	118	Pseudotsuga menziesii	Pinus ponderosa		40-70%	6-12	4-8'	no		<6	M
13	NNCR-2	122	Pseudotsuga menziesii	Pinus contorta	Betula papyrifera	>70%	6-12	4-8'	yes	<6	<6	H
44	NESC-1	128	Tsuga heterophylla	Acer macrophyllum	Thuja plicata	40-70%	6-12	8-12'	no		6-12	M
44	NESC-2	129	Tsuga heterophylla	Pseudotsuga menziesii	Alnus rubra	<40%	12-20	>12'	no		12-20	M
52	BAPO-1	130	Abies amabilis	Acer macrophyllum	Tsuga heterophylla	<40%	12-20	8-12'	no		12-20	L
52	BAPO-2	131	Thuja plicata	Pseudotsuga menziesii	Betula papyrifera	<40%	6-12	4-8'	no		6-12	M
48	DACR-1	134	Tsuga heterophylla	Pseudotsuga menziesii	Thuja plicata	>70%	12-20	4-8'	yes	6-12	6-12	M
48	DACR-2	135	Pseudotsuga menziesii	Thuja plicata	Tsuga heterophylla	>70%	12-20	8-12'	no		6-12	H
53	MACR-1	136	Tsuga heterophylla	Thuja plicata	Alnus rubra	>70%	>20	>12'	no		12-20	H
53	MACR-2	137	Tsuga heterophylla	Thuja plicata	Pseudotsuga menziesii	>70%	12-20	8-12'	no		12-20	M
40	THAR-1	148	Pseudotsuga menziesii	Tsuga heterophylla	Abies amabilis	40-70%	6-12	4-8'	no			
80	BOCR-2	151	Pseudotsuga menziesii	Pinus ponderosa		40-70%	12-20	8-12'	no		6-12	H
87	FKCR-2	157	Pseudotsuga menziesii	Pinus ponderosa	Acer macrophyllum	>70%	12-20	>12'	no		<6	L
12	LICR-1	160	Tsuga heterophylla	Thuja plicata	Pseudotsuga menziesii	<40%	6-12	4-8'	no		6-12	M
8	PECS-1	162	Pseudotsuga menziesii	Thuja plicata	Tsuga heterophylla	40-70%	12-20	4-8'	no		6-12	L
8	PECS-2	163	Tsuga heterophylla	Thuja plicata	Pseudotsuga menziesii	40-70%	12-20	>12'	no		12-20	M

Appendix I. Vegetation characteristics of sample stations with 'no animal' detections, NOCA 2003-2004.

Block	Site Acronym	Stn. ID	Common Canopy Tree1	Common Canopy Tree2	Common Canopy Tree3	Pct Canopy Cover	DBH Live Trees (inches)	Average Spacing Live Trees (feet)	Dead Trees >10% of Stand	Average DBH Dead Trees (inches)	DBH Woody Debris (inches)	Fuel Load
23	BARI-1	93	Tsuga heterophylla	Abies amabilis	Pseudotsuga menziesii	40-70%	12-20	>12'	no		>20	L
23	BARI-2	94	Tsuga heterophylla	Thuja plicata	Abies amabilis	>70%	>20	>12'	no		>20	L
34	DILA-2	98	Pseudotsuga menziesii	Pinus contorta	Tsuga heterophylla	40-70%	6-12	8-12'	yes	6-12	<6	M
38	GOCR-1	101	Pseudotsuga menziesii	Thuja plicata	Betula papyrifera	40-70%	6-12	4-8'	yes	>20	6-12	H
46	PAPO-2	104	Tsuga heterophylla	Abies amabilis	Pseudotsuga menziesii	40-70%	12-20	4-8'	no			
50	NECR-2	106	Tsuga heterophylla	Abies amabilis	Alnus rubra	40-70%	12-20	8-12'	no		6-12	M
13	NNCR-1	121	Pseudotsuga menziesii	Tsuga heterophylla	Thuja plicata	>70%	<6	<4'	yes	<6	<6	H
28	STCR-1	146	Tsuga heterophylla	Pseudotsuga menziesii	Alnus rubra	40-70%	12-20	>12'	yes	>20	12-20	L
28	STCR-2	147	Tsuga heterophylla	Pseudotsuga menziesii	Abies amabilis	>70%	6-12	4-8'	no		12-20	L
40	THAR-2	149	Pseudotsuga menziesii	Tsuga heterophylla	Thuja plicata	>70%	>20	>12'	no		12-20	H
43	THLA-2	153	Tsuga heterophylla	Thuja plicata	Pseudotsuga menziesii	40-70%	12-20	8-12'	yes	6-12	12-20	M
87	FKCR-1	156	Pseudotsuga menziesii	Pinus ponderosa		40-70%	6-12	8-12'	no		6-12	M
20	BBCR-1	158	Thuja plicata	Abies grandis	Tsuga heterophylla	40-70%	>20	>12'	yes	>20	>20	L
32	HIHA-2	165	Pseudotsuga menziesii	Tsuga heterophylla		40-70%	12-20	8-12'	no		6-12	L
15	LAAN-2	169	Tsuga mertensiana	Abies amabilis		<40%	12-20	>12'	no			

Appendix J. Topographic Data and NAD 27 Universal Transverse Mercator (UTM) coordinates of NOCA 2003 sampling stations.

		2003 Forest Carnivore Sample Sites				
Block No.	**Site Name**	**Site Acronym**	**UTM Easting**	**UTM Northing**	**Topographic Position**	**Elevation (ft)**
34	Diablo Lake	DILA-1	638468	5398270	valley bottom	1650
		DILA-2	640466	5396486	lower 1/3 slope	2027
50	Newhalem Creek	NECR-1	630879	5388602	lower 1/3 slope	1460
		NECR-2	631096	5386930	riparian	1650
54	North Fork Cascade River	NFCR-1	636466	5371063	riparian	283
		NFCR-2	638141	5372432	valley bottom	2140
35	Happy Flats	HAFL-1	642894	5399159	upper 1/3 slope	2430
		HAFL-2	644384	5398662	lower 1/3 slope	2530
26	Roland Creek	ROCR-1	645514	5405647	mid 1/3 slope	2417
		ROCR-2	646100	5403382	lower 1/3 slope	2141
13	No Name Creek	NNCR-1	641951	5417378	lower 1/3 slope	1900
		NNCR-2	644189	5417014	lower 1/3 slope	2220
18	East Bank Trail	EBTR-1	646863	5412070	lower 1/3 slope	2817
		EBTR-2	645856	5410534	mid 1/3 slope	2394
69	Coon Lake	COLA-1	659092	5363172	lower 1/3 slope	2360
		COLA-2	660472	5361436	mid 1/3 slope	2495
66	Flat Creek	FLCR-1	652873	5365362	riparian	2534
		FLCR-2	653232	5366967	lower 1/3 slope	3060
61	Bridge Creek	BRCR-1	657831	5366751	upper 1/3 slope	2240
		BRCR-2	658588	5368003	mid 1/3 slope	2154
74	Cabin Creek	CACR-1	660622	5359847	valley bottom	1008
		CACR-2	661957	5360234	valley bottom	936
86	Four Mile Creek	FOCR-1	675034	5350857	mid 1/3 slope	1110
		FOCR-2	676419	5349458	lower 1/3 slope	900
38	Goodell Creek	GOCR-1	627152	5395175	lower 1/3 slope	1712
		GOCR-2	627731	5393425	lower 1/3 slope	1943
23	Baker River	BARI-1	606659	5404673	riparian	1752
		BARI-2	608190	5404002	riparian	1783
10	Little Beaver Creek	LIBE-1	641569	5420819	valley bottom	2943
		LIBE-2	643213	5421123	lower 1/3 slope	2742
2	Silver Creek	SICR-1	639038	5425458	valley bottom	3454
		SICR-2	638676	5425356	valley bottom	3515
6	Hozomeen Lake	HOLA-1	644036	5424787	lower 1/3 slope	2110
		HOLA-2	643751	5423195	riparian	1914
46	Panther Potholes	PAPO-1	643750	5391620	upper 1/3 slope	1273
		PAPO-2	645309	5391049	lower 1/3 slope	1707
79	Company Creek	COCR-1	667466	5357412	mid 1/3 slope	2580
		COCR-2	669637	5355507	lower 1/3 slope	2110

Appendix J (continued). Topographic Data and NAD 27 Universal Transverse Mercator (UTM) coordinates of NOCA 2004 sampling stations.

		2004 Forest Carnivore Sample Sites				
Block No.	**Site Name**	**Site Acronym**	**UTM Easting**	**UTM Northing**	**Topographic Position**	**Elevation (ft)**
44	Newhalem Spawning Channel	NESC-1	627155	5392840	riparian	490
		NESC-2	626543	5390766	riparian	380
53	Bacon Point	BAPO-1	619722	5385881	upper 1/3 slope	1586
		BAPO-2	619546	5384021	upper 1/3 slope	1140
48	Damnation Creek	DACR-1	622399	5388088	mid 1/3 slope	2160
		DACR-2	621605	5386808	lower 1/3 slope	1100
53	Marble Creek	MACR-1	630100	5378227	riparian	1900
		MACR-2	628512	5377915	lower 1/3 slope	1629
60	Park Creek	PACR-1	654418	5368537	lower 1/3 slope	3643
		PACR-2	654386	5366788	lower 1/3 slope	3271
56	North Fork Bridge Creek	NFBC-1	659259	5371549	valley bottom	3150
		NFBC-2	660288	5369824	lower 1/3 slope	2940
68	Shady Campground	SHCA-1	657831	5365640	riparian	1920
		SHCA-2	659095	5364850	lower 1/3 slope	2638
64	McAlester Creek	MCCR-1	669442	5371455	valley bottom	3965
		MCCR-2	670116	5369952	riparian	4150
28	Stetattle Creek	STCR-1	633770	5400347	lower 1/3 slope	1795
		STCR-2	635154	5399279	lower 1/3 slope	1442
40	Thunder Arm	THAR-1	638424	5395132	mid 1/3 slope	2885
		THAR-2	640775	5393606	mid 1/3 slope	1660
80	Boulder Creek	BOCR-1	670387	5357424	mid 1/3 slope	1720
		BOCR-2	672082	5355393	lower 1/3 slope	1740
43	Thornton Lakes	THLA-1	623817	5392018	upper 1/3 slope	2415
		THLA-2	623717	5391112	mid 1/3 slope	2207
72	Rainbow Creek	RACR-1	671493	5363588	riparian	2232
		RACR-2	671612	5361829	lower 1/3 slope	2248
87	Flick Creek	FKCR-1	676888	5350660	mid 1/3 slope	1660
		FKCR-2	677034	5349077	lower 1/3 slope	2714
20	Big Beaver Creek	BBCR-1	638083	5406752	riparian	5480
		BBCR-2	640286	5406224	lower 1/3 slope	4930
12	Lightning Creek	LICR-1	647679	5420876	lower 1/3 slope	2800
		LICR-2	648046	5419033	lower 1/3 slope	2200
8	Perry Creek Shelter	PECS-1	635912	5420270	riparian	2780
		PECS-2	637581	5420098	lower 1/3 slope	2000
32	Hidden Hand Pass	HIHA-1	646650	5402739	mid 1/3 slope	4210
		HIHA-2	646566	5400357	lower 1/3 slope	4089
58	Twisp Pass	TWPA-1	674231	5371490	ridgetop	6210
		TWPA-2	673911	5370395	ridgetop	6170
15	Lake Ann	LAAN-1	597514	5410622	lower 1/3 slope	4061
		LAAN-2	598475	5409197	lower 1/3 slope	3195

As the nation's principal conservation agency, the Department of Interior has responsibility for most of our nationally owned public lands and natural and cultural resources. This includes fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interest of all our people. The department also promotes the goals of the Take Pride in America campaign by encouraging stewardship and citizen responsibility for the public lands and promoting citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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