



Olympic National Park Forest Carnivore Inventory **Conducted During the Winters of** **2001-2002 and 2002- 2003**

National Park Service
North Coast and Cascades Network



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February 2005
Report Series: NPS/PWR-NCCN/INV-2005-001

Funding Source:
Inventory and Monitoring Program, National Park Service

Bibliographic Information

File Name: Happe_2005_OLYMForestCarnivoreInventory.doc

Recommended Citation:

Happe, P.J., K.F. Beirne, C.E. Cantway, D.J. Manson, and D.W. Smith. 2005. Forest carnivore inventory, Olympic National Park. Olympic National Park, Port Angeles, WA. NPS/PWR-NCCN/INV-2005/001. 62 pp

Topic: Inventory

Theme Keywords: Inventory, Forest Carnivore, Fisher, Marten, Spotted Skunk, Camera Survey

Placename Keywords: Parkwide, Olympic National Park, Washington State, North Coast and Cascades Network.

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Summary

We used remotely triggered camera traps to inventory forest carnivores throughout forested habitat in Olympic National Park during the winters of 2001-2002 and 2002-2003. Due to logistical constraints, equipment malfunctions, and inclement weather, we had greater than anticipated difficulty in sampling to protocol; we were only able to sample in 13 4-mi² blocks each year, for a total of 26 blocks sampled to protocol over the 2 winters of the study. However, we obtained over 1270 animal pictures, and detected 21 different species, 7 of which were forest carnivores (ermine, long-tailed weasel, spotted skunk, bobcat, mountain lion, coyote, and black bear). The most common forest carnivore detected was the spotted skunk; it was detected throughout the park, in 42 % of the blocks and in 50% of the animal pictures. We obtained no detection of the fisher, confirming our belief that the species has been extirpated from the Park. We also did not detect any marten, raising concerns about the conservation status of this species in Olympic National Park, and coastal Washington.

Acknowledgements

This project is the product of a lot of people's labor. The project was conceived by Bob Kuntz, Jim Petterson, and Patti Happe. Jim Petterson graciously agreed to be the guinea pig and do the first years sampling in MORA. He worked out a lot of bugs and shared all he learned. Roger Hoffman was instrumental in conducting the initial GIS work that allowed us to develop the sampling scheme. Most of the field work and data entry during the first years work was conducted by Don Smith and Chris Cantway, in what was not known to be a good winter. Initial report preparation was also done by Don. In the second year the study was implemented by Dave Manson and Chris Cantway. We could not have sampled as many sites as we did without the help of volunteers: Kari Williamson, Jen McElligott, Josh Smith, Steve Acker, Kurt Laubenheimer, Scott Gremel, Bill Baccus and Shelley Hall. We thank Kurt Jenkins, Ron Holmes and Jim Schaberl for reviewing earlier versions of the document.

Introduction

In 1999 funding acquired through the Natural Resource Challenge provided resources for the National Park Service (NPS) to initiate species inventory projects. Within the North Coast and Cascades (NCCN) network, the second highest priority for terrestrial vertebrates was an inventory of forest carnivores (NCCN 2001).

This taxonomic group was ranked a high priority for several reasons. First, all the national parks in the network had very little information on forest carnivores. This lack of data stemmed primarily from the fact that forest carnivores were historically very difficult to study, especially in remote, wilderness areas. However, recently developed techniques and protocols for surveying forest carnivores offer alternatives that are cost effective, non-intrusive, and amenable to a wilderness environment (Aubry 1997, Zielinski and Kucera 1995). In addition, these methods can be used for more than one species at a time. These survey protocols have wide acceptance throughout the region, and have been employed by multiple land management agencies. However, the NPS had yet to systematically employ them in Washington.

Additionally, there was concern about the conservation status of several species. Some are listed on either federal or state endangered species lists (Federal: lynx, wolf, and grizzly bear. State: fisher), have been petitioned for listing (wolverine, fisher), have been proposed for listing (Federal: coastal marten), or are of special management concern (cougar). Many species of forest carnivores experience numerous threats: habitat loss outside of NPS units, isolation of remnant populations in protected areas, long standing effects of historic harvest pressure, continued harvest pressure outside the park, and loss of major food sources – i.e. salmon (Ruggiero et al. 1994).

The primary objective of the forest carnivore camera survey is to gain information on species presence (i.e. complete the 90% documented species list with current data). For most of the larger parks, some forest carnivore species have not been documented for over 40 years, and several are suspected to be extirpated (fisher in Mount Rainier (MORA), North Cascades (NOCA), and Olympic (OLYM), wolverine in NOCA, MORA, wolf in OLYM, MORA, and Canada lynx in MORA). The secondary objective was to gain insight on species distribution patterns across broad geographic, elevation and precipitation gradients. However, we expected from the onset that sample sizes would be too low for statistical analysis.

The Wildlife Working Group of the NCCN decided to survey for 2 winters in each of the three big parks. The group also decided to stagger the timing of the inventories. Surveys were first conducted in MORA (2001 and 2002), followed by OLYM (2002 and 2003) and NOCA was scheduled to go last (2003 and 2004). This schedule allowed the sharing of resources and equipment among parks. Additionally, by having one park start first (MORA), we were able to test and refine the protocol for subsequent parks and years.

This report summarizes the forest carnivore inventory effort that was conducted in OLYM in 2002-2003. A final report for the NCCN Network will be prepared upon completion of the survey efforts in NOCA.

Study Area

Olympic National Park encompasses 922,651 acres (373, 397 ha) in the center of Washington's Olympic Peninsula and along a 60 mile strip of wilderness coastline on the Pacific Ocean (Figure 1). The park is located less than 72 miles (116 kilometers) west/northwest of the Seattle-Tacoma area (36 miles as the crow flies).

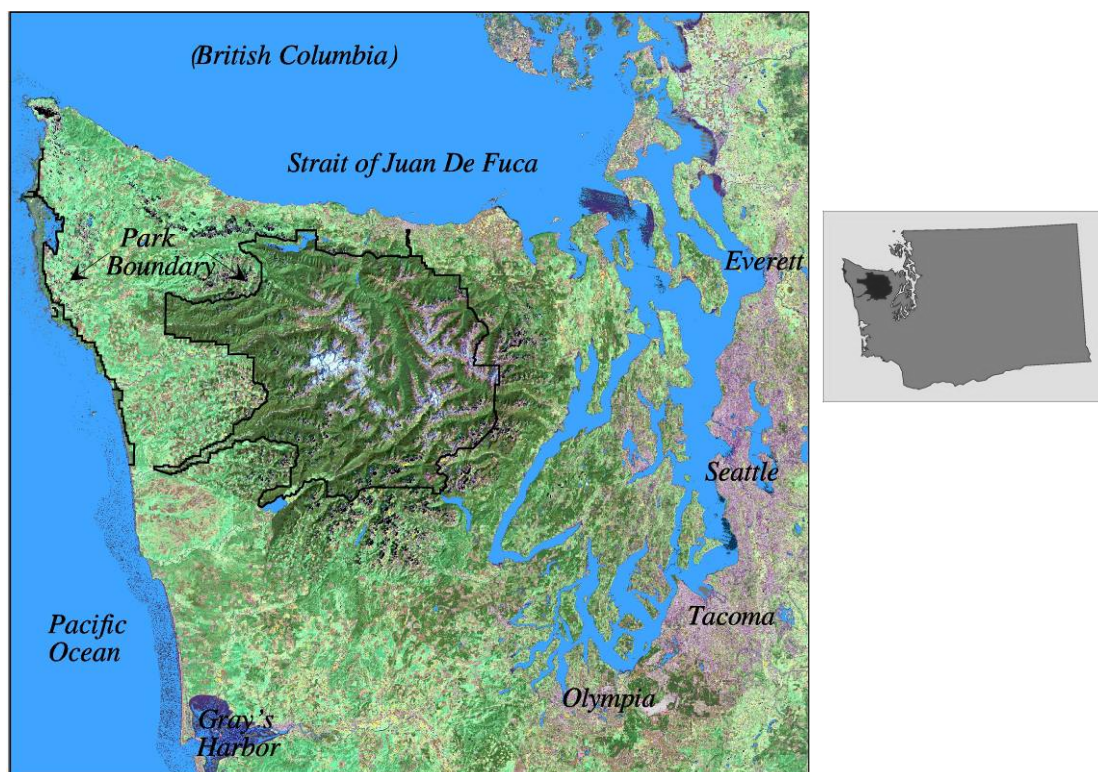


Figure 1. Location of Olympic National Park, Washington.

From sea level, the park rises to almost 8000 ft (2,435 m) at Mount Olympus in less than 40 miles. The Olympic Mountains intercept moisture-laden Pacific winds, resulting in a rainshadow effect more pronounced than any other in North America. Olympic National Park is the wettest spot in the conterminous United States. The west slopes of Mount Olympus receive about 200 inches (508 cm) of precipitation per year, while less than 34 miles to the east, precipitation is less than 20 inches (50.3 cm) per year.

The park's biotic diversity mirrors its climatic diversity. Park ecosystems range from the rich intertidal zone, to rainforests, montane forests, alpine meadows, and glaciers. Temperate rainforests blanket the western slopes of the mountains, while alpine tundra conditions prevail in the dry, northeast section of the park. Along this gradient, Sitka spruce, Western red cedar, and Western hemlock yield to subalpine fir, white pine, and lodgepole pine. Tree line generally occurs around elevations of 5000 ft.

Methods

By and large the methods we used were in agreement with the methods developed and published by Zielinski and Kucera (1995), with field implementation following recommendations from Keith Aubrey (1997, pers. comm. 2000), and modifications made by Jim Petterson after his first years efforts in MORA (Petterson 2001). Additionally, after discussions with Jim, and an evaluation of our logistical and budgetary constraints, we made further modifications to the study plan prior to the 2002 field season in OLYM.

Surveys were designed to be conducted in late winter and early spring to:

- 1) Take advantage of deep snows in upper elevations which may concentrate the target species to lower, more accessible, elevations, increasing the probability of detection.
- 2) Enable us to take advantage of snow tracking opportunities to augment the camera trapping.
- 3) Late winter/early spring is the breeding season for several of the target species (fisher, wolverine, and lynx). With increased travel by males during this period, trap success may be increased.
- 4) Avoid having bears, which should be hibernating in winter, destroy the stations. In addition, we wanted to minimize the chance of creating a nuisance bear situation (although no baits were located near roads or trails).

Sampling Scheme

Our original area of inference was all suitable habitats for forest carnivores within OLYM. This consisted of all forested habitats within the Park, from low-elevation forests on the coast, to deciduous riparian, mid- and late-seral coniferous, and up to and including subalpine forests. Because 95% of the Park is wilderness, with few roads (some of which are closed in the winter), safe access to sites during the winter posed severe logistical constraints. We decided at the onset to constrain the sample universe to accessible areas, defined as being within 1.5 km (1 mile) from roads and trails, and excluding areas where the slope was greater than 35%, or which access required traversing slopes greater than 35%. In addition, we also eliminated sites that required dangerous river crossings or traversing avalanche prone sites. Our original plan was to sample up to 20 km (12 miles) from trailheads in low elevation sites (less than 2000 ft (610m) or approximate snowline), up to 10 km (6 miles) from trailheads in mid elevations (up to 4000' or 1219m) and up to 3 km (1.8 miles) from the road at elevations greater than 4000 ft (NCCN 2001). However, we found that it was not possible to hike those distances and access a plot up to 1.5 km from a trail without overnight trips. We decided that it was not practical to require the crew to carry overnight camping gear for winter conditions in addition to the field gear required for the project (Appendix A). Consequently, the sample universe was further restricted to areas within 5 km (3 miles) of a trailhead. Exceptions were made in situations where there were backcountry ranger station cabins. These sites were treated as a trailhead, and we sampled up to 5 km down a trail from them (Figure 2).

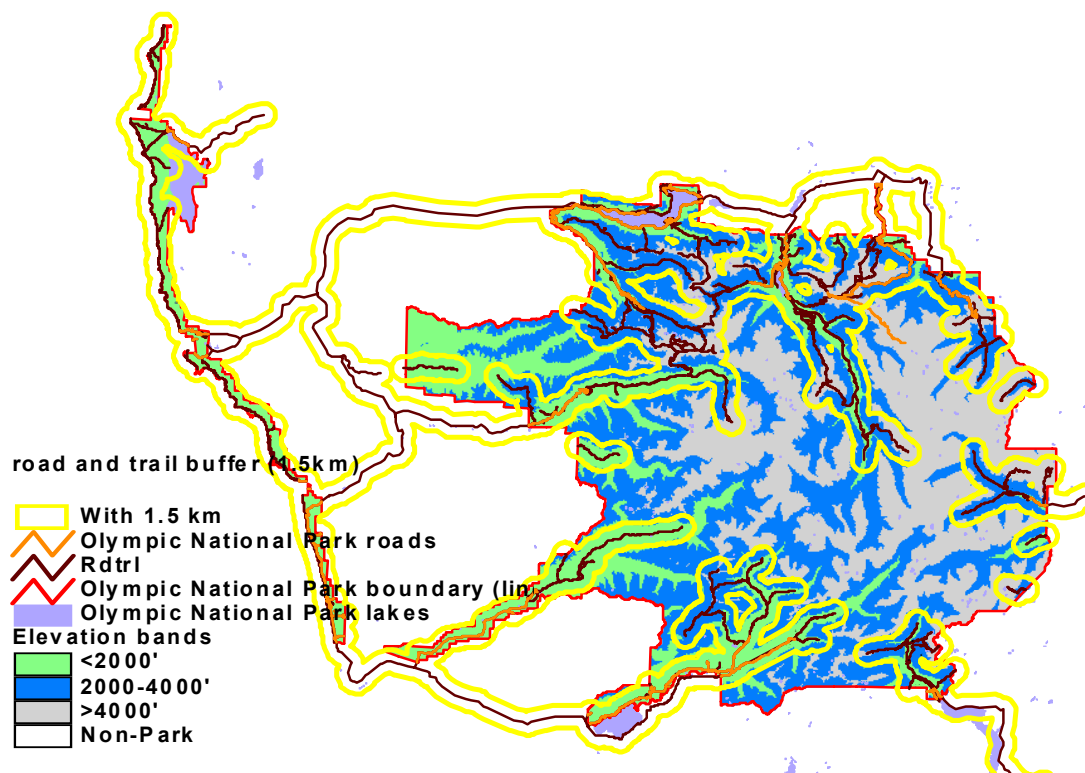


Figure 2. Elevation zones, roads, trails and 1.5 km buffer in Olympic National Park.

In order to have our sampling scheme as similar as possible to that used by Zielinski and Kucera, whose sampling scheme was based on 4mi^2 blocks derived from sections, we overlaid, using GIS, a 4mi^2 grid over the Park. We selected for possible sampling those blocks that were 1) greater than 50% inside the park, and 2) greater than 50% within 1.5 km of a road or trail, and 3) within 3 miles of a trailhead. In Olympic, this resulted in a possible sample size of 260 blocks (Figure 3).

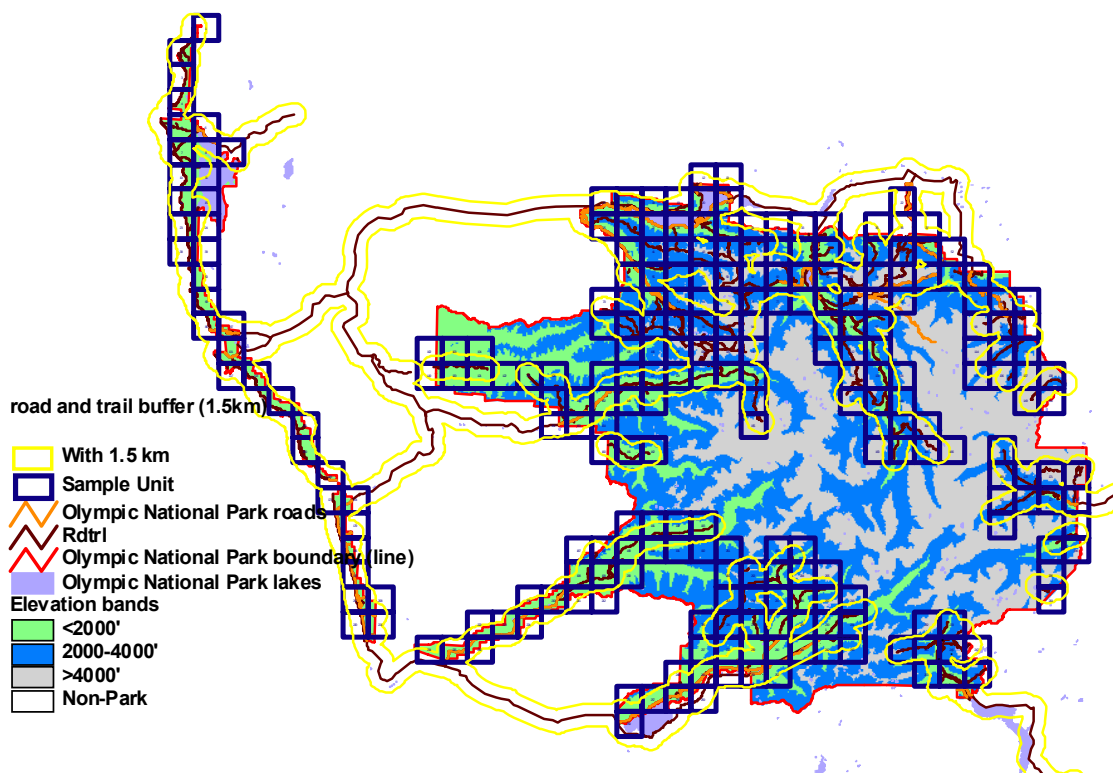


Figure 3. Location of 4mi² Forest Carnivore Inventory sample grids in Olympic National Park.

Protocol calls for each block to be sampled for 28 nights. The projected sampling period was 3 months. In forest service lands they were able to put out 2 stations in a block each day. Given this, we estimated that, given our more complicated logistics, we would be able to sample approximately 25 blocks per winter. We then systematically chose every 2.5 blocks, going from East to West and North to South across the grid, to select blocks to sample, resulting in a sample of 48 blocks. Prior to block selection, we decided to omit from selection the upper Queets (river crossing) and the Duckabush (access via long hike through Forest Service) valleys. Three of the selected blocks were omitted from the sample after further examination due to steepness and unsafe access, leaving a possible 45 blocks for sampling (Figure 4).

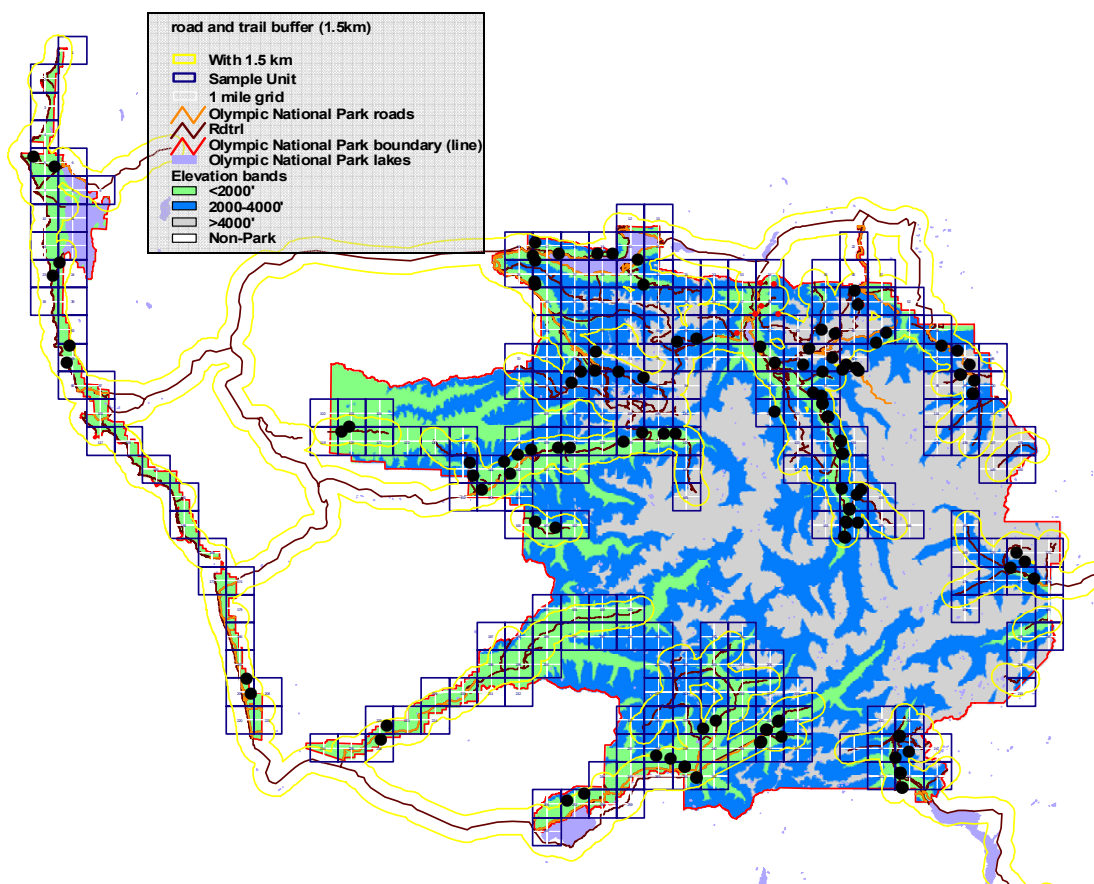


Figure 4. Location of selected sample points (black dots) in selected blocks, along with incidental sampling points.

Following the procedures described by Zielinski and Kucera (1995) we divided the 4mi² blocks into 4-1mi² sub-blocks, and then randomly selected 2 sub-blocks for sampling. (A sub-block had to contain habitat within 1.5 km from the trail, and safe access to be selected for sampling). We then randomly located sample points within each sub block for possible sample site location (Figure 4). Sites were located by randomly selecting a sub-block to select a site in first, then randomly locating a point within that sub-block (using block coordinates from ArcView and a random number generator in Excel). If a point was not accessible (greater than 1.5 km from the trail, in steep terrain (>35% slope), requiring a river crossing), a new point was randomly selected. This process continued until a safe and accessible point was selected in the first sub-block. We then selected a second site in the second sub-block, using the same process used for site selection in the first sub-block, with the added criteria that the second site had to be at least a mile apart from the first site (Zielinski and Kucera 1995). For each block we printed out topographic maps containing the point location and the UTM coordinates. For 2 blocks, where it appeared questionable whether the crews could safely access one of the 2 selected sub-blocks, we also selected a point in a third, alternative, sub-block.

Blocks were not sampled in a random firing order. Instead, to increase sampling efficiency, we tried to sample all blocks in a watershed, or a portion of a watershed, at the same time. This meant that a crew would travel to a valley and set up all plots in the area for a week, taking day trips out from the ranger station. We also intentionally spread the sampling effort out over the park between the years, trying to make sure there was good interspersed of west/wet and dry/east drainages, and low and high elevation sampling effort between the years.

Field Procedures

At each site, a field crew (team of 2) navigated as close as possible to the selected point, using maps, compass, altimeter, and where functioning, a GPS. Once at the site, the crew searched for the best suitable spot to deploy the camera traps (Appendix B). The best spot was defined as having large trees, where pairs of trees were between 5 and 10 m apart, oriented in a general North-South configuration. We searched for any prey or target species sign, and for forest structure (leaning trees, snags) that would be attractive to the target species.

At each site, a bait station consisting of a whole feathered chicken and a can of tuna was attached to a large tree (Figure 5a), approximately 1 m up from the base of the tree. The bait was placed on the south-facing side of the tree, with the chicken wrapped in chicken wire, to keep it from being removed by any species attracted to the site. A can of tuna was punctured, and screwed into the tree about one foot above the chicken as additional bait. A Trailmaster™ 550 dual sensor attached to a 35mm camera was placed on a tree approximately 5m away from the bait (Figure 5b). When an animal came to investigate the bait, it was recorded as an event on the Trailmaster sensor, and the sensor triggered the camera to take a picture. The sensor was placed in a north-facing direction, for we learned the hard way that the rising or setting sun could set the sensors off erroneously.



Figure 5. Chris Cantway setting up the bait (a) and installing the camera and sensor (b) at a site in the Elwha valley.

Skunk scent and a marten lure (scent) were also spread around the site to attract predators. Finally, in an open area near the bait, but not in view of the sensor, we placed an aluminum pie plate swinging from a string that would serve as a visual attractant to the site. For details of the site selection, camera and sensor settings, baits and lures used, see Appendix B.

According to the protocol (Zielinski and Kucera 1995, Aubry 1997), a station must be operational for 28 days and 28 nights. To be operational, the following conditions must all be met: all baits present, film in camera, camera and sensor functioning, pictures taken by camera are of sufficient quality that an animal, if present, would be identifiable. Because there are multiple factors that can cause a station to be non-operational, other researchers advised checking stations once a week, and replenishing bait, batteries, and film, if necessary. If a set-up is found to be non-operational, the set-up must remain in place for additional nights, until the 28 night protocol is met. According to the protocol, if one of the set ups in the block is operational for 28 nights, then the block can be considered sampled, and the set-up moved to another site.

In areas where access is limited, station set up time and checking time are essentially the same, for most of the effort is expended in getting to the site. Because of our logistical constraints (i.e. not being able to drive to sites), and our desire to sample as many sites as possible, we decided to check cameras every 2-3 weeks. This would allow us to deploy twice as many stations as we would have been able to do in one 30 day sampling period. This had an inherent risk in that a station may be in place for 2 weeks and only operational for one day, necessitating leaving it on site for much longer than planned. But since we were more limited by crew time than equipment, we decided to take that risk.

During each station check we determined if the station was still operational, and replaced film, batteries, bait, or scent if necessary (Appendix B). If there were problems with the set-up we either fixed them, or replaced problem units, and tried to determine how many more days the unit needed to be in the field (often a final determination was not possible until the slides were developed and reviewed).

Our back-country sites that were accessed from ranger stations required a huge investment in staff time. Typically for these we sent up a crew of 4 or more people and stayed for 3-5 days. At some of those sites we decided to deploy two camera set-ups per site, in the hope that if one failed, we would have a back-up in place and we would be more likely to meet the 28 day sampling requirement. In addition, at those sites we also deployed additional, incidental, set-ups. Although not part of the official sampling array (and hence not an unbiased distribution of sampling effort), we felt that since we spent so much time getting into an area, we should make it worth our while and increase our probability in picking up rare or uncommon species. Our motivation for this practice was the possibility that some of the hard to detect species, that we are particularly interested in (i.e. fisher and marten in OLYM, wolverine and wolves in NOCA) may be more prevalent in the more remote, hard to access portions of the park.

Data Entry

At each site we recorded information on set up times and conditions, camera and sensor status. In addition, at station checks we recorded information on any actions taken. During one visit we also recorded habitat variables. For more details on station variables and field forms, see Appendix B. The primary data for this study was the pictures taken by the cameras, and to a lesser extent the number and timing of events registered on the event recorders.

After the film was developed, the slides were reviewed for their consistency with the data on the event recorders (date, time, and number of pictures the event recorder said that it took). Slides were labeled with sub-block number, date, and species observed. Most slides with nothing detected in the picture were also saved for later review, unless it was obvious that the camera malfunctioned (i.e. took a picture every hour on the hour), or the slide were of unusable quality (clouded).

Data from the slides, event recorders, visit forms, and habitat assessment were entered into an access database. For database protocols and metadata, see Appendix C. All slides are in slide sheets, stored in notebooks, ordered by year and block number. For each sub-block, the slides are stored with the site maps, field forms, and printout from the Trailmaster™ dataloggers.

Data QA/QC.

All questionable slides were reviewed by more than one member of the field crew and the supervisor. Slides with no animals detected were reviewed twice, and later discarded. For the majority of the data entry, data was entered by one technician. At the end of data entry, a subset of the slides were reviewed by the supervisor, and the database was reviewed for consistency with the number of slides, field forms, and species detected in the slide notebooks.

Results and Discussion

Field Deployment

Even our conservative estimate of how many blocks we would be able to sample turned out to be a gross overestimate. At the end of 2 years, with a crew working over 3 months on the project each year, and assistance from numerous volunteers and non-project staff, we only managed to sample 26 blocks (13 in each year) (Table 1). Many stations were not pulled until May, June or July by crew members from other projects (backcountry rangers, spotted owl crew), or carnivore inventory staff that were working on other jobs at the time (i.e. spotted owl surveys or bear research projects). We ran into greater than anticipated problems with set-ups not being operational. 18/52 camera stations were non-operational at some point during their deployment (Appendix D). A host of things went wrong with the cameras, including:

- 1) The station being discovered by a target species (skunks in particular) and that species hanging out at the site and
 - a. shooting all the film in one or two days, and
 - b. eating the bait up, even while it remained in the chicken wire mesh.
- 2) Small mammals (presumably) chewing through the wires that connected the sensors to the camera.
- 3) Camera or sensor malfunction.
- 4) Poor slide images, principally due to fog.
- 5) Herd of elk walking by and knocking the camera out of alignment.

Table 1. Blocks sampled during forest carnivore inventory. Precipitation Gradient: dry=north and eastern valleys, wet=coast and western valleys. Elevation Zone: low=0-1999ft, mid=2000-3999ft, high=>4000ft.

Block Number	Area	Block Name	Precip. Gradient	Elevation Zone (ft)	Year Sampled
34	Elwha, Lower	Madison Creek	Dry	Low, Mid	2002
48	Elwha, Lower	Griff Creek	Dry	Low, Mid	2002
50	Morse	Lk Angeles Trail	Dry	Mid	2002
61	Elwha, Lower	Lake Mills	Dry	Low, Mid	2002
80	Elwha, Lower	Idaho Crk	Dry	Mid, High	2002
5	North Coast	Cape Alava	Wet	Low	2002
23	North Coast	Norwegian	Wet	Low	2002
102	Bogecheil	Lower Bogecheil	Wet	Low	2002
125	Hoh	Taft Creek	Wet	Low, Mid	2002
127	Hoh	Mineral Creek	Wet	Low	2002
129	Hoh	OGS	Wet	Low	2002
140	Hoh	West Twin Creek	Wet	Mid	2002
142	Hoh	Snyder Crk	Wet	Low	2002
26	Sol Duc	Eagle Lakes	Dry	Low	2003

Table 1. Blocks sampled during forest carnivore inventory. Precipitation Gradient: dry=north and eastern valleys, wet=coast and western valleys. Elevation Zone: low=0-1999ft, mid=2000-3999ft, high=>4000ft.

Block Number	Area	Block Name	Precip. Gradient	Elevation Zone (ft)	Year Sampled
82	Morse	Steeple Rock	Dry	High	2003
97	Elwha, Upper	Lillian	Dry	Mid	2003
99	Dungeness	Deer Park	Dry	Mid, High	2003
113	Elwha, Upper	Marys Falls	Dry	Low, Mid	2003
134	Elwha, Upper	Elkhorn	Dry	Mid	2003
157	Elwha, Upper	Hayes	Dry	Low, Mid	2003
164	Elwha, Upper	Upper Elwha	Dry	Low, Mid	2003
246	Skokomish	Flapjack	Dry	Mid	2003
254	Skokomish	Staircase	Dry	Low	2003
230	Quinault	S Fork Quin	Wet	Low	2003
242	Quinault	Graves Creek	Wet	Low	2003
251	Quinault	Bunch Field	Wet	Low	2003

Although we tried to leave the set-up in the field until a full 28 nights were sampled, we occasionally were not able to reach that objective, especially for the more remote sites. However, in all blocks at least one site functioned to protocol, consequently we are considering that block sampled (Zeilinski and Kucera 1995).

In early 2002, our survey efforts were hampered by somewhat higher than normal snowfall that fell at unfortunate times for planned high country visits. Due to crew safety concerns, we sent people out in two person teams. This is standard operating procedure for most wildlife field work in OLYM, and was especially critical during this project, which took place during a time of year that had short day lengths, low light, snow and/or drenching rain, trees blocking trails and roads, and trail washouts. Often a crew could only set out or check one sub-block a day (instead of two like in other studies). Although we made extensive use of volunteers, no one would consistently come out and assist the project under these conditions.

Because it looked apparent that we would not sample all blocks in the 2 years we had for this study, we decided to prioritize drainages in 2003 to ensure a good dispersion of the sampling effort over the 2 years. We also prioritized sites further from the park boundary. Consequently, at the end of the study there was no sampling effort in the lower Queets, South Coast, South Fork Hoh and Dosewallips drainages, and very little sampling in the Sol Duc, Lake Crescent, and Morse Drainages. We did end up with complete or almost complete sampling in the Quinault, Hoh, Bogachiel, North Coast (wet/west), Elwha, Dungeness, and Skokomish (dry/east) drainages (Figure 6).

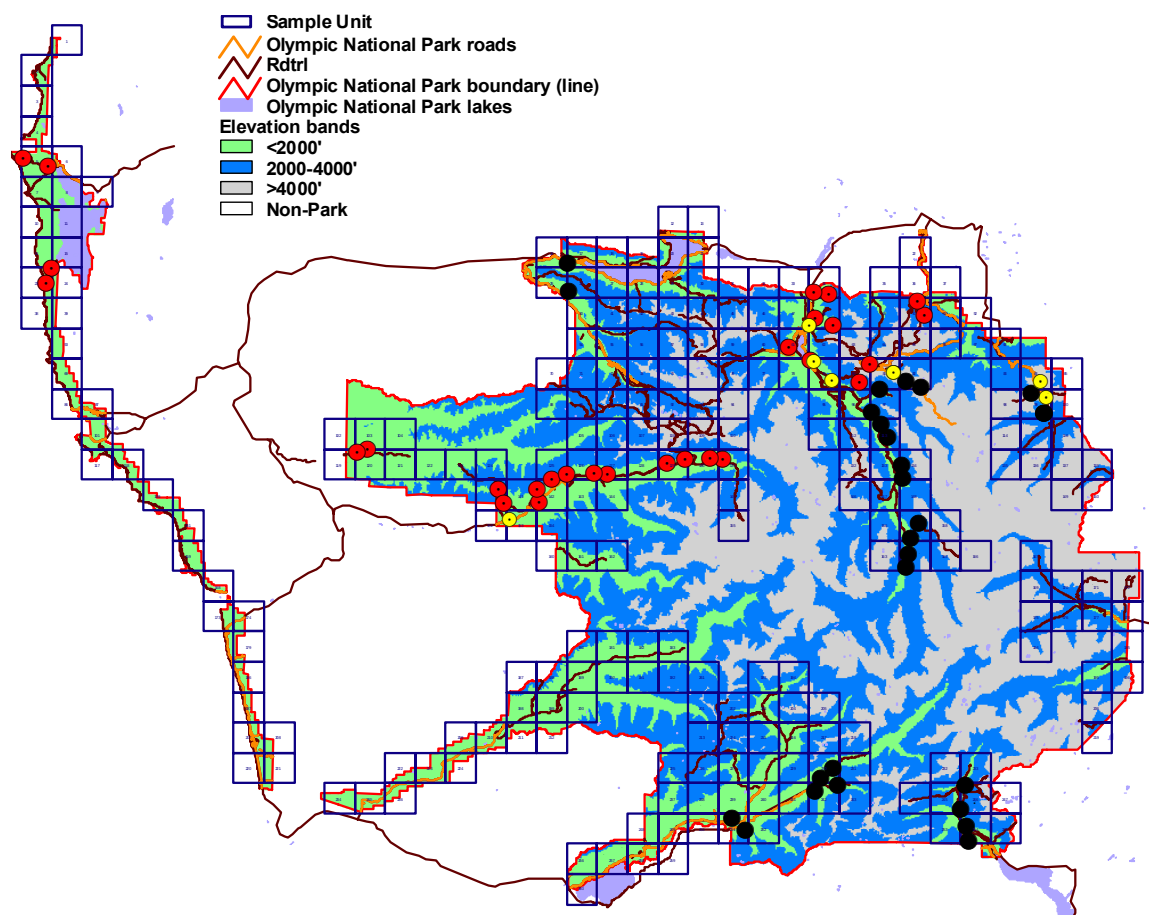


Figure 6. Location of points sampled in 2001-2002 (red dots), 2002-2003 (black dots) and incidental sites (yellow dots) in Olympic National Park.

Site Characteristics

The elevation of sampling sites ranged from 98 ft (30m) on the coast to 5,249 ft (1600m) off of the Obstruction Point Road; mean elevation of sample sites was 1,805 ft (550m). Due to access and safety constraints, we were unable place many stations at high elevation (> 4000 ft) sites (Table 1, Appendix E). Adding insult to injury, the few stations that we were able to place at higher elevations were prone to malfunction (25%) and did not sample for the complete 28 days. The majority of the sites were on the lower 1/3 (42%) or middle 1/3 (25%) of slopes, with much less sampling effort in riparian, valley bottom, or upper slopes (4-5% each) (Appendix E). Sites were located in a variety of stand types, with western hemlock and Douglas-fir being the most common species present. In almost half of the sites mean tree DBH was greater than 20 inches (Appendix F).

Species Detected

Out of a total of 3766 sensor-nights out over the 2 years of this study, only 2193, or 58%, were fully operational. In cases where the chicken bait was consumed, but the scent and can of tuna were still on the tree, we found that target species were still drawn to the stations. However, we concluded that the sampling effort was not the same in these cases. Consequently, those

observations were not included in the data for the inventory, but were included as incidental observations.

Over the course of the inventory, we collected 1270 animal pictures during the survey (Table 2, Appendix G). We tallied a total of 1281 detections when incidental observations were included with photographs. Although we sampled the same number of blocks in both years, our sampling success in terms of number of animal pictures was greater in 2002 than in 2003. However, in terms of frequency of individual species detections at the blocks (the number of blocks at which a species was detected), the years were quite equal, and the number of different species detected was greater in 2003 than in 2002 (Table 2). We detected the same number of forest carnivores between years; the difference in forest carnivore between 2002 and 2003 was that in 2003 we detected long-tailed weasels, whereas in 2002 we were unable to identify some weasels to species in some photos, and classified some photos in a generic weasel category.

Table 2. Annual and total counts of pictures taken and species detected on each block. The picture totals are only for when the set-ups were fully operational. (The number of no-animal pictures would greatly increase if the data from malfunctioning set-ups were included). Frequency of Detection is the number of species that were detected at each block (species that had multiple pictures in a block were counted only once). Each year n=13 blocks, for 26 total.

	2002	2003	Total
Number of Pictures	1202	459	1661
Number of Animal Pictures	912	358	1270
Number of No Animal Pictures	290	101	391
% Animal Pictures	76	78	77
Frequency of Species Detections ¹	41	46	87
Frequency of Carnivore Detections ²	18	21	39
Total Number of Species Detected	15	21	22
Total Number of Forest Carnivores Detected	7	7	8

¹Number of species detected in each block summed across blocks

²Number of carnivore species detected in each block summed across blocks

We suspect that the greater number of animal pictures in 2002 may have been due to the difference in winter conditions between the two years. In 2002 we had greater amounts and longer duration of snow in lower elevations. This may have decreased the food availability for the target species and increased the attractiveness of the bait. This tendency was most pronounced with spotted skunks, and to a lesser extent with ermine. In 2002 we detected spotted skunks in 7 blocks, and collected 511 spotted skunk pictures. In 2003 we detected spotted skunks at 4 blocks but got only 119 pictures (Appendix G).

Forest Carnivores Detected

The interpretation of data on the species detected on the inventory could be interpreted very differently, depending on if one looked at the number of photos taken versus the block detections

rates. This results from the difference in species behavior once they detect the bait. Spotted skunks, and to a lesser extent ermine, were very persistent at the bait once it was detected, often staying at the site throughout the night and getting their pictures taken multiple times (mean number of spotted skunk pictures per detection was 39, Table 3). Conversely, cougar pictures comprised less than 1% of the photos, but were detected at 12% of the sites. This is because once a cougar detected the bait, it investigated it, got its picture shot once and it moved on (mean number of cougar pictures per detection was 1). Because of this bias, all subsequent analysis of species distribution patterns will be based on the detection rates at the block or sub-block.

Table 3. Number of pictures and frequency of detection for all species found during the inventory, both years combined.

Species	Number of Pictures	Number of Blocks Species was Detected	Number Pictures per Detection (sub-block)	% of Animal Pictures	% of Blocks Species was Detected
<i>Forest Carnivore</i>					
Ermine	83	7	10.4	6.5%	26.9%
Long-tailed weasel	15	1	15.0	1.2%	3.8%
(Weasel species) ¹	11	4	2.8	0.9%	15.4%
Spotted skunk	630	11	39.5	49.6%	42.3%
Bobcat	24	6	4.0	1.9%	23.1%
Cougar	3	3	1.0	0.2%	11.5%
Coyote	12	2	6.0	0.9%	7.7%
Black Bear	9	5	1.8	0.7%	19.2%
<i>Miscellaneous Mammal</i>					
Mouse or vole ²	158	15	10.5	12.4%	57.7%
Red Backed Vole	1	1	1.0	0.1%	3.8%
Douglas Squirrel	4	4	1.0	0.3%	15.4%
Flying Squirrel	40	4	6.7	3.1%	15.4%
Snowshoe Hare	2	1	2.0	0.2%	3.8%
Black-tailed Deer	7	4	1.2	0.6%	15.4%
Elk	6	2	3.0	0.5%	7.7%
<i>Bird</i>					
Northern Spotted Owl	2	1	2.0	0.2%	3.8%
Accipiter ³	1	1	1.0	0.1%	3.8%
Stellers Jay	72	3	24.0	5.7%	11.5%
Gray Jay	185	8	18.5	14.6%	30.8%
Northern Flicker	1	1	1.0	0.1%	3.8%
Hairy Woodpecker	1	1	1.0	0.1%	3.8%
Brown Creeper	2	1	2.0	0.2%	3.8%
Blue Grouse	1	1	1.0	0.1%	3.8%

¹ Were able to determine that an animal was a weasel, but unable to determine which species

² Most were genus *Peromyscus*, we were unable to determine species from slide

³ Were unable to determine which *Accipiter* species from slide

Spotted skunks were by far the most common forest carnivore detected; they were detected in over 42% of the blocks (Table 3). They were found park-wide, during both years of the survey, and at all elevations sampled (Appendix H3). The next most common forest carnivore was the ermine; ermine were detected at 27% of the stations. Ermine were also detected throughout the range of habitats and elevations sampled, and on both years of the study (Appendix G, H1). Long-tailed weasel appeared to be less common; they were only captured on film at one block on the coast (Appendix H2).

We had fairly good success detecting the two felid species that are known to occur in the park. Bobcats were detected at 23% of the sites and cougar at 11.5%. Although these species are known to occur throughout the park, it is interesting to note that they were only detected in the Elwha drainage and the adjacent Morse Creek (Appendix H4 and H5). This data suggests that the abundance of felids is greatest on the northern side of the park. This area of the park is known to have a high density of deer, and to contain a key deer winter range.

Coyotes were detected infrequently; 2 out of the 26 blocks, in one block each of the 2 years. Coyotes are thought to occur throughout the park, but at unknown densities. The survey results bear this out: one block where they were detected is in the Elwha front country, whereas the second block was in the farthest block that we sampled from the park boundary (Appendix H6).

Black Bear were not targeted in this survey; in fact we tried to avoid them. However, due to logistical difficulties, we were occasionally late in pulling sites at the end of the season. These were primarily remote sits or sites that had numerous malfunctions. All bear detections occurred in late spring and early summer (April 9th to July 20th), and were at sites that were not pulled until May or later. Some incidental detections occurred at sites without any chicken left at the time of the bear detection; the bears were drawn in to just the scent and the can of tuna.

Species Not Detected

We did not detect several carnivorous species that are thought to inhabit the park: mink, river otter, striped skunks, raccoons, red fox, fisher, or marten.

- Mink and river otter are principally aquatic species, and we were not expecting to detect any of these species on this survey.
- Striped skunks are thought to be locally common near developed and low elevations areas, a habitat type that we did not sample.
- Raccoons are more prevalent in riparian and coastal areas, which were not sampled very heavily on this inventory. Consequently, it is not too surprising that we did not detect raccoons. We have detected them, using similar baits and the same equipment, in earlier incidental surveys. At all times the stations were immediately adjacent to lakes or large rivers.

- Red Fox is an exotic species that is gradually invading the Olympic Peninsula. We have received occasional, unverified reports that they have been seen in or near the Park. Due to their rarity, and the fact that they are more likely to occur on the Park boundary where we did not sample much, it again is not very surprising that we did not detect and red fox.
- Fishers were historically present in the Park. Historical records indicate that trappers had relatively good trapping success in the low elevation areas on the parks west side (Scheffer 1995, Aubry and Houston 1992). However fisher populations were greatly depleted prior to the Park's formation through trapping, poisoning (predator control), and habitat loss. Fishers are currently thought to be extirpated from Washington State (Lewis and Hayes 2004). Although we were hoping that we would have a pleasant surprise in this survey, the lack of fisher detections is what we expected.
- We are surprised, and alarmed, by the lack of marten detections. Although our results substantiate the concerns raised earlier about the status of marten in coastal areas of the Pacific Northwest (Zielinski et al. 2001), marten have been detected in the park as recently as 1992 (Sheets 1993).

Incidental Species

We detected 15 non-target species during the course of the inventory. Several (*Peromyscus* mice, Gray and Stellar's jays, Douglas and flying squirrels), were attracted to the bait, whereas most were captured as they traveled through the camera's range. (e.g. elk, deer, snowshoe hare, grouse). We suspect that the northern spotted owl and the accipiter were detected while they were foraging on small mammals (mice or flying squirrels) that were on the bait.

Distribution Across Gradients

Because of our small sample size, the data is not sufficient for any in-depth analysis of habitat relationship for forest carnivores in the park. Some species, however, had enough detections for some exploratory analysis. We used Chi-square analyses to test null hypotheses that frequencies of species detection were independent of distributions of sample sites relative to elevation gradients (in 1000-ft bands) and precipitation gradient (wet/west vs. dry/east). As expected, frequencies of detection of most species did not differ from the sample distributions (Table 4). Bobcat distribution was significantly greater than expected in the dry side of the park, and gray jays were distributed disproportionately on both the drier drainages, and at higher elevations; no gray jays were detected at elevations below 2000 ft. or in western drainages (Table 4, Appendix H7).

Table 4. Chi-Square analysis of selected species detection frequency as compared to the distribution of sample sites over elevation zones (in 1000ft increments) and precipitation zone. n= number of sub-blocks (elevation) or blocks (precipitation) in which the species was detected.

Species	Elevation Zone (sub-block n=52)			Precipitation Zone (block n=26)		
	n	X^2	P	n	X^2	P
Spotted Skunk	16	3.94	0.41	11	0.08	0.78
Ermine	8	0.94	0.92	7	0.001	0.97
Bobcat	6	4.50	0.28	6	5.72	0.02
Mouse	15	4.30	0.37	15	1.17	0.28
Flying Squirrel	6	5.56	0.23	4	0.58	0.45
Gray Jay	10	18.09	0.01	8	8.47	0.004

Conclusions

We had more difficulty sampling in the park than anticipated, both in terms of the time needed to deploy the cameras and the amount of time the stations were not fully operational. Although we are disappointed in our final sample size, we are encouraged about the amount of information that we did gain with the limited sample size.

We were surprisingly successful in detecting bears at stations that were left out too long, even at sites that only had can of tuna left as an attractant. Consequently, in summer of 2004 we started a pilot project looking at the efficacy of using scent lures, camera traps and hair snares to monitor black bear in the park. Data from that pilot project is currently being analyzed.

We were only able to get to half of the selected blocks. In the future, we will strive to complete the survey in order to have more confidence in the inventory. Gaining a larger sample size is critical because 1) we already reduced the sample effort by omitting areas greater than 1.5 km from trails and roads, and greater than 4.8 km from a trailhead (56% of Park); 2) we further restricted sampling by planning on only going to 48 out of a possible 260, or 18%, of the blocks. However, in this inventory we only sampled to protocol 26, or 10%, of the accessible blocks. Consequently, our sampling covered only about 5% of the Park. There are key portions of OLYM, especially the south coast, higher elevations, and locations on the Park's east side, that were not adequately sampled.

The fact that we did gain some useful insight into the species composition of forest carnivores in OLYM, and unexpectedly some insights into the distribution of some species, only furthers the incentive to continue on with this project; if we can continue to build on this data set we will be able to perform more in depth analysis of the forest carnivore assemblage in the park.

At the conclusion of this effort, we feel more certain of the conclusion that fisher are no longer present in the park. Although our sample size was small, we did cover fairly well what should be prime fisher habitat: low and mid elevation forests dominated by Douglas-fir and western hemlock, with mean live tree size greater than 20 inches DBH and snags and downed woody debris (Appendix G). The fact that we did not detect fisher in these areas, while we did detect spotted skunks and both weasels, further supports our conclusion. Following the results of this, and other recent surveys, the Park will now pursue a program to restore fisher to the park through reintroduction.

The lack of marten detections during this inventory supports the concerns raised about the status of marten in coastal areas raised by Zeilinski et. al. (2001). Historical data indicates that on the Olympic Peninsula marten were once distributed at all elevations, including along the coast (Scheffer 1995). The inventory methods that we used are very good at detecting marten if they are present; MORA and NOCA, which used the same sampling design and methods as we did in OLYM, including chickens from the same factory, not only detected marten, but over half of all their detections were marten. Consequently, we conclude that if marten were present in OLYM in any significant numbers, and fully occupying their former range, we would have detected them during this inventory.

However, unlike the case with fisher, we do not yet feel confident in concluding that marten are extirpated from the park. Marten have been documented as being present in OLYM as recently as 13 years ago (Sheets 1993). In other areas marten are more frequently found at higher elevations, and all recent marten sightings on the Olympic Peninsula have been at higher elevations on the East and Southeast side of the park (Zeilinski et al. 2001, Forsman, pers. comm.). During this inventory, our sampling efforts both at higher elevations and on the east side of the park were not as extensive as in other areas of the Park. A high priority for future efforts will be 1) as stated above, complete the inventory, 2) put more sampling effort into elevations greater than 3000ft, and on the parks east side, where marten are most likely to still occur (Zielinski et al. 2001), and 3) explore methods that can be used in the summer, when higher elevations are more accessible, yet will not be an attractive nuisance for bears.

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Appendix A. Field Gear List

Compiled by Don Smith 2002

Equipment

Cameras and Sensors - Trailmaster (a trademark product) infrared sensors and modified commercial cameras were used (see Zielinski and Kucera 1995).

Latex gloves- these are essential for handling the different baits. Especially the skunk scent lures, but certainly the raw meat as well.

Chicken wire – works much better than hardware cloth which is smaller weave, but seems to be more brittle and easy for animals to invade, as well as being much more expensive than chicken wire. This author had experience with both types of mesh and Chicken wire was preferred.

Fencing wire - to wrap/tie bait to the tree.

Cordless Drill – I found this to be much better than a hammer and nails because the sets sometimes have to be moved about and adjusted so that all the components line up. Screws are easier to set and remove repeatedly than nails are. Additionally, you can screw a can of tuna fish to a tree and it won't get removed (not a single can has been torn off the tree in over 60 station sets.) We have good evidence that the tuna fish acts as a sufficient attractant even if the chicken gets stolen in the first couple of days. I think the extra weight of the cordless drill and battery (heavier than a hammer) is well worth it, being more efficient and versatile, as long as you make sure to keep the battery charged each night or two.

Drywall screws 2" and 1". The long screws really help on trees with thicker bark, and they will go right through a tuna fish can.

Pliers – essential for every station visit

Metal Shears – cuts the chicken wire into manageable chunks more quickly than pliers, but these are optional items. Another alternative is to pre-cut the chicken wire prior to setting out.

Garbage bags – essential for hauling dead chicken in and out as well as used gloves and other oddments around. Take plenty each day.

C cell batteries – the Trailmaster sensors run on these.

AA batteries – the GPS unit and headlamp

Camera batteries – we changed these out at least every other check, depending on weather conditions. We went prepared to change cameras every visit.

Plastic 1 gallon milk cartons – we cut these in half and used them to shield the camera from rain. They seemed to work better than the little metal roof provided by Trailmaster (nothing works that well here), and they were a lot lighter to pack around.

36 exposure 400 speed (ASA) slide film – we needed the faster, more expensive film due to winter light conditions and the relatively weak flash on the cameras. We managed a lot more identifications from what would have been otherwise unusable shots with a slow film. We figure the extra expense is worth it. Using this method, the pictures are the only evidence we had, so we needed all the useable ones we could get. As it was, quite a number were not useful.

Appendix A “continued”

Miscellaneous

Notebook
Flagging
Pie plates (to attract felids)
Swivels- keeps the pie plate from tangling all up, lets it turn freely in the wind.
Sharpie
Field forms
Electrical tape
GPS unit
Site Maps on waterproof paper
Container for skunk and marten scents
Whole feathered chicken
Tuna fish cans regular small size
Small Phillips head screwdriver

Office Equipment

Field forms
Data downloaders – from Trailmaster
Battery Tester
Data downloader software (provided by Trailmaster with the downloader)
Data downloader cable – from Trailmaster
Slide protectors
Light table

The Address for Trailmaster is:

Trail Master

10614 Widmer
Lenexa Kansas, 66215
(913)345-8555

Scents were purchased from:

M&M Furs INC.
PO Box 15
Bridgewater, SD 57319
Phone: (605) 729 – 2535

We got the skunk scent from
Rocky Mountain Fur
15007 Willis Road
Caldwell ID. 83607
(208) 459-6894

In 2001/2002 we got chicken from Mount Rainer crew who got it from a place called Starkell. A big commercial place in Puyallup. In 2003 we got whole feathered chickens from another farm along with NOCA. We also used chicken from the supermarket at about \$4.00 apiece when the feathered chicken ran out, or on long trips when weight was an issue. They worked just as well, or so it seemed, but were obviously more expensive.

Appendix B. Field Procedures

(Prepared by Jim Pederson, MORA) (any *OLYM* modifications are 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 (*or Olympus*) 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 (or *day/time*) 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.

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

Appendix B “continued”

- 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) (*In OLYM used white plastic cottage cheese container type lids*) directly above the bait using nails, 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

(*In OLYM we used Block and Sub-block numbers i.e.126-1*)

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.

Appendix B “continued”

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.

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 (*OLYM used screws*). 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 (*OLYM screwed the tuna in above the chicken... the dripping fluids added to the general aroma of the rotting chicken*). 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 (*Since there are no lynx in OLYM, and earlier attempts to bait in cougar and bobcat with lynx pads were unsuccessful, we omitted these in OLYM*). 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.

Appendix B “continued”

- 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 operational and that there have simply not been any visitors that have tripped the unit since the last visit.
- 3 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.
- 4 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.
- 5 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.”
- 6 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 preceding 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

Appendix B “continued”

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) (*In OLYM we 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.

(At the end of 2002, there occasionally was confusion as to which film went with what set up when... which we were able to rectify after careful review of the data, reading the placards in the slides, and the date stamp on the pictures. However, to minimize this problem, in 2003 we pre-numbered all rolls of film at the onset of the field season, and recorded the roll number on the station set up sheet at the onset of the sampling bout)

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. 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.

OLYM developed at Camera Corner in Port Angeles (24 hr turn-around). Data sheets were placed with slide sheets in three ring binder.

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

Appendix B “continued”

Station ID: The same number you put on the placard identifying the 5 letter acronym of the camera station, e.g., WHRI-2. *In OLYM used Block # and sub block # (i.e. 34-1 or 34-2)*

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. *In OLYM we did not always use stream names, but instead the most recognizable local feature (i.e. Cape Alava Boardwalk). In 2003 we changed the naming conventions so that the names of the sub-blocks were similar enough that we could easily recognize that they were in the same block i.e. Elkhorn Upper, Elkhorn Lower.*

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).

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.

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.

Appendix B “continued”

BACK OF DATA SHEET:

Box 1: Setup/New Roll: 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.

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 B “continued”

2001 Remote Camera Survey in Mount Rainier National Park

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	_____	_____

Record data for initial setup and each subsequent check on back

Appendix B “continued”

<u>Setup/New Roll:</u> 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: _____ _____ _____ _____
--

<u>Check #1:</u> 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: _____
--

<u>Check #2:</u> 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: _____
--

<u>Check #3:</u> 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: _____
--

<u>Check #4:</u> 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: _____
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Appendix B “continued”

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.

(this was rarely done at OLYM, we relied on GPS coverage, maps, site directions to relocate sites.

Overview map

Site map

Appendix B “continued”

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:

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)

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 Station Established:

Station Checked:

Station Checked:

Station Checked:

Station Checked/Removed:

CAMERA	OPERATIONAL					
CAMERA	MAINTENANCE					
CAMERA	STOLEN					
FILM	DEPLETED					
FILM	REPLACED					
BATTERY	DEAD					
BATTERY	REPLACED					

Appendix C. Data Entry and Metadata

NORTH COAST AND CASCADES FOREST CARNIVORE DATABASE

Contact information

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600 East Park Ave.
Port Angeles, WA 98362
GIS Office
(360) 565-3063

Database description

Title: North Coast and Cascades Forest Carnivore Database
Purpose: data entry, storage, query, summation, reports
File name: forestcarnivore.mdb
Network location: I:\NRM\Wildlife\ForestCarnivore\Data\Access
Software: Microsoft Access 97
Update status: development in progress
Time period: December 2001-2002
Completion date: Unknown
Distribution: Restricted to NPS personnel at this time

Project description

Database contains data collected for Olympic National Park's forest carnivore survey, 2001-2002. Remote infrared camera technology was implemented to detect forest carnivore presence in Olympic National Park. Data were collected using field visits and remote instrumentation.

Keywords

vertebrate, carnivore, mammal, mammalia, camera, remote, detection, infrared, survey, Olympic, National Park

Related documents and information

- Aubry, K.B. 1997. Remote camera survey to detect the presence of fishers in southwestern Oregon. USDA Forest Service, PNW Research Station, unpublished report. 16pp.
- Petterson, J. 2001. Remote Camera survey to detect the presence of forest carnivores in Mt. Rainier NP. Unpublished report.

Primary investigator contact information

Olympic National Park – Patti Happe, Wildlife Biologist, 600 East Park Ave., Port Angeles, WA 98362, (360) 565-3065
Mount Rainier National Park - Jim Petterson, Wildlife Biologist
North Cascades National Park - Roger Christophersen, Wildlife Biologist
Fort Clatsop – Scott Stonum, Resource Manager

Appendix C “continued”

Database directions for use

The database is a relational database composed of related tables. Data entry and general query are done using forms. The database is designed to enter data sequentially so that necessary relationships are established among the tables as data entry progresses from sample unit data to event data entry. Equipment and sample unit data must be entered first, followed by station data, then station set-up and station check data, and finally event data. It is strongly suggested that data from station set-up and station check field forms be entered into the database as the data comes in from the field. This will help avoid later confusions and errors. See Smith 20002 for study methods and standard operating procedures; these documents will further clarify fields in the database. Note: when your cursor is in a field in a data entry form, there is a brief field description at the bottom of the database window to help you remember the field's description or format.

The first form that opens when the forestcarnivore.mdb is opened asks the user to select “data entry” or “data query”. The “data query” button takes the user to some standard queries. It is unfinished at this time (there have been field name modifications that have not been accounted for in the queries as of 4/26/2002). The “data entry” button takes the user to the main data entry form. From the main data entry form, the user can navigate to specific forms. A list of cameras and sensors should be entered (and this can be done before fieldwork begins) so that equipment used during the project can be tracked. Camera hardware information and loan status are entered in the form that comes up when you use the “Enter camera unit information” button. Sensor numbers and loan status are entered using the “Enter sensor information” button on the main data entry form.

The sample unit data should be entered next, followed by station data. That way each station will be linked to a specific park and a sample unit number. The “Enter sample unit data” button on the main data entry form takes you to a form where you can enter the sample unit number and the park (a four letter acronym) in which the sample unit was located. The sample unit number must be numeric, not alphanumeric. Enter each sample unit ONCE. There is a list provided in the form to check and see if a sample unit has already been entered into the database. Sample unit data must be entered before survey station data can be entered. Click on “exit” to return to the main data entry form or click on “Add new sample unit record” to add another sample unit to the database.

Click on the “Enter survey station information” button in the main data entry form to go to the station data entry form. Enter each survey station ONCE. There is a list at the top of the form to browse stations that have already been entered into the database. Select the sample unit number in which the plot is located from the drop-down list. If the sample unit has not yet been entered, the “Add a new sample unit number” button will take you to the sample unit data entry form. Enter the station code (if you are using one) and name. Check the box for “Incidental station” if the station was established at an incidental location. Enter the dates on which the station was installed and when the station was removed. The number of sample days will have to be calculated by hand. Using the each station's installation and removal dates to calculate the total number of sample days will not account for days during which the station was inoperable (and inoperability often is not known until photo frames have been inspected). A program to calculate the number of sample days may be developed in the future. Enter the UTM coordinates for the station. At OLYM, defaults were set for UTM zone (10) and datum (North American Datum 1983). Estimate the each station's mapped locational accuracy in meters and specify the source of the coordinates (GPS, DOQ (digital orthophoto quadrangle), or estimate from a USGS 7.5 minute quadrangle map). These station data must be entered before survey station set-up, station check, and event data are entered. Click on the “exit” button to return to the main data entry form or click on “Add new station record” to enter data for another survey station.

After sample unit and station data are entered, data for station set-ups can be entered. A station may have more than one set-up during the season. There will be the initial set-up, but other set-ups may occur during the course of the station's operation. A set-up record should be entered for a station any time a camera or a sensor is changed. Select the station name from the drop-down list. Enter the camera unit and sensor that were used for the set-up. Enter the dates during which the camera was active. Enter camera setting information, bait and lure types, and

Appendix C “continued”

snow conditions. Be sure to enter film roll data in the subform. Use the “browse film rolls” tab to check and see what film roll numbers have already been entered for a station (hopefully this will help avoid duplicate film roll numbers for a given station). Click on the “exit” button when finished entering records to go back to the main data entry form or click on “Add new set-up record” to add another set-up. If animal tracks are observed, use the drop-down list to select the species to which the tracks belong (you may enter more than one species using this subform).

Survey station check data are entered when stations are visited, or “checked”, to monitoring station conditions. A station check record cannot be entered unless the set-up record has been entered first. This will create a relationship between the station check data and its set-up information (equipment, bait conditions, etc.). Enter the proper station set-up using the drop-down list. Make sure to look at the station name and the date the station was set-up since there may be multiple set-ups for each station. If the set-up data has not been entered yet, click on the “Add a new set-up record” button. Enter the date of your visit, the event number on the camera, the station’s operational status and if inoperable, the reason why, snow conditions, and the number of photo frames that have been taken. The number of days since the survey station was last checked will have to be calculated manually. Check the “Tracks present” box if animal tracks were observed at the station and record the species to which the tracks belong (you can enter multiple species). The station check data form should have film roll information entered *only* if a new film roll is installed in the camera during the visit. Use the “browse film rolls” tab to see the film roll numbers that have already been entered for a given station. Click on the “exit” button when finished entering records or click on “Add new station check record” to add another record.

On the main data entry form, the “Enter event data” button goes to a form that will step the user through a data import process to get event, frame, and date data from the sensors, via the data collector, into the database. See the TrailMaster instruction book for data collector operation directions. The database is designed to enter event data only after survey unit, station, station set-up, and station check data have been entered. This will ensure the proper relationships are established between event data and station data. The import process is also structured to import on station’s data at a time. The data collectors are capable of holding data records from multiple stations, but the data collection process was not done that way at OLYM. The import process will have to be modified if other network parks wish to import multiple station records through one data collector.

The first three steps import data from the data collector into the forestcarnivore.mdb database. These first three steps will bring files created in StatPak software, reformat it, and append it to a temporary event data table. Using the data collector and the import process will avoid transcription errors and save time by bypassing having to manually type dates and event and frame numbers. Step 4 takes the user to the event data entry form (in spreadsheet view to better see consecutive records) where species and film roll data are entered. Step 5 appends the event data into the main (or master) event data table once all event data has been entered and checked for errors.

Step 1. will import the StatPak records and Step 2. will reformat the fields into the database’s standard. Step 3. takes you to a new form with two steps. Step 1. in this form requires you to select the station name from which the data collector records came. Once the proper name is selected you push the button “Enter station identification to event records” in Step 2. This will create a relationship between the event records and the station from which they were recorded. Click on “exit” to go back to the main event record form. Once steps 1-3 have been accomplished, the user must enter data from the photo frames. Step 4. will take you to the data entry form for photo frames. You may begin at step 4 if you have already imported batches of data from the data collectors, but have not yet entered photo frame data.

In the event data entry table, use the drop-down list in the “film roll number for station’s event” field to select the proper film roll number from which the photo came. This will link the photo to its proper station data (either station setup data or station check data) and specific station equipment. Species, or lack of species, observed in each photo must be entered in the “Species” field. The species field contains a look-up table that lists mammals and birds. This species list is taken from the NPS I&M Program’s database named “NPSpecies”. If this database will be used across the NCC Network, the species list will have to be augmented with species that are not present in OLYM, or each park will need to have its own park specific species look-up table

Appendix C “continued”

added to (or linked to) the forest carnivore database. Currently, there is a “none” category (code = -999999). “None” means no species were present, or detectable, in the photo frame. This field cannot remain null. A null value for species indicates that the frame was not evaluated for species presence or no photo was taken when the event was logged into the sensor (e.g. camera malfunction, film depleted, etc.). There is also an “Unknown” category (code = -9999999). “Unknown” indicates that the animal in the photo frame cannot be identified to its genus level. If more than one species are observed in a photo, then each species observed should have its own event record (with the same date, time, event, and frame number among the records for that photo). There is a default check (meaning “yes”) in the box for the field “Was the station operational”. Uncheck the box if the photo frame shows that the station was not operational. The field named “event condition or description” can be used to further explain the situation for each photo or event or reason for station inoperability. Use the window’s “X” button in the upper right corner to close the event data entry form.

Step 5. still needs to be implemented as of 7/17/2002. This will take verified and validated event records entered in Step 4. and append them to the master event data table.

Vegetation data may be entered any time after the sample unit and survey station data have been entered. Click on the “Add vegetation data” button in the main data entry form. Select the proper station from the drop-down list. Use the choices in the drop-down fields for data entry. The vegetation table uses the NPSpecies vascular plant list as a look-up table for any field that requires species entry.

Some error checks have been created using macros. These are simple error checks that are designed to catch some general data entry, or omission, errors. The error checks will not let the user update a record until the necessary data has been entered. The error checks are intended to do this to enforce data entry. Not all fields must have data entered. The error checks operate on fields that should have available data at the time of data entry. The form properties have been set to data entry mode so that previously entered records will not be altered. To turn this off and be able to browse through previously entered records, each form’s “Data Entry” property should be set to “No” (from each form’s design view, right click in the grey area, click on “properties”, click on the “All” tab, and scroll to “Data Entry”).

Appendix C “continued”

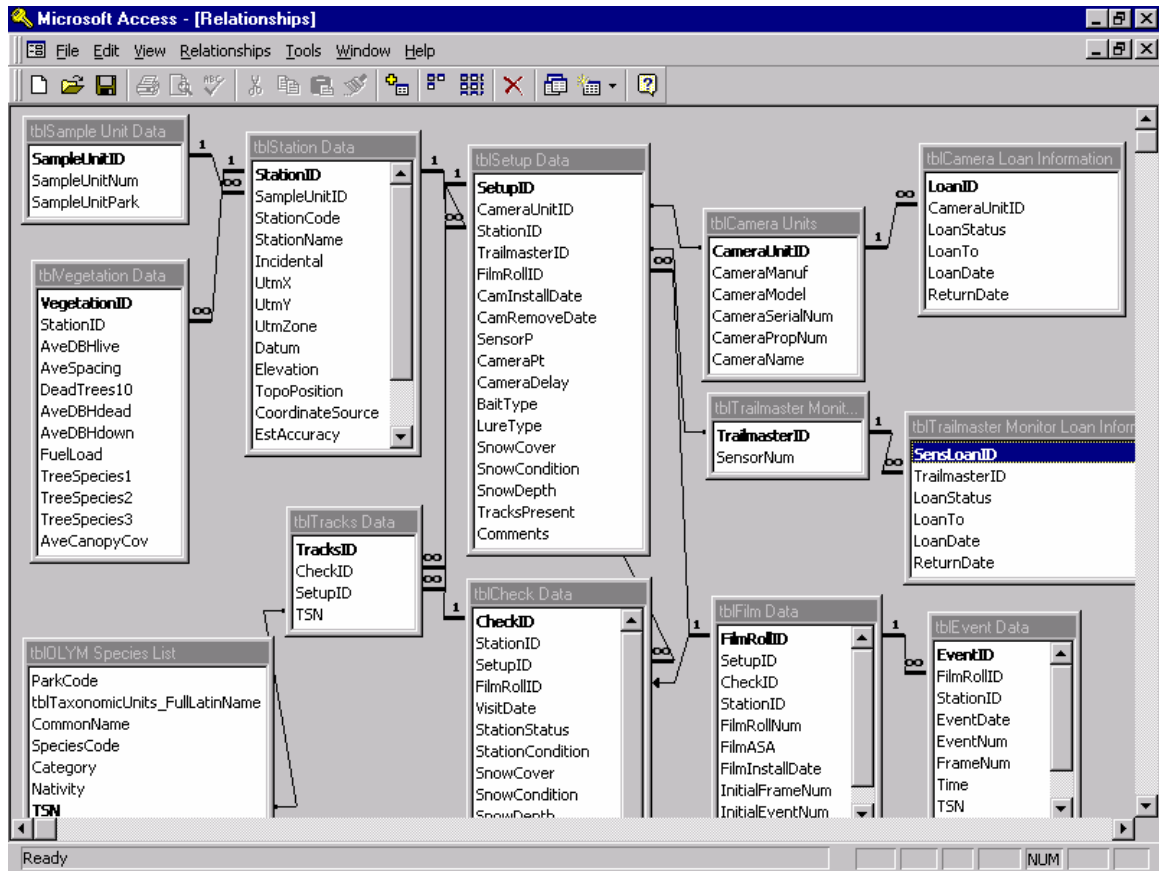


Figure 1. Table relationships for forestcarnivore.mdb.

Appendix D. History of Plot Deployment and Function

Appendix D. History of Plot Deployment and Function.							
Block	Sub Block	Region	Sub Block Name	Start Date	Stop Date	Number Nights Out	Number Nights Operational
5	1	North Coast	CAPE ALAVA BOARDWALK RANGER STATION	1/4/2002	2/14/2002	41	40
5	2	North Coast	CAPE ALAVA BEACH	1/4/2002	2/14/2002	41	40
23	1	North Coast	NORWEGIAN MEMORIAL	1/5/2002	3/12/2002	66	32
23	2	North Coast	ALLENS BAY	1/5/2002	3/12/2002	66	33
26	1	Sol Duc	EAGLE LAKES SOUTH	1/23/2003	2/25/2003	33	33
26	2	Sol Duc	EAGLE LAKES NORTH	1/23/2003	2/25/2003	33	0
34	1	Elwha, Lower	MADISON CREEK LOWER	1/14/2002	5/22/2003	128	40
34	2	Elwha, Lower	MADISON CREEK UPPER	1/14/2002	5/22/2003	128	86
48	1	Elwha, Lower	GRIFF CREEK UPPER	12/14/2001	1/31/2002	48	18
48	2	Elwha, Lower	GRIFF CREEK LOWER	1/10/2002	4/26/2002	106	42
50	2	Morse	LAKE ANGELES TRAIL UPPER	2/20/2002	4/27/2002	66	66
50	3	Morse	LAKE ANGELES TRAIL LOWER	2/22/2002	5/28/2002	95	49
61	1	Elwha, Lower	HAPPY LAKE TRAIL	12/11/2001	1/23/2002	43	29
61	2	Elwha, Lower	LAKE MILLS	12/11/2001	2/11/2002	62	60
80	1	Elwha, Lower	IDAHO CREEK LOWER	1/24/2002	3/11/2002	46	35
80	2	Elwha, Lower	IDAHO CREEK UPPER	2/24/2002	4/28/2002	63	61
82	1	Morse	STEEPLE ROCK WEST	2/7/2003	6/30/2003	143	0
82	2	Morse	STEEPLE ROCK EAST	2/7/2003	6/30/2003	143	42
97	1	Elwha, Upper	LILLIAN NORTH	3/7/2003	7/28/2003	143	116
97	2	Elwha, Upper	LILLIAN SOUTH	3/5/2003	4/9/2003	35	35
99	1	Dungeness	DEER PARK SOUTH	2/4/2003	6/24/2003	140	28
99	2	Dungeness	DEER PARK NORTH	2/4/2003	6/13/2003	129	121
102	1	Bogechell	MOSQUITO CREEK	12/12/2001	1/9/2002	28	28
102	2	Bogechell	KAHKWA CREEK	12/12/2001	1/9/2002	28	28
113	1	Elwha, Upper	MARYS FALLS SOUTH	3/4/2003	5/26/2003	83	55
113	2	Elwha, Upper	MARYS FALLS NORTH	3/4/2003	4/9/2003	36	36
125	1	Hoh	TAFT CREEK UPPER	2/13/2002	3/14/2002	29	28
125	2	Hoh	TAFT CREEK LOWER	2/12/2002	3/13/2002	29	29
127	1	Hoh	MINERAL CREEK DOWNSTREAM	12/18/2001	1/16/2002	29	29
127	2	Hoh	MINERAL CREEK UPSTREAM	12/18/2001	1/16/2002	29	29
129	1	Hoh	DOWNSTREAM OGS	2/6/2002	7/31/2002	175	28
129	2	Hoh	HOH BURN	2/6/2002	8/8/2002	183	145
134	1	Elwha, Upper	ELKHORN SOUTH	3/4/2003	5/25/2003	82	55
134	2	Elwha, Upper	ELKHORN NORTH	3/4/2003	5/25/2003	81	45
140	1	Hoh	WEST TWIN CREEK UPPER	12/19/2001	4/25/2002	127	50
140	2	Hoh	WEST TWIN CREEK LOWER	12/19/2001	3/13/2002	84	46
142	1	Hoh	SNYDER CREEK ROADSIDE	12/20/2001	2/12/2002	54	50

Appendix D. History of Plot Deployment and Function.

Block	Sub Block	Region	Sub Block Name	Start Date	Stop Date	Number Nights Out	Number Nights Operational
142	2	Hoh	SNYDER CREEK UPPER	12/20/2001	2/12/2002	54	37
157	1	Elwha, Upper	HAYES WEST	3/27/2003	6/27/2003	92	60
157	2	Elwha, Upper	HAYES EAST	3/26/2003	6/28/2003	94	1
164	1	Elwha, Upper	UPPER ELWHA SOUTH	3/25/2003	6/27/2003	94	26
164	3	Elwha, Upper	UPPER ELWHA NORTH	3/26/2003	7/1/2003	97	56
230	1	Quinalt	SOUTH FORK QUINALT SOUTH	1/28/2003	3/11/2003	42	42
230	2	Quinalt	SOUTH FORK QUINALT NORTH	1/20/2003	4/16/2003	86	36
242	1	Quinalt	GRAVES CREEK SOUTH	1/29/2003	3/12/2003	42	42
242	2	Quinalt	GRAVES CREEK NORTH	1/29/2003	3/11/2003	41	41
246	1	Skokomish	FLAPJACK NORTH	2/19/2003	3/19/2003	28	0
246	2	Skokomish	FLAPJACK SOUTH	2/20/2003	4/17/2003	56	56
251	1	Quinalt	BUNCH FIELD NORTH	1/27/2003	3/10/2003	42	14
251	2	Quinalt	BUNCH FIELD SOUTH	1/30/2003	3/10/2003	39	39
254	1	Skokomish	STAIRCASE NORTH	2/20/2003	4/27/2003	56	28
254	2	Skokomish	STAIRCASE SOUTH	2/18/2003	3/18/2003	28	28

Appendix E. Location (UTM) and Topographic Data for Sample Sites

Coordinates are actual plot locations, not the random points generated for plot location.

Appendix E. Location (UTM) and Topographic Data for Sample Sites							
Block	Sub Block	Topographic Position	UtmX	UtmY	Elevation Field Form (ft)	GIS Elevation (ft)	Elev Band (ft)
5	1	riparian	372358	5335310	100	209	0
5	2	valley bottom	374985	5334574	200	119	0
23	1	riparian	374700	5322093	20	163	0
23	2	ridgetop	375344	5323604	220	98	0
26	1	upper 1/3 slope	430316	5321150	1500	1477	1000
26	2	lower 1/3 slope	430147	5324245	1300	1100	1000
34	1	lower 1/3 slope	456355	5321109	800	803	0
34	2	ridgetop	457919	5321010	2400	2376	2000
48	1	mid 1/3 slope	458411	5317553	2750	2755	2000
48	2	lower 1/3 slope	456476	5318388	630	616	0
50	2	upper 1/3 slope	468125	5318595	3400	3472	3000
50	3	mid 1/3 slope	467360	5320104	2480	2555	2000
61	1	lower 1/3 slope	453701	5315240	2250	2086	2000
61	2	lower 1/3 slope	455922	5313971	800	923	0
80	1	mid 1/3 slope	461150	5311483	2550	2542	2000
80	2	ridgetop	462256	5313455	4850	4873	4000
82	1	upper 1/3 slope	466205	5311598	4800	4537	4000
82	2	upper 1/3 slope	467711	5311065		5249	4000
97	1	mid 1/3 slope	463309	5310833	2150	2135	2000
97	2	lower 1/3 slope	462487	5308419	2400	2391	2000
99	1	mid 1/3 slope	480846	5308275	3180	3279	3000
99	2	upper 1/3 slope	479465	5310459		4763	4000
102	1	lower 1/3 slope	408922	5304515	760	511	0
102	2	valley bottom	407775	5304078	360	354	0
113	1	mid 1/3 slope	464150	5305674	2300	2207	2000
113	2	lower 1/3 slope	463541	5307108	2000	1917	1000
125	1	mid 1/3 slope	428495	5301236	1740	1605	1000
125	2	lower 1/3 slope	430106	5301785	780	836	0
127	1	lower 1/3 slope	433000	5302000	1100	686	0
127	2	lower 1/3 slope	434400	5301800	950	683	0
129	1	lower 1/3 slope	440709	5302915	1050	1028	1000
129	2	lower 1/3 slope	442706	5303417	1100	1158	1000
134	1	lower 1/3 slope	465840	5301302	2200	2130	2000
134	2	mid 1/3 slope	465639	5302837	2350	2354	2000
140	1	ridgetop	422815	5300286	3200	2722	2000
140	2	mid 1/3 slope	423435	5298684	2100	2018	2000
142	1	valley bottom	427200	5298797	550	520	0
142	2	riparian	426900	5300294	1400	1697	1000
157	1	lower 1/3 slope	466616	5295080		1877	1000

Appendix E. Location (UTM) and Topographic Data for Sample Sites							
Block	Sub Block	Topographic Position	UtmX	UtmY	Elevation Field Form (ft)	GIS Elevation (ft)	Elev Band (ft)
157	2	mid 1/3 slope	467527	5296615		3238	3000
164	1	lower 1/3 slope	466087	5291891		1886	1000
164	3	lower 1/3 slope	466355	5293377		2053	2000
230	1	riparian	457065	5269527	680	640	0
230	2	lower 1/3 slope	458455	5270547	1280	1214	1000
242	1	lower 1/3 slope	456448	5268104	1540	1532	1000
242	2	lower 1/3 slope	458830	5268722	1150	1386	1000
246	1	mid 1/3 slope	472476	5268741	2700	2841	2000
246	2	mid 1/3 slope	471985	5266259	2300	2094	2000
251	1	valley bottom	447677	5265197	350	354	0
251	2	lower 1/3 slope	449037	5264052	900	889	0
254	1	lower 1/3 slope	472555	5264439	1000	957	0
254	2	mid 1/3 slope	472784	5262874	1900	1959	1000

Appendix F. Vegetation Characteristics of Sample Blocks.

See vegetation data sheet (Appendix B) for explanation of variables and how they were gathered.

Appendix F. Vegetation											
Block	Sub Block	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	Fuel Load
5	1	Thuja plicata	Tsuga heterophylla	Acer macrophyllum	<40%	6-12	>12'	no		12-20	L
5	2	Thuja plicata	Tsuga heterophylla	Picea sitchensis	>70%	6-12	8-12'	no		6-12	L
23	1	Picea sitchensis	Thuja plicata	Tsuga heterophylla	40-70%	12-20	>12'	no		6-12	M
23	2	Thuja plicata	Tsuga heterophylla		<40%	6-12	8-12'	yes	12-20	12-20	H
26	1	Tsuga heterophylla	Thuja plicata	Pinus monticola	40-70%	>20	8-12'	no		<6	L
26	2	Pseudotsuga menziesii var. menziesii	Tsuga heterophylla		>70%	12-20	4-8'	no		6-12	M
34	1	Pseudotsuga menziesii var. menziesii	Thuja plicata		>70%	12-20	8-12'	no		<6	L
34	2	Pseudotsuga menziesii var. menziesii	Abies amabilis	Thuja plicata	>70%	12-20	4-8'	no		<6	L
48	1	Tsuga heterophylla	Thuja plicata	Pseudotsuga menziesii var. menziesii	>70%	<6	4-8'	no		6-12	H
48	2	Pseudotsuga menziesii var. menziesii	Thuja plicata	Tsuga heterophylla	>70%	12-20	8-12'	no		6-12	M
50	2	Thuja plicata	Pseudotsuga menziesii var. menziesii	Taxus brevifolia	>70%	6-12	<4'	no		6-12	M
50	3	Pseudotsuga menziesii var. menziesii	Tsuga heterophylla	Thuja plicata	40-70%	6-12	4-8'	no		6-12	M
61	1	Tsuga heterophylla	Pseudotsuga menziesii var. menziesii		>70%	6-12	4-8'	no		6-12	L
61	2	Tsuga heterophylla	Acer macrophyllum		<40%	6-12		no		<6	
80	1	Pseudotsuga menziesii var. menziesii	Thuja plicata	Tsuga heterophylla	>70%	6-12	4-8'	no		6-12	M
80	2	Abies lasiocarpa var. lasiocarpa			<40%	12-20	4-8'	no			
82	1	Pseudotsuga menziesii var. menziesii	Abies lasiocarpa var. lasiocarpa	Pinus monticola	>70%	>20	4-8'	no		12-20	M

Appendix F. Vegetation

Block	Sub Block	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	Fuel Load
82	2	Abies lasiocarpa var. lasiocarpa			40-70%	12-20	4-8'	no			
97	1	Tsuga heterophylla	Pseudotsuga menziesii var. menziesii	Thuja plicata	>70%	>20	8-12'	no		6-12	M
97	2	Pseudotsuga menziesii var. menziesii	Tsuga heterophylla	Thuja plicata	>70%	>20	8-12'	no		12-20	H
99	1	Pseudotsuga menziesii var. menziesii	Tsuga heterophylla		>70%	12-20	4-8'	no		6-12	M
99	2	Tsuga heterophylla	Abies amabilis	Abies lasiocarpa var. lasiocarpa	>70%	6-12	4-8'	yes	<6	<6	H
102	1	Tsuga heterophylla	Pseudotsuga menziesii var. menziesii	Acer circinatum	>70%	>20	>12'	yes	12-20	6-12	H
102	2	Tsuga heterophylla	Alnus rubra	Picea sitchensis	40-70%	12-20	>12'	yes	6-12	12-20	H
113	1	Pseudotsuga menziesii var. menziesii	Tsuga heterophylla	Pinus monticola	40-70%	12-20	8-12'	no		<6	L
113	2	Pseudotsuga menziesii var. menziesii	Tsuga heterophylla		<40%	6-12	8-12'	no		6-12	L
125	1	Tsuga heterophylla	Pseudotsuga menziesii var. menziesii	Thuja plicata	40-70%	12-20	8-12'	yes	12-20	>20	H
125	2	Pseudotsuga menziesii var. menziesii	Tsuga heterophylla	Thuja plicata	40-70%	>20	>12'	yes	12-20	12-20	M
127	1	Tsuga heterophylla	Thuja plicata	Pseudotsuga menziesii var. menziesii	>70%	12-20	>12'	yes	12-20	6-12	L
127	2	Pseudotsuga menziesii var. menziesii	Tsuga heterophylla	Acer circinatum	40-70%	>20	>12'	no		12-20	M
129	1	Tsuga heterophylla	Pseudotsuga menziesii var. menziesii	Acer circinatum	<40%	>20	>12'	yes	>20	>20	H
129	2	Tsuga heterophylla	Pseudotsuga menziesii var. menziesii	Picea sitchensis	<40%	>20	>12'	yes	>20	>20	H
134	1	Pinus contorta var. contorta	Pseudotsuga menziesii var. menziesii	Tsuga heterophylla	40-70%	6-12	4-8'	no		6-12	L
134	2	Tsuga heterophylla	Pseudotsuga menziesii var. menziesii		>70%	12-20	8-12'	no		12-20	L
140	1	Tsuga heterophylla	Abies amabilis		40-70%	12-20	4-8'	yes	12-20	12-20	H
140	2	Tsuga heterophylla	Abies amabilis	Picea sitchensis	>70%	>20	>12'	no		12-20	H

Appendix F. Vegetation

Block	Sub Block	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	Fuel Load
142	1	Picea sitchensis	Pseudotsuga menziesii var. menziesii	Acer circinatum	>70%	>20	>12'	no		>20	H
142	2	Thuja plicata	Tsuga heterophylla		>70%	>20	>12'	no		12-20	H
157	1	Tsuga heterophylla	Pseudotsuga menziesii var. menziesii		40-70%	>20	>12'	no		>20	M
157	2	Pseudotsuga menziesii var. menziesii	Tsuga heterophylla		40-70%	>20	8-12'	no		<6	L
164	1	Pseudotsuga menziesii var. menziesii	Tsuga heterophylla		>70%	>20	>12'	no		>20	M
164	3	Pseudotsuga menziesii var. menziesii	Tsuga heterophylla		40-70%	>20	8-12'	no			M
230	1	Tsuga heterophylla	Thuja plicata	Pseudotsuga menziesii var. menziesii	>70%	>20	>12'	no		12-20	H
230	2	Tsuga heterophylla	Thuja plicata	Pseudotsuga menziesii var. menziesii	>70%	>20	>12'	no		>20	H
242	1	Tsuga heterophylla	Pseudotsuga menziesii var. menziesii	Abies lasiocarpa var. lasiocarpa	>70%	>20	>12'	yes	>20	>20	M
242	2	Tsuga heterophylla	Thuja plicata	Abies lasiocarpa var. lasiocarpa	40-70%	>20	>12'	yes	>20	>20	H
246	1	Pseudotsuga menziesii var. menziesii	Tsuga heterophylla	Pinus monticola	40-70%	12-20	4-8'	no	none	<6	L
246	2	Tsuga heterophylla	Pseudotsuga menziesii var. menziesii	Pinus monticola	40-70%	>20	>12'	no		12-20	L
251	1	Tsuga heterophylla	Alnus rubra	Picea sitchensis	>70%	>20	8-12'	no		>20	H
251	2	Tsuga heterophylla			40-70%	>20	>12'	no		>20	H
254	1	Tsuga heterophylla	Pseudotsuga menziesii var. menziesii	Abies lasiocarpa var. lasiocarpa	>70%	12-20	4-8'	no		12-20	M
254	2	Abies amabilis	Thuja plicata	Tsuga heterophylla	>70%	>20	8-12'	yes	12-20	12-20	M

Appendix G. Number of Animal Pictures, by Species, for Each Sub-Block.

Does not include incidental data.

Appendix G1. Mammalian carnivores.									
Block	Sub Block	Ermine <i>Mustela erminea</i>	Long Tailed Weasel <i>Mustela frenata</i>	Weasel Spp	Spotted Skunk <i>Spilogale putoris</i>	Bobcat <i>Lynx rufus</i>	Cougar <i>Puma concolor</i>	Coyote <i>Canis latrans</i>	Black Bear <i>Ursus americanus</i>
5	1								
5	2								
23	1	34	15						
23	2	26							
26	1								
26	2								
34	1				88				
34	2				53		1		
48	1				56				
48	2				123	1	1		
50	2								
50	3					5			
61	1				61	7			
61	2				22				
80	1				49	9			
80	2	7						2	
82	1								
82	2								
97	1	1		1		1			1
97	2						1		
99	1				80				
99	2								
102	1								
102	2								
113	1				18				1
113	2								
125	1								
125	2				1				
127	1								
127	2								
129	1				33				
129	2				1				5
134	1	1							1
134	2								
140	1				6				
140	2				18				
142	1								
142	2								
157	1					1			
157	2								

Appendix G1. Mammalian carnivores.

Block	Sub Block	Ermine <i>Mustela erminea</i>	Long Tailed Weasel <i>Mustela frenata</i>	Weasel Spp	Spotted Skunk <i>Spilogale putoris</i>	Bobcat <i>Lynx rufus</i>	Cougar <i>Puma concolor</i>	Coyote <i>Canis latrans</i>	Black Bear <i>Ursus americanus</i>
164	1							10	
164	3								1
230	1	4		5					
230	2								
242	1	3		4	1				
242	2	7							
246	1								
246	2								
251	1								
251	2				20				
254	1			1					
254	2								

Appendix G2. Birds.

Block	Sub Block	Northern Spotted Owl <i>Strix occidentalis caurina</i>	Accipiter <i>Accipiter</i>	Stellers Jay <i>Cyanocitta stelleria</i>	Gray Jay <i>Perisoreus canadensis</i>	Northern Flicker <i>Colaptes auratus</i>	Hairy Wood-pecker <i>Picoides villosus</i>	Brown Creeper <i>Certhia americana</i>	Blue Grouse <i>Dendragapus obscurus</i>
5	1								
5	2							2	
23	1								
23	2			56					
26	1								
26	2								
34	1								
34	2				31				
48	1								
48	2								
50	2				3				
50	3			1	10				
61	1								
61	2								
80	1				27				
80	2				1				
82	1				1				
82	2								
97	1								
97	2				16				
99	1	2	1						1
99	2								
102	1								
102	2								

Appendix G2. Birds.

Block	Sub Block	Northern Spotted Owl <i>Strix occidentalis caurina</i>	Accipiter <i>Accipiter</i>	Stellers Jay <i>Cyanocitta stelleria</i>	Gray Jay <i>Perisoreus canadensis</i>	Northern Flicker <i>Colaptes auratus</i>	Hairy Wood-pecker <i>Picoides villosus</i>	Brown Creeper <i>Certhia americana</i>	Blue Grouse <i>Dendragapus obscurus</i>
113	1			15	7				
113	2								
125	1								
125	2								
127	1								
127	2								
129	1								
129	2								
134	1				27	1			
134	2								
140	1								
140	2								
142	1								
142	2								
157	1						1		
157	2				62				
164	1								
164	3								
230	1								
230	2								
242	1								
242	2								
246	1								
246	2								
251	1								
251	2								
254	1								
254	2								

Appendix G3. Miscellaneous detections

Block	Sub Block	Mouse	Red Backed Vole <i>Clethrionomys gapperi</i>	Douglas Squirrel <i>Tamiasciurus douglasii</i>	Flying Squirrel <i>Glaucomys sabrinus</i>	Snow-shoe Hare <i>Lepus americanus</i>	Black-tailed Deer <i>Odocoileus hemionus columbianus</i>	Elk <i>Cervus elaphus roosevelti</i>	Un-known	Noth-ing
5	1									3
5	2	1							1	
23	1	22								18
23	2	14								12
26	1									
26	2									
34	1	9								6

Appendix G3. Miscellaneous detections

Block	Sub Block	Mouse	Red Backed Vole <i>Clethrionomys gapperi</i>	Douglas Squirrel <i>Tamiasciurus douglasii</i>	Flying Squirrel <i>Glaucomys sabrinus</i>	Snow-shoe Hare <i>Lepus americanus</i>	Black-tailed Deer <i>Odocoileus hemionus columbianus</i>	Elk <i>Cervus elaphus roosevelti</i>	Un-known	Noth-ing
34	2			1			1			11
48	1						1			
48	2	13					1			7
50	2				1					13
50	3	8		1	7					7
61	1	9								17
61	2									5
80	1	4			1					3
80	2				29					10
82	1									36
82	2					2				2
97	1						2		1	1
97	2	7					1			2
99	1			1					1	26
99	2									
102	1									6
102	2	3								7
113	1								1	4
113	2									
125	1									
125	2									
127	1								1	
127	2									
129	1									3
129	2							5		61
134	1		1					1		4
134	2	1		1					1	
140	1									73
140	2									7
142	1									6
142	2	25			1					13
157	1	39							1	3
157	2									1
164	1								1	4
164	3				1				1	3
230	1						1			1
230	2									
242	1								1	2
242	2	1								1
246	1									
246	2	2								2
251	1									
251	2								1	
254	1									

Appendix G3. Miscellaneous detections										
Block	Sub Block	Mouse	Red Backed Vole <i>Clethrionomys gapperi</i>	Douglas Squirrel <i>Tamiasciurus douglasii</i>	Flying Squirrel <i>Glaucomys sabrinus</i>	Snow-shoe Hare <i>Lepus americanus</i>	Black-tailed Deer <i>Odocoileus hemionus columbianus</i>	Elk <i>Cervus elaphus roosevelti</i>	Un-known	Noth-ing
254	2									

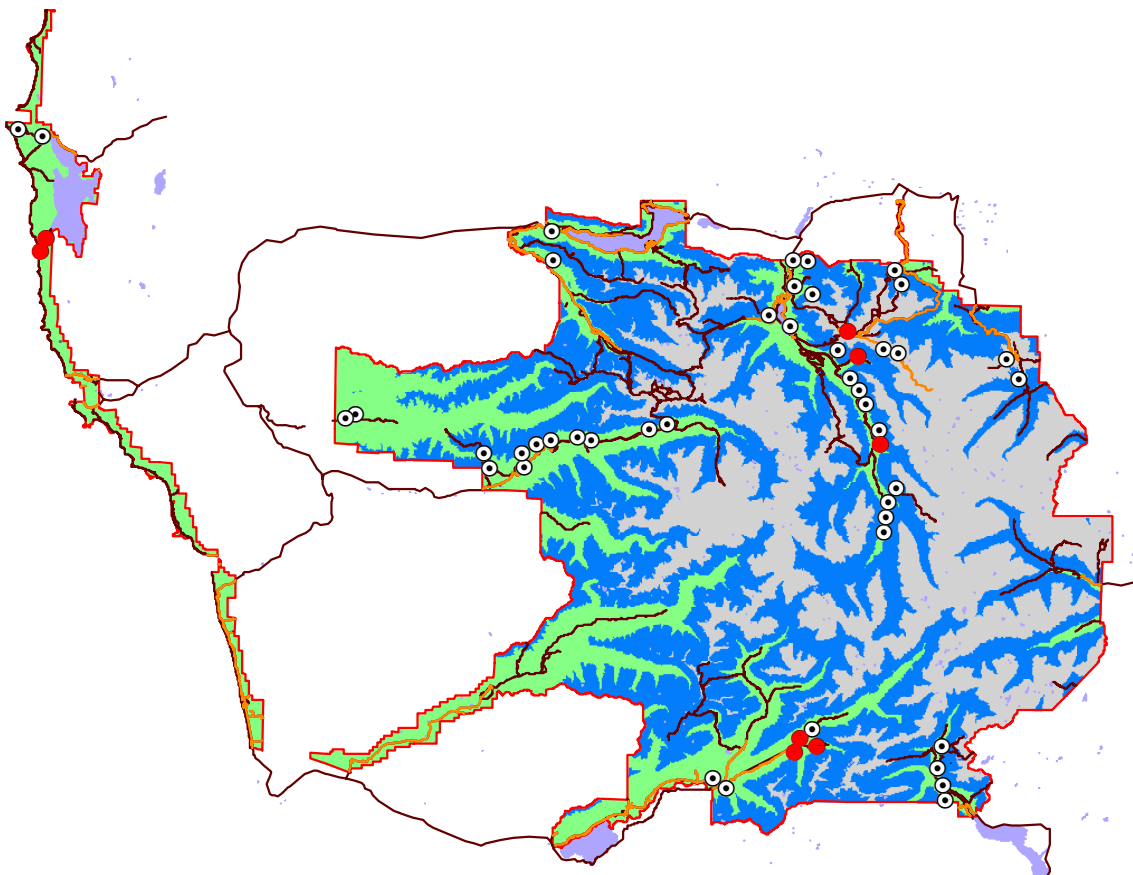
Appendix H. Species detection location maps.

Location of inventory survey sites (white circles) and species detections (red circles).

Legend:

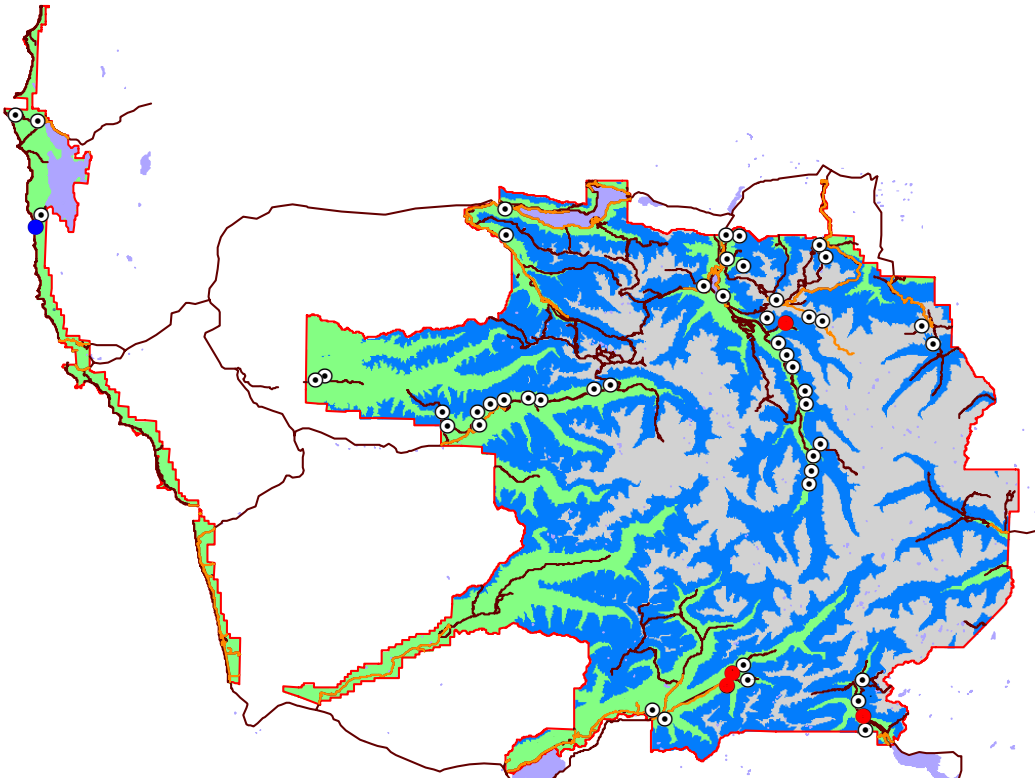
- Species Detection
- Forcarnsta
- Olympic National Park roads
- Rdtrl
- Olympic National Park boundary (line)
- Olympic National Park lakes
- Elevation bands**
 - <2000'
 - 2000-4000'
 - >4000'
 - Non-Park

H1. Ermine

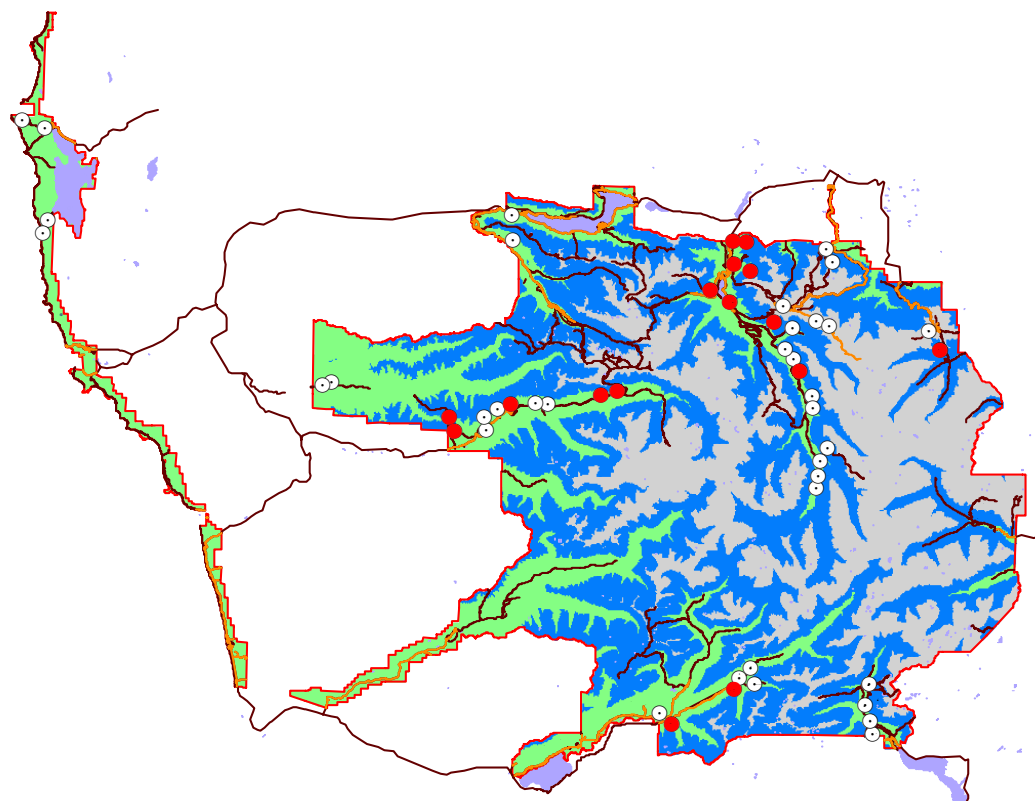


Appendix H “continued”

H2. Long-tailed weasel (blue dot) and unidentified weasel species (red dot)

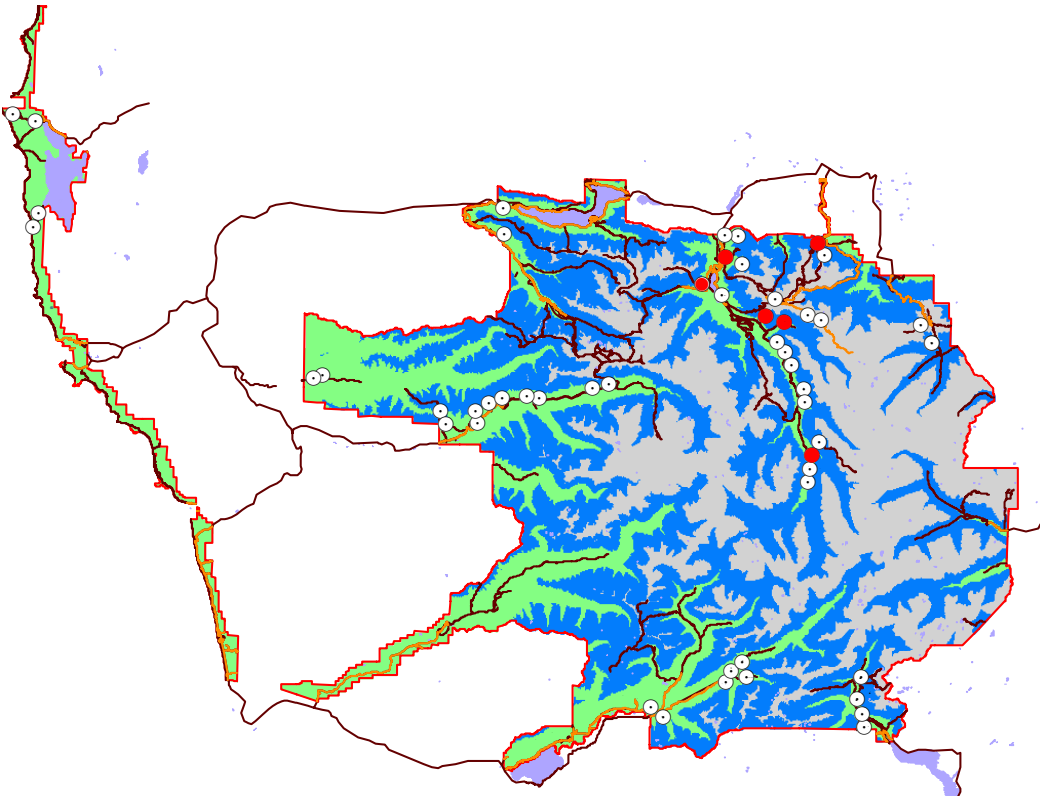


H3. Spotted skunk.

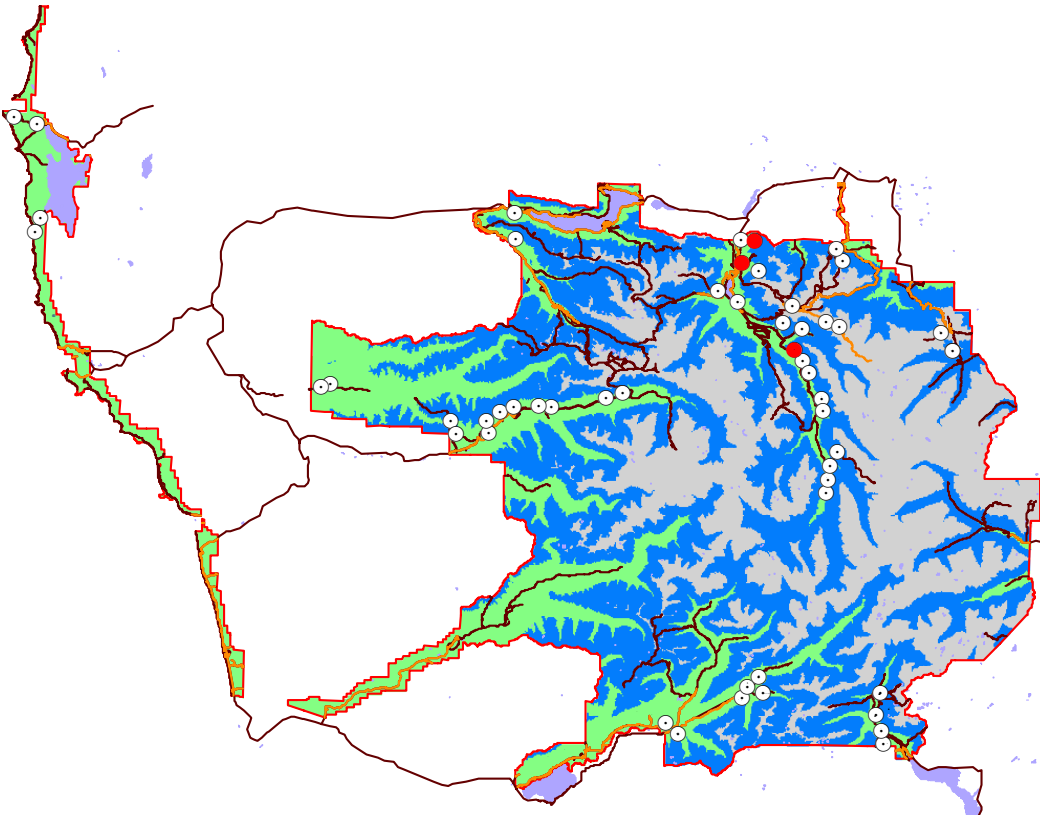


Appendix H “continued”

H4. Bobcat

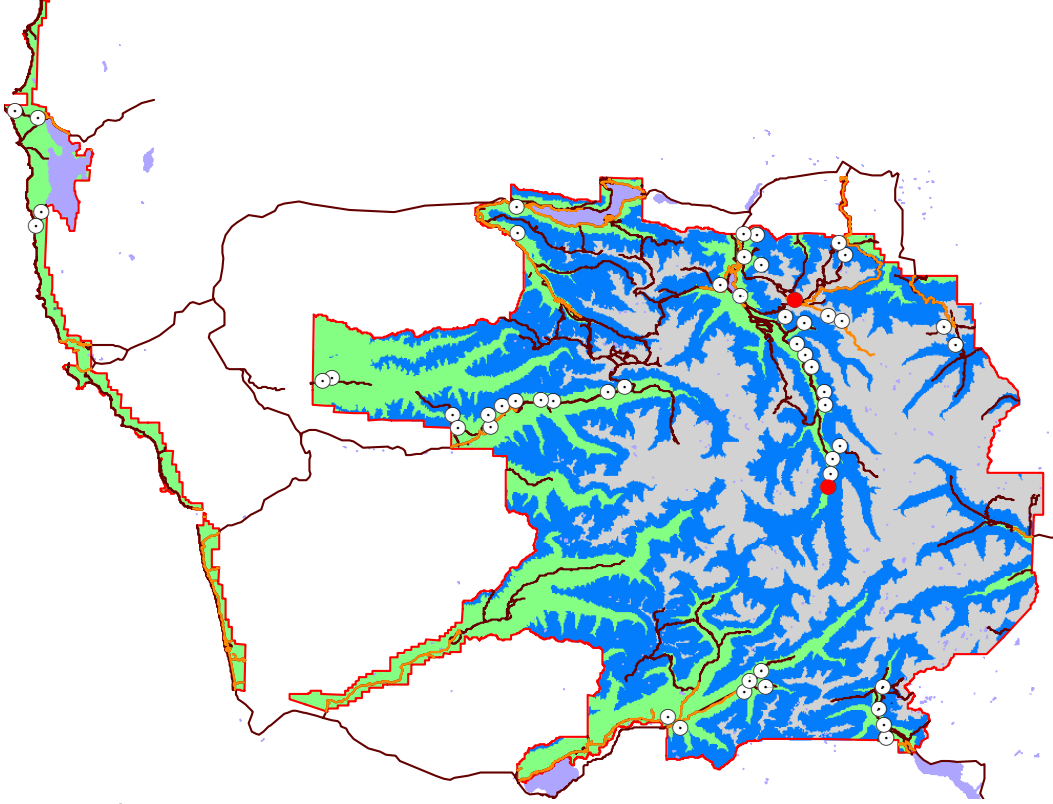


H5. Cougar

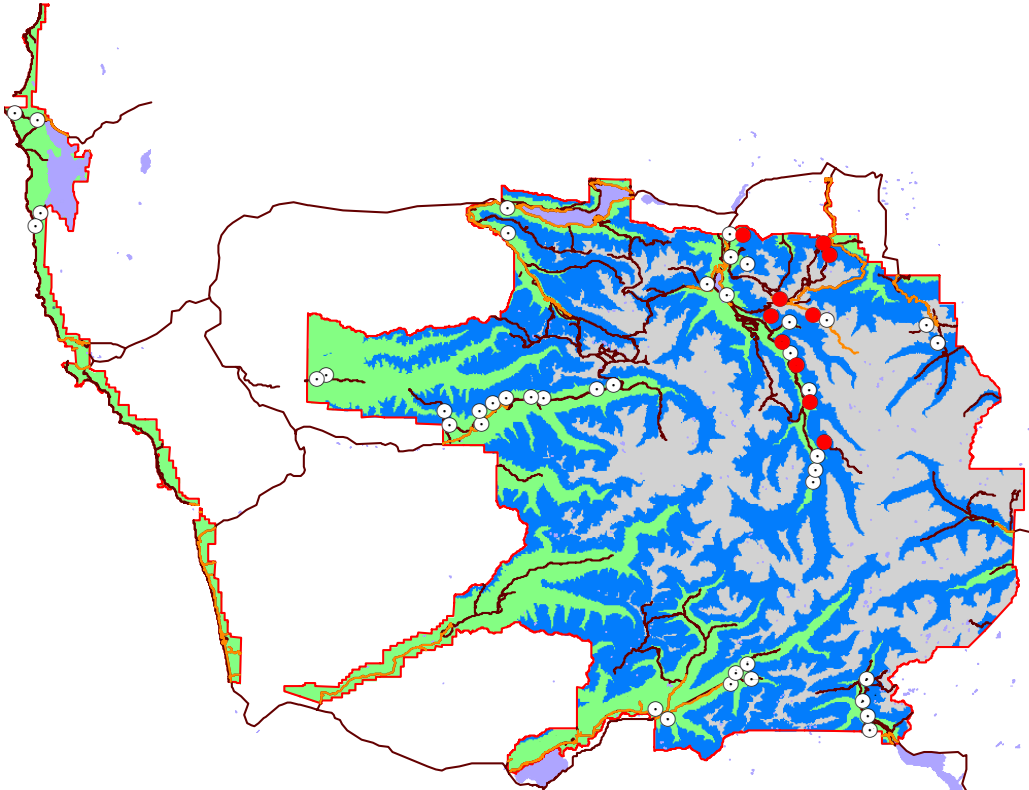


Appendix H “continued”

H6. Coyote



H7. Gray jay



Appendix I. Budget.

Does not include costs for GIS, supervision, or park administration.

2002 Budget

	Income:						
12,500				Funding from NCCN Inventory (2125-i219-nii)			
8,305				Funding from OLYM Prototype (9504-m255-nii)			
20,805				Total funding for 2002			
	Expenses:						
20,805							
7,250	13,555						
5,400	1,850			Equipment			
4,530	870			In park per diem and housing			
0	4,529			GSA- vehicle			

2003 Budget:

	Income:							
12,500				Funding from NCCN Inventory (2125-i219-nii)				
3,400				Funding from OLYM Prototype (9504-0349-nii)				
4,272				Funding from Park Base (9504-0002-nzi)				
20,172								
	Expenses:							
20,172								
4,067	16,105			Personnel (GS07 Biotech 7 pp, GS 05 Biotech 8pp)				
2,800	1,267			In park per diem and housing				
1,200	1,600			Equipment				
0	1,200			GSA- vehicle				