

CITIZEN WILDLIFE MONITORING PROJECT

2018 FIELD SEASON REPORT



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Table of Contents

EXECUTIVE SUMMARY	3
PROJECT OVERVIEW	5
WOLF MONITORING	7
WOLVERINE MONITORING	7
GRIZZLY BEAR MONITORING	9
I-90 CORRIDOR MONITORING	10
TRANSBOUNDARY LYNX MONITORING	10
METHODOLOGY	11
SURVEY AREA SELECTION	11
CAMERA INSTALLATIONS	13
SPECIES PRIORITIZATION	14
RESULTS AND DISCUSSION	15
GRIZZLY BEAR	16
GRAY WOLF	18
GENERAL WILDLIFE ALONG THE I-90 CORRIDOR	20
WOLVERINE	22
CANADA LYNX	26
RECOMMENDATIONS FOR FUTURE MONITORING	27
ACKNOWLEDGEMENTS	28
REFERENCES	30

Cover Photo: A male wolverine detected at a camera station in the Central Cascades.

EXECUTIVE SUMMARY

For more than a decade, the Citizen Wildlife Monitoring Project (CWMP) has conducted research using remote cameras, wildlife tracking and DNA sample collection, to study Washington's rare and sensitive wildlife through citizen science. Led by Conservation Northwest (CNW) in partnership with the Wilderness Awareness School and other groups and agencies, the CWMP has engaged in monitoring wildlife presence and activity in critical areas for wildlife connectivity and conservation. The CWMP emphasizes the importance of monitoring and conservation efforts to ensure a stable landscape for our region's wildlife.

Citizen scientists from this project continue to contribute valuable, new information about the presence and distribution of wildlife in our state through both remote camera surveys and snow tracking. CWMP often covers geographic areas beyond those of ongoing professional research efforts, supplementing and strengthening the work of agencies, biologists and other collaborators on our Advisory Council. Not only does visual documentation of species influence research and policy decisions, these images create a narrative and a face for our wildlands.

During the 2018 remote camera season, 52 volunteers contributed more than 3,100 hours to the CWMP by attending trainings, and installing and maintaining 81 camera installations in 36 survey areas in Washington and British Columbia.

CWMP's monitoring efforts are broken into two projects: remote camera monitoring (annual monitoring with heavier effort from May-October) and snow tracking along Interstate 90 (typically December-March). At the culmination of each project, a monitoring report is prepared and made public through Conservation Northwest's website (<https://www.conservationnw.org/wildlife-monitoring/>). This report focuses on our results from the 2018 remote camera monitoring year. Separate snow tracking reports are available on our website.

In 2018, we concentrated our study area in two distinct landscapes – the Cascade Mountains in Washington and the transboundary Kettle River Mountain Range of northeast Washington and southern British Columbia, including the Rossland Range in B.C. Within the Cascade Mountains, we have divided the study area into three regions:

1. Washington's North Cascades: North of Interstate-90 (North Cascades)
2. I-90 Corridor: Between Snoqualmie Pass and Easton along I-90
3. Washington's South Cascades: South of I-90 (South Cascades)

The main objectives for the 2018 field season were to:

- 1) Detect the presence of gray wolf (*Canis lupus*) in the South Cascades.
- 2) Detect the presence of wolverines (*Gulo gulo*) in new locations and continue to monitor known populations in the North and South Cascades.
- 3) Detect grizzly bears (*Ursus arctos*) in the North Cascades Grizzly Bear Recovery Zone (Appendix I).
- 4) Monitor the presence of a wide variety of species of wildlife in the I-90 corridor (Snoqualmie Pass to Easton).
- 5) Document transboundary Canada lynx (*Lynx canadensis*) presence in northeast Washington and southern

British Columbia.

With the assistance of Conservation Northwest program staff, contractors and our Advisory Council (listed in Acknowledgements), survey areas were established for each of our project objectives. Program volunteers managed two grizzly bear survey areas, 13 wolf, 15 wolverine and three multi-species areas in the I-90 corridor. There were also three survey areas in northeast Washington's Kettle River Mountain Range for lynx monitoring, with our partners at Selkirk College in British Columbia also maintaining one lynx survey area in southern British Columbia's Rossland Range.

Highlights from this field season include:

- The continued documentation of wolverines in the Cascades. Our citizen science teams documented wolverines in the North Cascades in five survey areas on multiple separate occasions. One team observed two individuals in close proximity to a monitoring installation.
- Although our teams recorded no Canada lynx on the Washington side of the border this year, the efforts of our volunteers have contributed to a larger study by our partners at Washington State University. Dr. Dan Thornton's Mammal Spatial Ecology and Conservation Lab has been able to add our data to their larger study focused on distributions and population density of the Canada lynx in the Kettle Range and Columbia Highlands of northeast Washington. They have developed a methodology for large-scale, long-term monitoring of lynx in Washington state (Appendix VI). Dr. Lui Marinelli's students at Selkirk College, working in southern British Columbia's Rossland Range, were successful in documenting Canada lynx. These efforts contribute to furthering our collective knowledge and conservation efforts to protect this rare and sensitive species.
- Our volunteer teams documented fishers at two survey areas in the South Cascades, both locations are in close proximity to where reintroduction efforts have taken place in Washington state, led by the Washington Department of Fish and Wildlife (WDFW), National Park Service and Conservation Northwest. The photo documentation provides our partners with visual evidence of the health of the animal at the date the photo was taken. Reintroduced individuals have internal radio transmitters providing location information via overhead telemetry flights, however, these devices will not provide information on the following generation¹. In the coming years, we plan to expand our fisher monitoring in the Cascade Mountains and expect our efforts to play a role in documenting the presence of offspring and provide further evidence of an expanding population.
- American martens were recorded at 14 different survey areas in the Cascades. While not a target species for our project, data collected on martens is shared with our Advisory Council members carrying out research on these animals.
- Animals documented at Interstate 90 survey areas for the 2018 season were of particular interest due to the completion of 11 wildlife crossing structures of varying sizes and functions between Gold Creek and the

¹ Lewis, Jeff. Restoring fishers in Washington State. Wildlife Seminar at UW Jan 22, 2018.

Keechelus Lake overcrossing structure by the Washington State Department of Transportation. These structures are intended to greatly improve habitat connectivity and increase opportunity for north and south movement of wildlife east of Snoqualmie Pass. CWMP's survey areas are located within close proximity to these new highway-crossing structures in order to help evaluate their impact. Our Easton cameras continue to record baseline data at this site for a planned wildlife overcrossing structure. Easton recorded the presence of eight different species in habitat adjacent to the highway, representing a high degree of diversity for our camera installations. The high number of species highlights the utility for a wildlife crossing structure at this location. Since the underpasses have transitioned to a restoration phase, we expect to see wildlife making more use of them and areas adjacent to them. The first wildlife overpass on I-90 has been completed. We will continue to pay especially close attention to wildlife activity nearby, including monitoring efforts after revegetation, which is expected in 2020.

The work of our volunteers through the Citizen Wildlife Monitoring Project increases our understanding of wildlife on the Washington landscape and in the transboundary region between Washington and British Columbia.

PROJECT OVERVIEW

More than a decade ago, Conservation Northwest began using citizen science as a way to fulfill our mission to protect, connect and restore wildlands and wildlife from the Washington Coast to the British Columbia Rockies. Through our Citizen Wildlife Monitoring Project (CWMP) We continue to train and deploy more than 100 citizen scientists each year throughout our mission area. This project uses remote cameras, genetic sample collection and snow tracking to document the presence and behavior of rare and sensitive species, as well as the presence of common species in locations strategically important for landscape connectivity. Since its inception, the CWMP has remained an asset to wildlife agencies and professionals by providing valuable data from monitoring efforts in areas identified as potential core habitat for some of our region's rarest wildlife. Our main project objectives are:

1. To engage and educate citizens about native species and monitoring in critical habitat areas;
2. To record wildlife presence in the I-90 corridor and along the I-90 Snoqualmie Pass East Project in strategic locations and in core habitat through remote camera monitoring and snow tracking;
3. To record the presence of rare and sensitive species that regional and national conservation efforts aim to recover including fisher, gray wolf, grizzly bear, lynx and wolverine;
4. To facilitate the exchange of information about wildlife, including data from monitoring efforts, between public agencies, researchers, conservation organizations and interested individuals.

Due to the number of partners in the Cascades Ecosystem, the CWMP operates through a collaborative effort between Conservation Northwest and numerous other non-governmental organizations as well as government agencies. Throughout each monitoring year, Conservation Northwest acts as the Project's administer, fiscal sponsor and volunteer coordinator for all efforts, as well as the lead on remote camera monitoring and equipment. The Wilderness Awareness School provides in-kind and financial support to the project for activities associated with the I-90 corridor, as well as training resources and venues.

The CWMP has enhanced its positive impact through an Advisory Council (listed in Acknowledgements) made up of project partners, government agency biologists and professional researchers. Our Advisory Council provides valuable input to the review of our program and steers our yearly monitoring objectives and site locations. Council members assist in developing our protocols, confirm identification of priority images from the season, and provide a scientific audience for the results of our work. These collaborations between project partners and advisers are crucial to the success of the program year to year. Collaboration keeps our efforts scientifically informed and relevant, ensures coordination rather than duplication of monitoring efforts statewide, and adds valuable, on-the-ground information to the conservation community.

In 2018, we concentrated our study area in two distinct landscapes – the Cascade Mountains in Washington and the transboundary Kettle River Mountain Range of northeast Washington and southern British Columbia, including the Rossland Range in B.C. Within the Cascade Mountains, we have divided the study area into three regions:

1. Washington's North Cascades: North of Interstate-90 (North Cascades)
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At the start of each year, monitoring objectives are established by project staff with feedback and guidance from the Advisory Council. In 2018, our monitoring objectives were to:

1. Monitor the recovery of gray wolves (*Canis lupus*) in the Cascade Mountains, with a particular focus south of Interstate 90 in the Southern Recovery Zone identified by Washington's Wolf Conservation and Management Plan. Our sites were determined based on areas identified as high-quality habitat where wolves are expected to expand their existing range.
2. Document the presence of wolverines (*Gulo gulo*) in the North and South Cascades. In addition to visual documentation through remote cameras, these sites are set up to collect valuable genetic information for wildlife agencies, primarily through "hair snags".
3. Document grizzly bears (*Ursus arctos*) and other rare carnivores in the federally-designated North Cascades Grizzly Bear Recovery Zone, approximately from Interstate 90 north to the U.S.-Canada border.
4. Observe the behavior and presence of all wildlife species in key habitat connectivity areas along Interstate 90 between Snoqualmie Pass and Easton, where wildlife crossing structures are completed, under construction or planned for construction as part of the I-90 Snoqualmie Pass East Project.²
5. Detect transboundary wildlife activity between northeast Washington and British Columbia with a specific

² The I-90 Snoqualmie Pass East Project is designed to improve wildlife movement across I-90 between Hyak and Easton. The I-90 project design includes 14 key animal-travel areas, where one or more improvements will be made to allow for wildlife to better move across the interstate and waterways under the interstate. Maps of the identified areas for wildlife passage can be found at: wsdot.wa.gov/NR/rdonlyres/F6513B4C-12AE-43D3-ABA1-95104CAAD29D/72075/I90_Project_Folio_ConstWeb.pdf

focus on documenting and collecting genetic information from Canada lynx (*Lynx canadensis*).

WOLF MONITORING

Since 2008, when this program's remote cameras documented the first wolf pups born in Washington in more than 70 years, Conservation Northwest has played a major role in wolf recovery in Washington. As of December 2018, Washington is home to 27 confirmed wolf packs. WDFW released their Washington Gray Wolf Conservation and Management 2018 Annual Report to reflect the state's most up-to-date wolf count, with a minimum of 126 wolves calling Washington state home at the end of 2018³, though some estimates put this number higher, around 150 individuals in Washington State⁴. In addition to shaping wolf policy in Washington and leading the Range Rider Pilot Project, through the CWMP, Conservation Northwest carries out monitoring efforts. The results of these efforts are used to better understand the distribution of wolves across the state and guide ongoing conservation efforts. The Wolf Conservation and Management Plan identifies three recovery zones in Washington: Eastern Washington, the North Cascades, and the Southern Cascades and Northwest Coast.⁵ According to this plan, wolves will be considered recovered in the state of Washington if there are 15 successful breeding pairs for three consecutive years, geographically distributed across the three regions. Additionally, each recovery zone must have at least four breeding pairs for three consecutive years. In 2018, the CWMP focused the majority of its wolf monitoring efforts on detection south of I-90 in the state's designated Southern Cascades and Northwest Coast Recovery Zone. Installations were located in areas of predicted high-quality wolf habitat or in response to specific anecdotal reports of potential wolf activity within these recovery zones. As of December 31, 2018, none of Washington's 27 wolf packs have been documented in the Southern Cascades and Northwest Coast recovery zone.

WOLVERINE MONITORING

Wolverines are the largest terrestrial members of the weasel family and are among the rarest carnivores in North America.⁶ They prefer alpine and subalpine environments where snow packs persist into late spring. Perhaps because they live in these harsh environments where food is scarce, wolverines are extremely mobile carnivores with large home ranges between 100 km² to more than 900 km². This means they typically live in low densities across large landscapes.⁷ After near eradication from the lower 48 states in the early 1900's, wolverines have

³ Washington Department of Fish and Wildlife, Confederated Colville Tribes, Spokane Tribe of Indians, USDA-APHIS Wildlife Services, and U.S. Fish and Wildlife Service. 2019. Washington Gray Wolf Conservation and Management 2018 Annual Report. Washington Department of Fish and Wildlife, Ellensburg, WA, USA. <https://wdfw.wa.gov/publications/02062>, Accessed April 2019.

⁴ <https://www.conservationnw.org/news-updates/senate-wolves-in-washington/> January 2019.

⁵ Gary J. Wiles, Harriet L. Allen, and Gerald E. Hayes, *Wolf Conservation and Management Plan: State of Washington* (Olympia, WA, USA: Washington Department of Fish and Wildlife, December 2011).

⁶ Keith B. Aubry, Kevin S. Mckelvey, and Jeffrey P. Copeland, "Distribution and Broadscale Habitat Relations of the Wolverine in the Contiguous United States," *Journal of Wildlife Management* 71, no. 7 (2007): 2147, doi:10.2193/2006-548.; Vivian Banci, "Wolverine," in *The Scientific Basis for Conserving Forest Carnivores: American Marten, Fisher, Lynx, and Wolverine in the Western United States.*, ed. Leonard F. Ruggiero et al. (Fort Collins, Colorado, USA: USDA Forest Service Technical Report, 1994), 99–127.

⁷ Banci, Vivian. "Wolverine." In *The Scientific Basis for Conserving Forest Carnivores: American Marten, Fisher, Lynx,*

begun to recover in areas such as the North Cascades, and, since 2005, researchers have identified more than a dozen individual wolverines. Much is still unknown about these rare and elusive species, and the CWMP is helping to collect more information.

Though conservation groups have pursued listing the wolverine as Endangered under the Endangered Species Act at both the federal and state levels, in the fall of 2014, the U.S. Fish and Wildlife Service (USFWS) published their final ruling on the listing status for wolverine nationwide, and determined that the species did not warrant federal protections.⁸ In response to the negative finding from USFWS, conservation groups have filed a lawsuit against the government to continue to pursue protection, citing habitat loss due to climate change and other factors⁹. Conservation Northwest and other organizations are pushing decision-makers to create state and federal safeguards for wolverines as they recover across Washington and other parts of the lower 48 states.

Through CWMP monitoring activities, Conservation Northwest will help shape recovery and critical habitat plans for wolverines in Washington by informing land management decisions, and building upon ongoing research in the Cascades. Our goals for wolverine monitoring in 2018 were to:

- 1) Document the presence of wolverines in the southern portion of the North Cascades and the South Cascades.
- 2) Expand recent documentation of wolverines on the western side of the North Cascades in the Mount Baker vicinity where anecdotal reports of sightings and tracks have been made for a number of years.
- 3) Collect genetic data through hair samples to help identify individual wolverines at all of our wolverine monitoring locations.

In 2018, our wolverine monitoring continued in numerous established locations as well as several new survey areas. To ensure that our efforts add to existing research, we focus on locations where definitive documentation of wolverines is lacking or sparse, and where our collaborators have made specific requests to complement their efforts. We look forward to providing support and continued collaboration with larger regional studies such as this one.

CWMP's 2018 wolverine monitoring was bolstered through a collaboration with the Cascades Wolverine Project (CWP). Headed by wildlife biologists David Moskowitz and Stephanie Williams, the CWP supports wolverine recovery efforts in the North Cascades. In 2018 they maintained seven field camera installation sites in the eastern North Cascades to detect wolverines. Through this partnership, their detection data expanded CWMP's

and Wolverine in the Western United States., edited by Leonard F. Ruggiero, Keith B. Aubry, Steven W. Bushkirk, Jack L. Lyon, and William J. Zielinski, 99–127. Fort Collins, Colorado, USA: USDA Forest Service Technical Report, 1994.

⁸ Washington Department of Fish and Wildlife December 17, 2013 press release: fws.gov/mountain-prairie/pressrel/2013/12172013_wolverine.php

⁹ Federal Agency Ignores Best Available Science in Decision Not To List Wolverine: <http://www.conservationnw.org/news/pressroom/press-releases/federal-agency-ignores-best-available-science-in-decision-not-to-list-wolverine>

own monitoring efforts to this critical wolverine habitat.

GRIZZLY BEAR MONITORING

At one time, grizzly bears (*Ursus arctos*) roamed throughout most of what is now Washington state. After their near extirpation from the lower 48 states in the 1800's, grizzly bears were listed as Endangered under the Endangered Species Act in 1975¹⁰. In 1997, the North Cascades, along with five other recovery zones, was identified as a key area for recovery of the endangered bear species and designated as a federal Grizzly Bear Recovery Zone.¹¹ Now, 22 years after the recovery plan was written, the National Park Service (NPS) and the U.S. Fish and Wildlife Service (USFWS) are in the midst of an important public process to explore options for recovering grizzly bears in the North Cascades.¹²

Despite anecdotal reports of grizzlies in the North Cascades and recent confirmed sightings just north of the British Columbia border, no population or individual has been confirmed in the Washington portion of the ecosystem since 1996¹³. Based on expert opinion and a database of sightings, the USFWS believe there are fewer than 10 grizzly bears remaining in Washington's North Cascades ecosystem¹⁴. As of 2012, the British Columbia Ministry of Environment estimates there are six grizzly bears in the Canadian North Cascades¹⁵.

In 2010, with oversight from the North Cascades Interagency Grizzly Bear Subcommittee, the Cascade Carnivore Connectivity Project (CCCP) and other project partners began an extensive survey to detect grizzlies potentially occupying Washington's North Cascades Ecosystem (NCE)¹⁶. The efforts of the CCCP covered approximately 25 percent of the NCE and did not detect photographic or genetic evidence of grizzly bears in the study area. Continued monitoring in the area assists the NPS and the USFWS in evaluating options for grizzly bear restoration in the region. The CWMP's effort to detect grizzly bears in the NCE was designed to complement the work already carried out by the CCCP. Survey locations are selected based on the sampling model created by CCCP and the sampling method they employed based on the "hair corral" described by Kendall and McKelvey (2008).¹⁷ The

¹⁰ Grizzly Bears and the Endangered Species Act, *National Parks Service*:

<http://www.nps.gov/yell/learn/nature/bearesa.htm>

¹¹ Servheen, C. 1997. Grizzly bear recovery plan: North Cascades ecosystem recovery plan chapter. U.S. Fish and Wildlife Service. Missoula, MT.

¹² North Cascades Ecosystem Grizzly Bear Restoration Plan/Environmental Impact Statement:

<http://parkplanning.nps.gov/projectHome.cfm?projectId=44144>

¹³ http://wdfw.wa.gov/conservation/endangered/species/grizzly_bear.pdf

¹⁴ U.S. Fish and Wildlife Service Species Assessment and Listing Priority Assignment Form:

<http://ecos.fws.gov/docs/species/uplisting/doc4748.pdf>

¹⁵ British Columbia Grizzly Bear Population Estimate for 2012:

http://www.env.gov.bc.ca/fw/wildlife/docs/Grizzly_Bear_Pop_Est_Report_Final_2012.pdf

¹⁶ Cascades Carnivore Connectivity Project Grizzly Bear Survey:

<http://www.cascadesconnectivity.org/research/grizzly-bear-survey/>

¹⁷ Long, R.A., J.S. Begley, P. MacKay, W.L. Gaines, and A.J. Shirk. 2013. The Cascades Carnivore Connectivity Project: A landscape genetic assessment of connectivity for carnivores in Washington's North Cascades Ecosystem. Final report for the Seattle City Light Wildlife Research Program, Seattle, Washington. Western Transportation Institute, Montana State University, Bozeman. 57 pp. and Kendall, K.C., and K.S. McKelvey. 2008. Hair collection.

CWMP's field protocol adapted these methods to focus on simple detection using remote camera data rather than DNA analysis based on genetic sample (hair) collection. CCCP's primary research objectives were to collect information on the genetic structure of carnivore populations in the NCE and to detect grizzly bears and other rare carnivores. The CWMP's primary research goal is detection of grizzly bears.

I-90 CORRIDOR MONITORING

I-90 acts as a major barrier to wildlife traveling north and south in the Cascades. Results from a large-scale connectivity analysis designate a narrow corridor along Interstate 90 to be particularly crucial for wildlife passage.¹⁸ In an effort to create a more permeable interstate, the Washington State Department of Transportation (WSDOT) has developed a 15-mile highway expansion project called the I-90 Snoqualmie Pass East Project, which includes measures for safer wildlife passage. Multiple crossing structures, including overpasses, have been built or are slated for construction within the next five years¹⁹.

Our project has worked in concert with WSDOT and Western Transportation Institute for close to a decade to monitor wildlife activity along I-90 within the project area, with support from the I-90 Wildlife Bridges Coalition. Through remote camera monitoring and snow tracking, the CWMP has provided valuable data informing the I-90 Snoqualmie Pass East Project throughout its planning and implementation phases. During the 2018 monitoring season, the wildlife underpasses at Gold Creek and Rocky Run were complete and habitat restoration within and adjacent to the crossing structures was underway. In September of 2016, construction of the first archways for the Keechelus Lake Wildlife Overcrossing began, with the completion of the overcrossing structure and associated wildlife fencing projected for 2019²⁰. In 2018, our goals along I-90 were to document wildlife activity in habitat adjacent to the completed wildlife crossing structures as well as in areas relevant to future phases of the project.

TRANSBOUNDARY LYNX MONITORING

Much like the history of wolverines in our state, lynx were targeted in the fur trade in the 1800's and early 1900's, and trapping pressure along with habitat decline reduced their numbers drastically in Washington. Because of these pressures, lynx are protected under the federal and state Endangered Species Acts. Washington has approximately 3,800 km² of habitat suitable for this species.²¹ Researchers have documented the dispersal of lynx across the Canadian border in northeastern Washington.²² Conservation Northwest works closely with U.S. and

Pages 141–182 in Long, R. A., P. MacKay, W. J. Zielinski, and J. C. Ray, editors. *Noninvasive survey methods for carnivores*. Island Press, Washington, D.C.

¹⁸ I-90 Wildlife Bridges Project description and connectivity analysis: i90wildlifebridges.org/project-info

¹⁹ I-90 Snoqualmie Pass East Project Final Environmental Impact Statement:
<http://www.wsdot.wa.gov/Projects/I90/SnoqualmiePassEast/Finaleis>

²⁰ <http://i90wildlifebridges.org/construction-begins-on-first-wildlife-overpass-on-i-90/>

²¹ Gary M. Koehler et al., "Habitat Fragmentation and the Persistence of Lynx Populations in Washington State," *The Journal of Wildlife Management* 72, no. 7 (2008): 1518–1524, doi:10.2193/2007-437.

²² Stinson, *Washington State Recovery Plan for the Lynx*; J.D. Brittell et al., *Native Cats of Washington, Section III: Lynx*, Unpublished (Olympia, WA, USA: Washington Department of Fish and Wildlife, 1989); and Kim G. Poole, "Dispersal Patterns of Lynx in the Northwest Territories," *The Journal of Wildlife Management* 61, no. 2 (1997): 497–505.

Canadian conservation allies to ensure that lynx and other wildlife can travel safely and seamlessly across the border.

Over the past several years, Conservation Northwest has piloted approaches to extend our monitoring efforts into the transboundary Kettle River and Rossland mountain ranges in Washington and southern British Columbia. These efforts are aimed at documenting the presence of lynx and collecting genetic information on individuals outside of ongoing agency research in the Cascade Mountains.

The major objectives for 2018 lynx monitoring in British Columbia were to document the presence of lynx in the transboundary Kettle River Range between British Columbia and northeast Washington, and to collect genetic data from hair snags placed at each remote camera installation. Working toward these goals, we aim to increase our understanding of lynx in this area and their relation to adjacent, better-studied lynx populations in the Rockies and Cascade Mountains.

We have continued collaborating with Dr. Lui Marinelli and students from Selkirk College in British Columbia, who maintained three lynx monitoring installations in Rossland Range, B.C. using CWMP cameras. These cameras, installed in October of each year, run through the winter and provide us with a look at transboundary species detections north of the border. Additionally, our project volunteers installed and maintained 11 camera installations on the Washington side of the border, providing support and supplementing a larger lynx monitoring effort led by Dr. Dan Thornton and his Mammal Spatial Ecology and Conservation Lab at Washington State University.

METHODOLOGY

The CWMP is a volunteer-based project supported by Conservation Northwest staff, contractors, interns and other project partners. Though our winter monitoring season includes snow tracking techniques along I-90, the majority of our work is accomplished through the use of remote, motion-triggered cameras. The use of motion-triggered cameras represents an easy and verifiable method of documenting wildlife presence and has been used as a significant, non-invasive research tool in many projects worldwide.²³ Additionally, motion-triggered cameras provide a tangible, low-cost way to engage citizens in wildlife monitoring and conservation. Together, our network of volunteers and cameras provides invaluable data on the presence of rare and sensitive species. Some of our camera installations also include devices for collecting hair samples for genetic analysis.

SURVEY AREA SELECTION

At the beginning of each season, we select and prioritize survey areas in collaboration with project partners and our Advisory Council. Survey areas are selected based on our research objectives with consideration for our equipment inventory as well as staff and volunteer capacity. Our list of survey areas goes through numerous

²³ Masatoshi Yasuda, "Monitoring Diversity and Abundance of Mammals with Camera Traps: A Case Study on Mount Tsukuba, Central Japan," *Mammal Study* 29, no. 1 (2004): 37–46.; and Christen Wemmer, Thomas H. Kunz, and Virginia Hayssen, "Mammalian Sign," in *Measuring and Monitoring Biological Diversity*, by Don E. Wilson et al. (Washington: Smithsonian Institution Press, 1996).

iterations as we discuss priorities and capacity with our Advisory Council. The finalized list of survey areas serves as a guide for volunteer recruitment.

Each survey area is chosen for a particular target species based on our monitoring objectives for the year (Figure 1). Our project staff works with specific advisers from our Advisory Council to develop survey area descriptions that include the purpose of the survey area, special considerations, and general information that our volunteers use to help select specific installation locations and camera trap design.

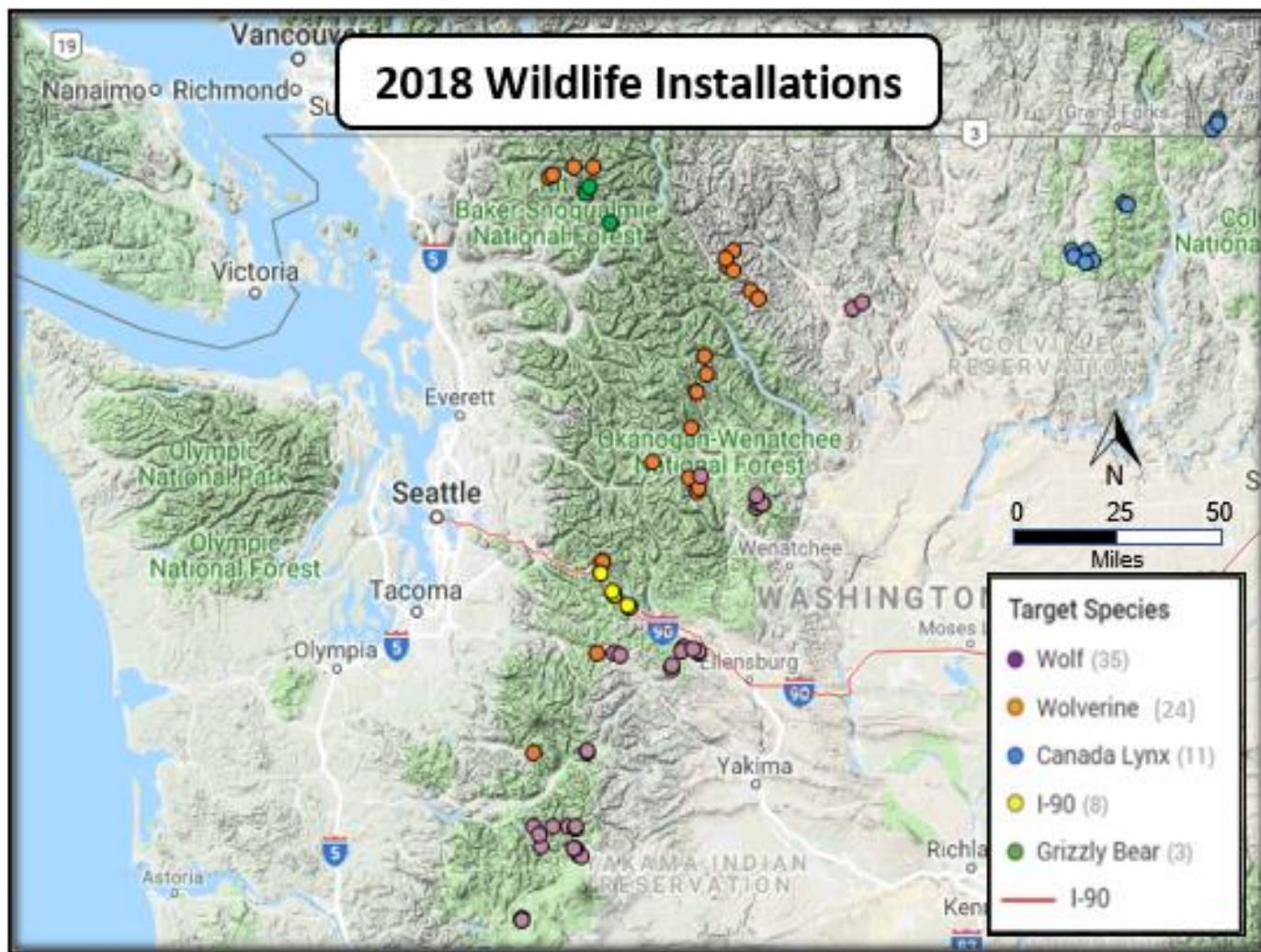


Figure 1: Locations of all 2018 camera installations specified by target species: wolf, wolverine, Canada lynx, I-90 Wildlife Corridor and grizzly bear.

Throughout the season, the field knowledge and experience of our volunteers help the CWMP staff and Advisory Council reassess each survey area based on data gathered during the season. Because of their consistent presence in the field, volunteers provide invaluable feedback about the best survey area locations and current field conditions.

Over the course of the 2018 field season, our volunteers placed 81 unique camera installations at 36 survey areas throughout the Cascade Mountains and in the Kettle River Mountain Range. Each survey area had between one and seven discreet camera trap installations spread out spatially and/or temporally throughout the survey area. Based on guidance from our Advisory Council we had 15 survey areas targeting wolverine, 13 for gray wolf, two for grizzly bear, three targeting multiple species along I-90, and three survey areas focused on detecting lynx.

CAMERA INSTALLATIONS

The CWMP follows specific protocols for remote camera installations based on the target species or monitoring activity. The application of scent lure or bait in our project adheres to guidelines established by our Advisory Council. Wildlife use scent markings as important means of communication to establish territories, find mates and prey, assess levels of danger, and interact with other individuals within the same vicinity.²⁴ Scent lure mimics this natural mode of communication and acts as an attractant, bringing individual wildlife to the remote camera installation. No artificial attractants are used for the I-90 corridor where the proximity of the installation is close to the roadway and we do not want to attract wildlife towards the road.

Most installations targeting wolves include motion-triggered cameras secured to trees with scent lure applied nearby. In addition to scent attractants, wolf installations focus on travel patterns, such as junctions between game trails and closed or lightly-traveled roads. Generally, two installations are placed within a designated survey area, which can range in scale. Cameras are moved and new installations established over the course of the year to increase the area surveyed.

Installations targeting grizzly bears use a special lure developed by the U.S. Forest Service containing fermented cattle blood and fish oil. This lure is highly attractant to bears and is poured over a large pile of brush and sticks constructed by volunteers maintaining these installations (Appendix III). Cameras are positioned to capture bears as they smell and explore the brush pile and lure. Though these installations do not include hair snares, if grizzly bears are suspected to have visited the installation, volunteers are instructed to collect hair if available.

The majority of installations targeting wolverines have a setup conducive to capturing visual documentation of their chest blazes (Appendix IV). These installations, called run-pole stations, are constructed with natural materials on-site. Wolverine run-pole stations include two cameras: a run-pole camera, set directly across from the run pole, and a vicinity camera, off to the side. These cameras are accompanied by bait, strung strategically above the run-pole. The hope is that the wolverine will stand on the run-pole and look up at the bait, allowing the run-pole camera to document its chest blaze. Wild bait (deer, elk, etc., often from road-killed animals) is preferred for these installations. However, in cases where wild bait is unavailable, bait is purchased at butcher shops. In addition to the bait, each installation designated for wolverine detection is equipped with snags for hair collection as well as a scent attractant. Though individual wolverines can be identified visually from chest blaze photographs, DNA analysis provides more detailed information about animals that are detected, such as their relationship to other wolverines in the study area. The hair snag system that the CWMP employs consists of a gun-brush belt with five gun brushes attached horizontally. This belt is attached just below the run-pole around

²⁴ Fredrick V. Schlexer, "Attracting Animals to Detection Devices," in *Noninvasive Survey Methods for Carnivores*, by Robert A Long (Washington, D.C.: Island Press, 2008).

the tree. In the field, if photographs from remote cameras indicate the target species has visited the site, hair samples are removed from the gun brushes using latex gloves and are immediately sent for lab analysis.

Installations targeting lynx on the Washington side of the border have transitioned Dr. Dan Thornton's large-scale detection protocol that was designed for lynx monitoring, which took place over the summer of 2017 (Appendix V). This has been a recent change from the national lynx-detection protocol developed in 1999 by McKelvey, still being utilized in British Columbia (Appendix VI). In addition to having remote cameras, these installations are also equipped with hair snares and scent stations designed to attract lynx for DNA analysis. A special mixture of glycol, glycerin and beaver castoreum is used at scent stations set up as recommended by McKelvey et al.

During the 2018 season, the majority of our remote cameras were Bushnell Trophy Cam XLT, with a few installations employing Reconyx RC55 or RC60 and lightweight Brownings for backcountry sites. Camera settings are standardized for comparability across the study area as outlined in the protocols (Appendix II). Volunteers are trained in camera installation and maintenance prior to each season at a training held by project staff.

SPECIES PRIORITIZATION

Though each survey area is established with a specific target species in mind, data on the presence of non-target wildlife is also valuable. We use a species priority list that categorizes species in order of significance to our project. Using our category structure, we are able to establish protocols for documenting certain species of interest and facilitating timely communication with project partners during the season. All Level 1 species detected at a remote camera installation during the season are immediately reported to project staff and the Advisory Council for confirmation and further communication.

The priority listing for our 2018 season is as follows:

Level 1

Wolverine
Fisher
Lynx
Wolf
Grizzly bear
Mountain red fox/Cascade red fox

Level 2

Cougar
Marten
Mountain goat

Level 3

Beaver
Black bear
Bobcat
Coyote
Elk

Hoary marmot
Mule deer /White-tailed deer / Black-tailed deer
Moose
Porcupine
Raccoon
Striped Skunk/ Spotted Skunk
Snowshoe hare and smaller mammals (squirrels, rodents, American pika)
Livestock (cow and sheep)
Human (non-volunteer) includes: domestic dog with human, horse and rider, bicycle and vehicles
Domestic dog (no human presence recorded)

RESULTS AND DISCUSSION

During the 2018 monitoring season, volunteers collected data year-round with the majority of the cameras deployed from May through October. Over the course of the season, CWMP project volunteers established and maintained 36 survey areas with 81 sites. The following results cover all of the mammal species detected on our camera traps, including all events involving priority species for the project as outlined above. The impacts of livestock and human presence on wildlife are of significant conservation interest, and records of their presence are also included here. Though our program expands knowledge of wildlife presence in Washington, limitations to the breadth of our data do exist. Our data cannot ascertain species diversity—a measure of evenness of distribution of different species, population size—or species absence. Rather, our data focuses on species richness, the number of different species counted within an ecosystem or area, which has invaluable applications to the conservation and management of rare and sensitive species in Washington. In addition to assessing species richness, we assess the number of observed events of identified priority-level species per study area. For the purposes of this project, an event is defined as any visit of a single animal (or group of animals belonging to the same species) to a camera installation with no gap greater than five minutes between images.

Results for this year are organized by target species. The number of discrete remote camera installations at each survey area and the total number of trap nights, or 24-hour monitoring periods, is presented below as an index of relative survey effort in each area. This year we have added an overview of our program effort and percent of the total for the entire project (Table 1, Figure 2).

Total Trap Nights CWMP – 2018	
Grizzly Bear	549
I-90 Wildlife	1531
Wolf	3632
Wolverine	4405
Canada Lynx	778
Total Trap Nights	10895

Table 1. Total Trap nights for all target species survey areas in 2018.

Total Trap Nights CWMP 2018 DRAFT

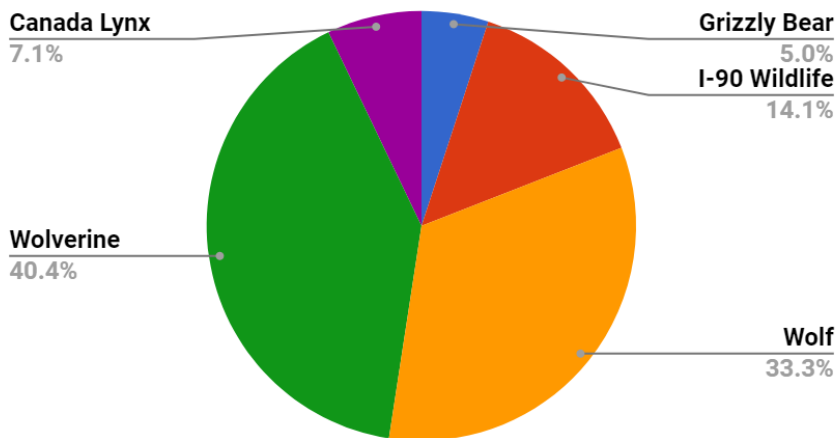


Figure 2: Total trap nights for CWMP by target species and percent of overall effort.

GRIZZLY BEAR

This season, two survey areas in the North Cascades were maintained for detecting grizzly bears with an additional goal of detecting the presence of any other rare carnivores such as gray wolves or wolverines in the North Cascades (Figure 3).

The Baker River survey area had two installations, and both North Cascades National Park biologists and volunteers revisited the sites to collect data. Volunteers retrieved the Thornton Lake camera, which was installed in 2015 and remained active for 57 days before the batteries died. Two cameras have been out for multiple seasons—one at Green Lakes and one at Blum Lakes. No photos have been received from these cameras, though we are hopeful that retrieval missions this spring or summer will be successful as Thornton Lake was this past year. These survey areas are in remote, relatively high-elevation locations in the North Cascades, most requiring hours of off-trail navigation and bush-whacking to reach. The challenge that these locations have posed to our

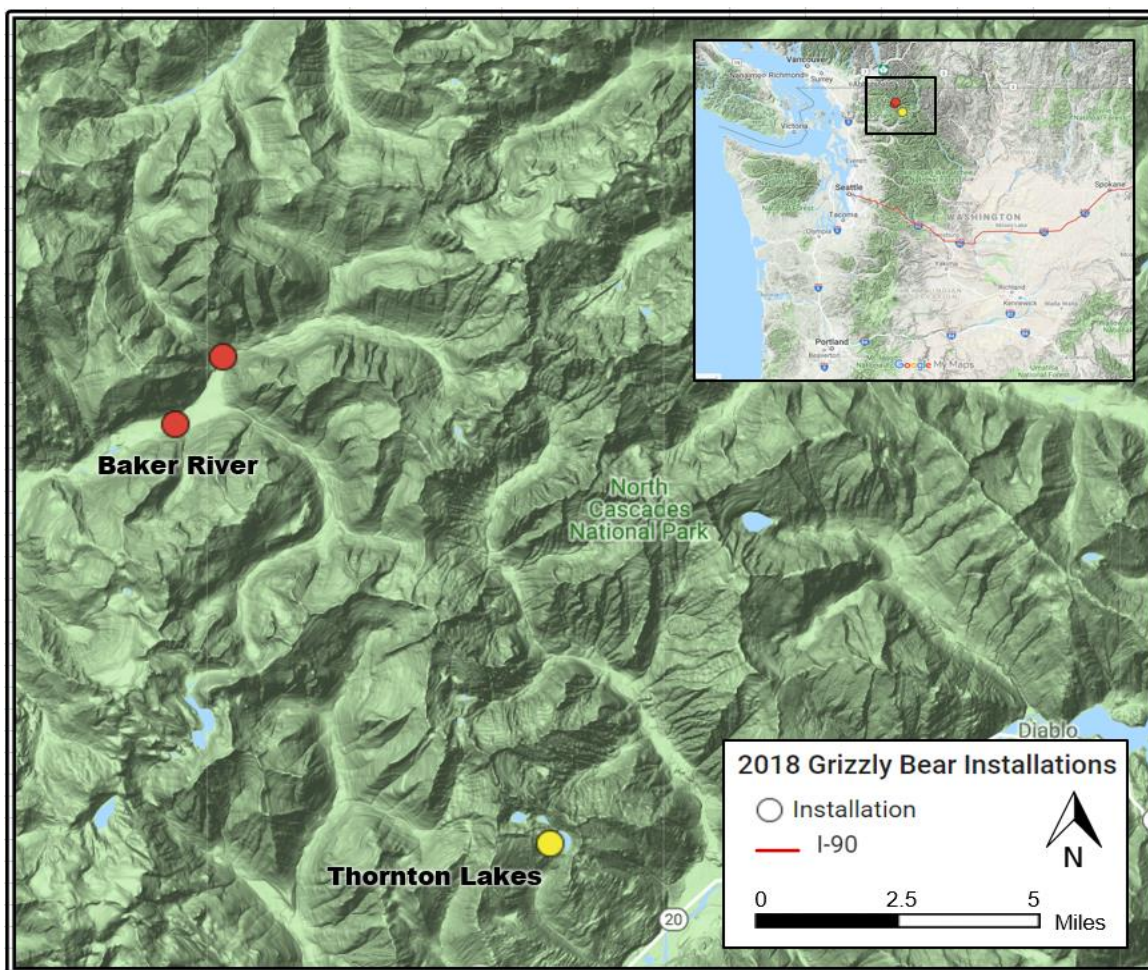


Figure 3: All grizzly bear installations for 2018 were located within the North Cascades National Park.

volunteers in the past have led to more careful thought on placement and team commitment prior to some camera installations. For 2018, limited effort was focused on camera traps set to detect grizzly bears in the North Cascades Complex: three installations, 549 trap nights and five percent of our total effort (Table 2, Figure 2).

Table 2. Grizzly bear survey area information, including duration of monitoring and number of installations.

Grizzly Bear Camera Survey Areas 2018						
Survey Area	General Region	# of Installations	Installation Date	Removal Date	Total Trap Nights	Lure
Baker River	NCNP	2	2017/09/03	2018/09/29	492	Grizzly Bear
Thornton Lake	NCNP	1	2015/09/09	2015/11/05**	57	Grizzly Bear

Five species were detected at Baker River: wolverine, black bear, coyote, mule deer, snowshoe hare and smaller mammals (Table 3). The wolverine detection, during the winter at 1,230-ft elevation, is significantly lower than where camera traps are usually set for wolverines. Our camera at Thornton Lake was installed in 2015 and retrieved during the summer of 2018, and had recorded data for 57 days and detected one species--mule deer--before malfunction associated with high snow levels buried the camera.

Table 3. Number of detection events by species at grizzly bear survey areas.

Species Detection Events at Grizzly Bear Survey Areas 2018					
Species Priority	Level 1	Level 3			
Survey Area	Wolverine	Black Bear	Coyote	Mule Deer	Snowshoe hare and smaller mammals
Baker River	1	13	3	33	3
Thornton Lake				2	

GRAY WOLF

There were 13 survey areas that followed our species-specific protocols for detecting gray wolves, and all but four were located south of I-90 (Figure 4). Our monitoring efforts dedicated to detecting wolves consisted of 32 installations and a total of 3,632 trap nights, making up for 33.3 percent of the 2018 monitoring season (Table 4, Figure 2).

While no wolves were detected in this region, fishers were captured on camera at two locations. Images have been shared with our project partners involved in recent fisher reintroduction efforts. While the first generation of reintroduced fishers have a transmitter to aid in monitoring efforts, the detection of fishers will become even more important to help monitor the reproduction and recovery of this species on the landscape. Mountain lions were seen at eight survey areas. Nine Level 3 species (black bear, bobcat, coyote, elk, mule deer, striped and spotted skunks, porcupine, snowshoe hare and smaller mammals) and humans (non-volunteer) (Table 5), were detected during the season. Blue Lake Ridge and Manastash detected eight Level 3 species and Eagle Creek, Little Naches, and Taneum detected seven. Three sites, Loup Pass, Jack Creek and Cispus, all had a relatively-low number of species detections. It is noted that all of these sites were primarily active during the winter months, and this is not representative of this area over a full calendar year.

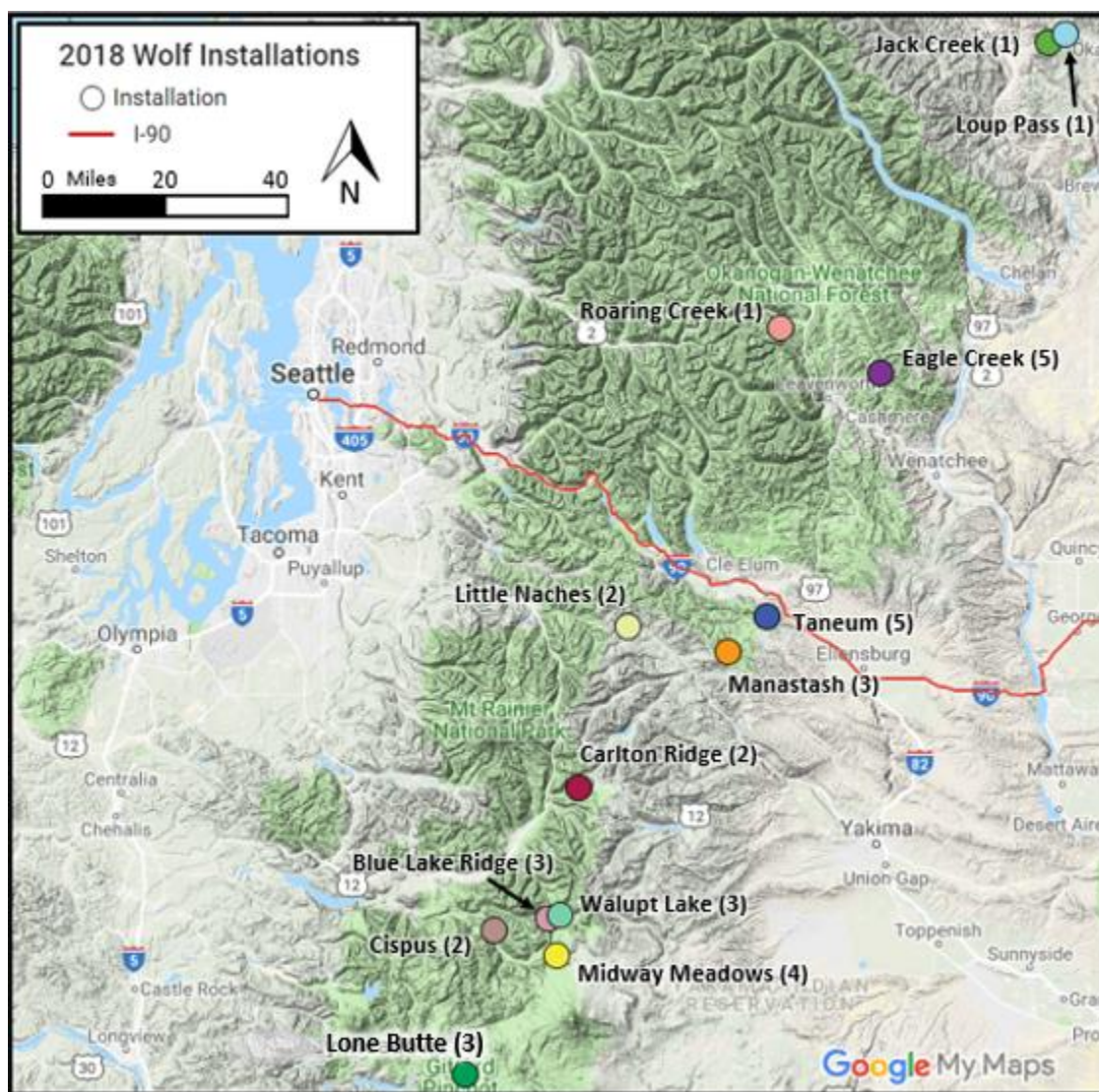


Figure 4: All gray wolf installations for 2018

Table 4. Information for all wolf survey areas, including duration of monitoring and number of installations.

^Denotes the first date of photos received from survey areas left active over the winter. *Denotes the last date photos were received, but survey area was not uninstalled.

Wolf Camera Survey Areas 2018						
Survey Area	General Region	# of Installations	Installation Date	Removal Date	Total Trap Nights	Lure
Blue Lake Ridge	GPNF	3	2017/10/17^	2018/10/07*	581	Gusto
Carlton Ridge	GPNF	2	2018/06/23	2018/11/17?	294	Gusto
Cispus	GPNF	2	2018/01/14^	2018/05/18	248	Gusto
Eagle Creek	OWNF	5	2018/05/12	2018/11/28	309	Gusto
Loup Pass	OWNF	1	2017/11/15	2018/02/22	69	None
Little Naches	OWNF	2	2018/05/29	2018/11/04	254	Gusto

Lone Butte	GPNF	3	2018/05/20	2018/10/06	278	Gusto
Jack Creek	OWNF	1	2017/11/15	2018/03/27	132	None
Manastash	OWNF	3	2017/11/25^	2018/10/14*	692	Gusto
Midway Meadows	GPNF	4	2018/06/22	2018/09/29	297	Gusto
Roaring Creek	OWNF	1	2018/07/01	2018/10/21	112	Gusto
Taneum	OWNF	2	2018/05/19	2018/10/14	268	Gusto
Walupt Lake	GPNF	3	2017/08/19	2017/09/23	98	Gusto

Table 5. Number of detection events by species at wolf survey areas. *Species of skunk include; ~Striped, **Spotted

Species Detection Events at Wolf Survey Areas 2018											
Species Priority	Level 1	Level 2	Level 3								
Survey Area	Fisher	Mountain Lion	Bobcat	Black Bear	Coyote	Elk	Mule Deer	Skunk	Porcupine	Snowshoe Hare & Smaller Mammals	Human
Blue Lake Ridge	2	19	12	28	5	15	149	**3		14	39
Carlton Ridge		1		2	3	122	1				27
Cispus			3			38	14				
Eagle Creek		5	7	14	2		21	~8		47	37
Jack Creek		1			1		25				
Little Naches		1	3		23	87	7		9	44	22
Lone Butte			2	11	15	75	16			119	6
Manastash		10	14	1	36	22	19		1	54	10
Midway Meadows	3		1	16	6	163	14			1	
Roaring Creek				10			9	~1			
Taneum		5	2	1	79		15	~9		31	70
Walupt Lake		1	10		2	3	15			25	
Loup Pass					1		1			2	

GENERAL WILDLIFE ALONG THE I-90 CORRIDOR

The I-90 corridor for this project is defined as the 15-mile stretch along I-90 between Hyak (immediately east of Snoqualmie Pass), at milepost 54, and Easton, at milepost 70 (Figure 5). The I-90 survey areas in 2018 monitored priority areas within close proximity to a few of the the 11 completed wildlife crossing structures or areas which have been planned as future wildlife connectivity improvements as part of the I-90 Snoqualmie Pass East Project. Two of the survey areas, Gold Creek and Price Noble, are in wildlife travel corridors leading to completed wildlife crossing structures. Easton is monitoring a location planned for a future crossing structure. These installations, established in the I-90 corridor, detect general wildlife movement and presence adjacent to the wildlife crossing structures. Our efforts totaled eight discreet locations being monitored and 1,531 trap nights accounting, for 14.1 percent of our monitoring efforts (Table 6, Figure 2).

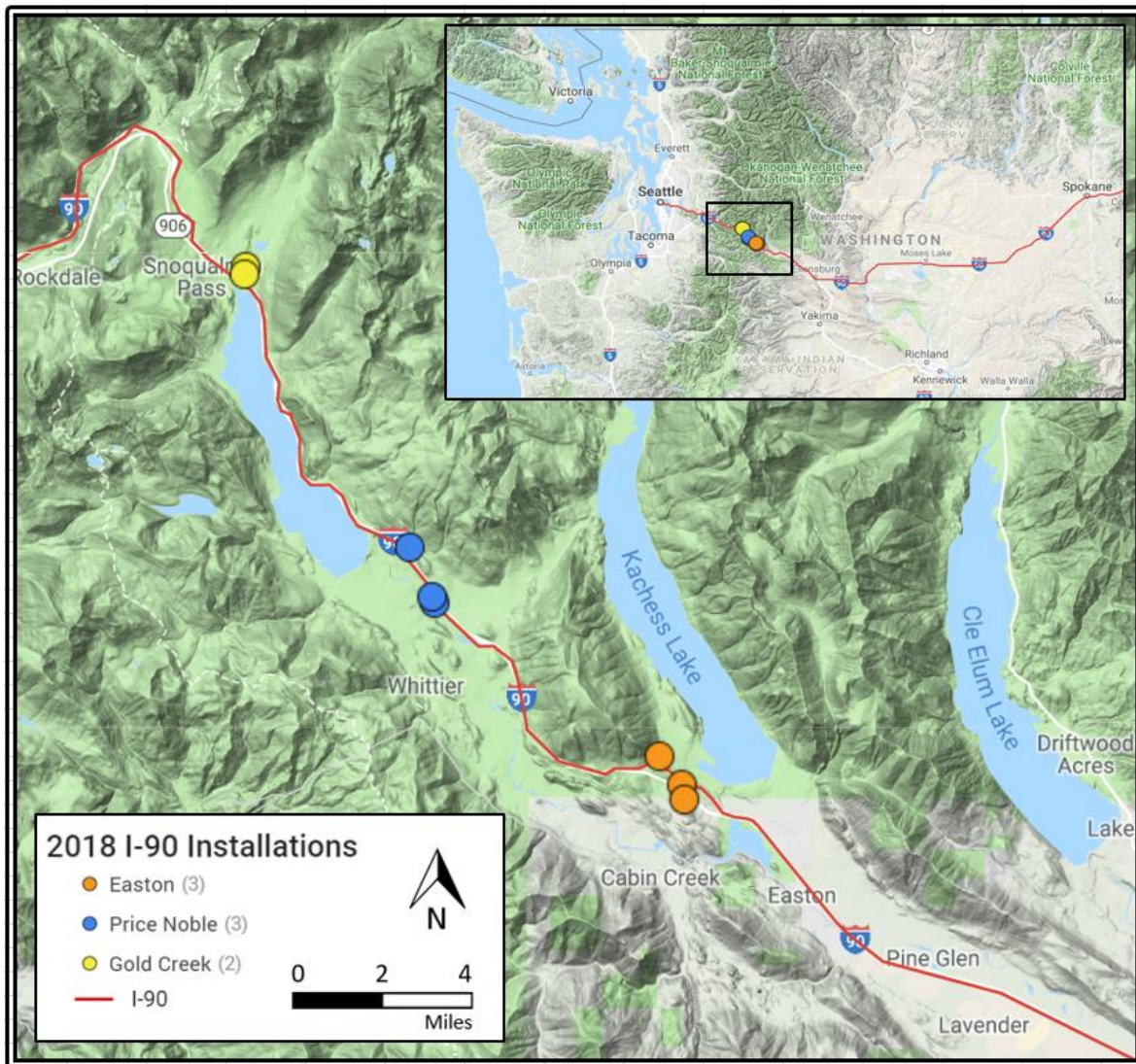


Figure 5: All general I-90 wildlife installations for 2018 were located between Hyak and Easton on the I-90 corridor.

Table 6. Information for all I-90 survey areas, including duration of monitoring and number of installations. ^Denotes the first date photos were received from survey areas left active over the winter. *Denotes the last date photos were checked, but survey area was not uninstalled.

I-90 Wildlife Corridor Camera Survey Areas 2018						
Survey Area	General Region	# of Installations	Installation Date	Removal Date	Total Trap Nights	Lure
Easton	OWNF	3	2017/11/18^	2018/10/14*	990	None
Gold Creek	OWNF	2	2018/04/04	2018/10/17*	165	None
Price Noble	OWNF	3	2018/04/19	2018/11/14*	376	None

Over the course of the season, mountain lions were detected at Easton, including a collared individual of interest

to researchers with the Muckleshoot Tribe. Seven Level 3 species (bobcat, black bear, coyote, elk, mule deer, snowshoe hare, smaller mammals and domestic dog) and humans (non-volunteer) were detected. All species were seen at Price Noble, Easton detected six species and Gold Creek five. (Table 7).

Table 7. Number of detection events by species at I-90 survey areas.

Species Detection Events at I-90 Survey Areas 2018									
Species Priority	Level 2	Level 3							
Survey Area	Mountain Lion	Bobcat	Black Bear	Coyote	Elk	Mule deer	Snowshoe Hare & Smaller Mammals	Human	Domestic Dog
Easton	7	12	20	35	117	45	9	12	
Gold Creek		1		5	11	35	2	6	
Price Noble		4	6	21	51	36	5	69	1

WOLVERINE

Our wolverine survey areas this season spanned throughout Washington’s North and South Cascades, both east and west of the Cascade Crest (Figure 6).

The wolverine monitoring included 24 distinct installations and 4,405 trap nights, making up 40.4 percent of our total monitoring efforts for the year (Table 8, Figure 2). Six of our 15 wolverine survey areas were active all year in 2018: Lookout Mountain, Kendall Peaks, Hannegan Pass, Chiwaukum, Union Gap and Lake Ethel. Numerous wolverine survey areas have been maintained over the winter season from 2018-2019. These active sites include: Chiwaukum, Chiwawa, Union Gap, Lookout Mountain, Kendall Peak and Lake Ethel.

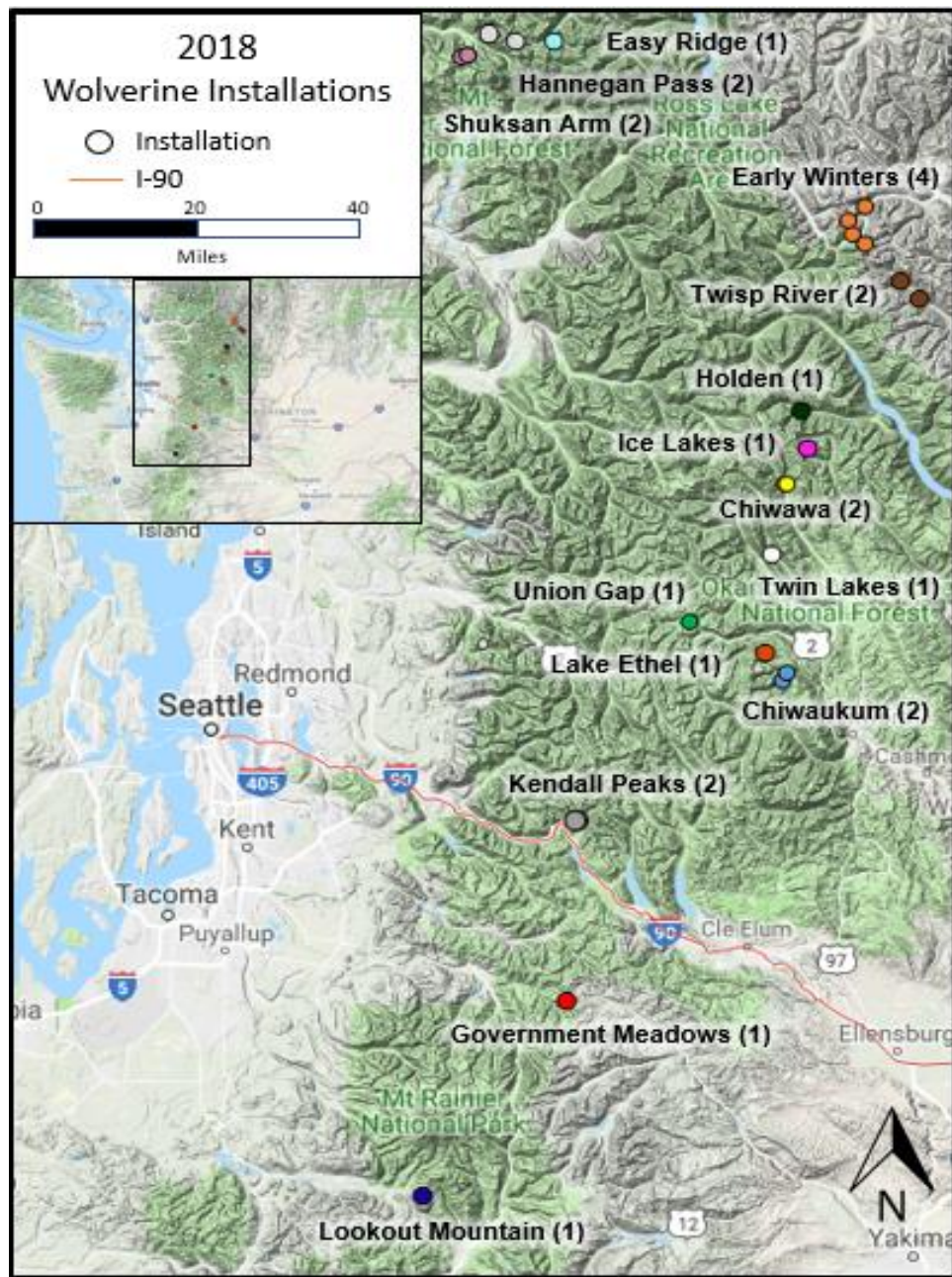


Figure 6: All wolverine installations for 2018 spanned between the Mount Baker-Snoqualmie National Forest in the southwest and northwest, to the Okanogan Wenatchee National Forest east of the cascade crest, and the North Cascades National Park in the northeast.

As previously described, wolverine survey areas are different from our other survey areas because they typically consist of two cameras at each installation. The vicinity camera captures detections within the general area and the run-pole camera photographs animals head-on, on the run-pole. For run-poles that have been elevated to accommodate for winter snowpack, the height differential between ground level and the run-pole can sometimes

Table 8. Wolverine survey area information, including duration of monitoring and number of installations. *Denotes a survey area without a run-pole installed. ^Denotes the first date photos were received in 2018 from survey areas left active over the winter. *Denotes the last date cameras were checked, but survey area was not uninstalled.

Wolverine Camera Survey Areas 2018						
Survey Area	General Region	# of Installations	Installation Date	Removal Date	Total Trap Nights	Lure
Lookout Mountain	GPNF	1	2017/10/28^	2018/10/13	350	Gusto / Bait
Government Meadows +	MBSNF	1	2018/08/01	2018/11/16	107	Gusto / Bait
Kendall Peaks +	MBSNF	2	2017/08/15^	2018/12/14	441	Bait
Shuksan Arm +	MBSNF	2	2018/06/24	2018/08/30	107	Gusto / Bait
Easy Ridge+	NCNP	1	2017/08/27^	2018/05/25	271	Gusto / Bait
Hannegan Pass +	NCNP	2	2017/11/07^	2018/10/22	390	Gusto / Bait
Chiwaukum	OWNF	2	2017/11/11^	2018/11/04	716	Gusto / Bait
Chiwawa	OWNF	2	2018/05/28	2018/11/03	159	Gusto / Bait
Ice Lakes	OWNF	1	2017/07/23^	2018/08/12	140	Gusto / Bait
Lake Ethel	OWNF	1	2017/10/18^	2018/10/20	367	Gusto / Bait
Union Gap	OWNF	1	2017/10/14^	2018/07/31	290	Gusto / Bait
Twin Lakes +	OWNF	1	2017/12/20^	2018/10/05	250	Gusto / Bait
Early Winters (CWP)+	OWNF	4	2017/12/11	2018/05/13	518	Gusto / Bait
Twisp River (CWP)+	OWNF	2	2017/12/14	2018/04/18	250	Gusto / Bait
Holden (CWP)+	OWNF	1	2018/01/15	2018/03/05	49	Gusto / Bait

be more than 10 feet. Since two cameras are running simultaneously, duplicate events are deleted prior to updating our database to obtain a more accurate understanding of detection rate and species detected, without doubling detection events. Eight survey areas did not have run-poles established: Hannegan Pass, Easy Ridge, Twin Lakes, Union Gap, Kendall Peaks and the Cascade Wolverine Project (CWP) sites. Their set-up was based on the Multi-State monitoring effort²⁵ protocol. Our cameras detected wolverines at Hannegan Pass, Ice Lakes, Lake Ethel, and two Cascades Wolverine Project sites, Holden and Early Winters, also detected wolverine presence. The Hannegan Pass camera had two individuals visit the site, as differentiated by a white marking on the left front paw on one individual. A lower-elevation site was established along Ruth Creek that also detected a wolverine, though no distinguishing marks were documented. This remains a high-priority area for wolverine monitoring in the North Cascades. The Ice Lakes camera, which has detected wolverines in past years, again had two wolverines detected together by the volunteers as they approached the site to maintain the camera. The Lake Ethel site had a previously-identified male, based on his unique chest blaze.

In areas with high detection rates of target species, like Hannegan Pass or Ice Lakes, we will be developing a plan

²⁵ https://wildlife.org/wp-content/uploads/2016/12/7_Bjornlie_WY-TWS-presentation.pdf

for volunteers to visit the site more frequently or have a backup team that can revisit the site, with the goal of collecting a valid genetic hair sample and refreshing the bait and scent lure.

Table 9. Number of detection events by species at wolverine survey areas.

Species Detection Events at Wolverine Survey Areas 2018												
Species Priority	Level 1	Level 2		Level 3								
Survey Area	Wolverine	Mountain Lion	Marten	Bobcat	Black Bear	Coyote	Elk	Mule deer	Striped Skunk	Snowshoe Hare & Smaller Mammals	Human (non-volunteer)	Domestic Dog
Chiwaukee		2	10	23	107	10	1	45		239		
Chiwawa			9		11			24		15		
Hannegan Pass	20		4	2	13			1		2		
Ice Lakes	9		3		1			5		31	4	
Kendall Peaks			155		9		1	5			12	1
Lake Ethel	5	1	70		15	1		3		1	2	
Lookout Mountain			17	3	4	3	1			80		
Shuksan Arm			1		13	1	1	2				
Union Gap			156							45		
Twin Lakes		2	79	1				2		312	4	
Government Meadows					2		15					
Easy Ridge			1		43					1		
Early Winters - CWP	8		515			15				82	1	2
Holden - CWP	1		3			1						
Twisp River - CWP			12	28					1	78		

Marten and mountain lion, both Level 2 species, were detected at 14 and three wolverine survey areas, respectively (Table 8). Marten detection levels, particularly in the Early Winters survey area, are extremely high due to instances where a single Marten frequented baited installation sites to feed. Seven Level 3 species, including black bear, bobcat, coyote, elk, mule deer, snowshoe hare and smaller mammals, and humans (non-volunteer), were also documented at wolverine survey areas (Table 9). Marten, black bear, and snowshoe hare and smaller mammals were the most frequently detected, which is a similar trend to past years (Table 9).

CANADA LYNX

Out of our three survey areas, two were located in northeast Washington's Colville National Forest and one was located on the British Columbia side of the border in the Rossland Range, part of the larger Monashee Mountains (Figure 7). Volunteers maintained eight distinct camera installations on the Washington side of the border throughout the monitoring season and data was shared

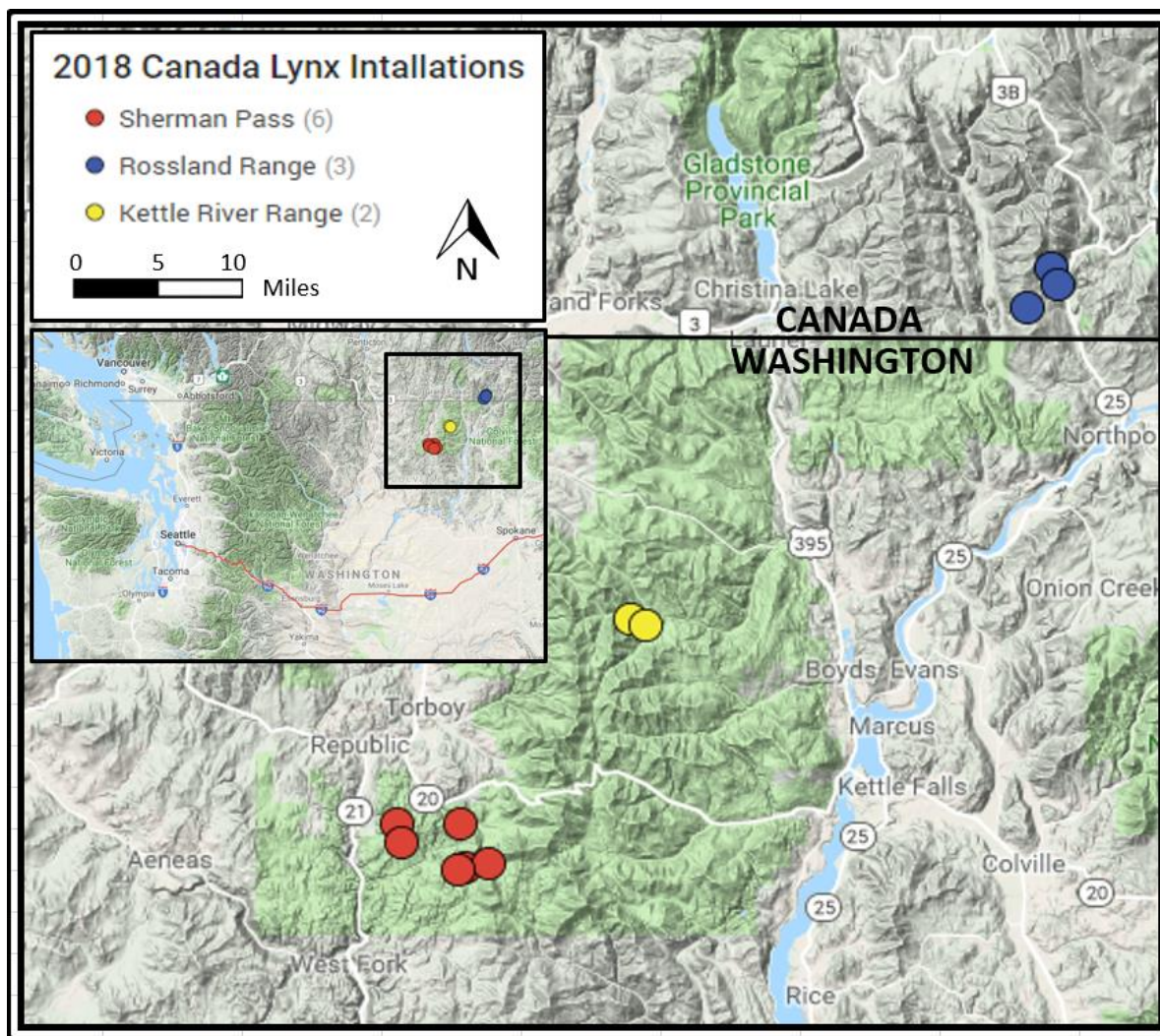


Figure 7: All Canada lynx installations for 2018 spanned from the Rossland Range to the north in British Columbia, to the Kettle Range in the United States.

Table 10. Lynx survey area information for eleven camera installations.

Canada Lynx Camera Survey Areas 2018						
Survey Area	General Region	# of Installations	Installation Date	Removal Date	Total Trap Nights	Lure
Kettle River Range	CNF	2	2018/07/18	2018/11/04	167	None
Rossland Range	BCRR	3	2017/10/28	2018/03/04	289	Lynx
Sherman Pass	CNF	6	2017/09/14	2018/10/22	322	None

from three camera installations located in the Rossland Range in British Columbia, totaling 7.1 percent of our overall effort with 778 trap nights (Table 10, Figure 7). Our partners in B.C. have detected Canada lynx consistently each monitoring year since 2015, though not during the monitoring season in 2018. Our program compliments larger efforts of those researching the transboundary Canada lynx population. We look forward to receiving updates from our collaborators at Washington State University researching the Canada lynx population in Washington state, and researchers at Selkirk College working on better understanding the lynx population within the B.C. Kettle and Rossland mountain ranges.

While no lynx were detected, species of note include gray wolves at the Kettle River Range and Sherman Pass survey areas (Table 11). Detected from cameras in the Kettle River Range were a trio and a pair of wolves travelling together. Other detections were of single wolves. There are 17 confirmed packs in the Eastern Washington recovery region, making the likelihood of detecting wolf much higher than elsewhere in Washington state.

Table 11. Number of detection events by species at lynx survey areas.

Species Detection Events at Canada Lynx Survey Areas 2018													
Species Priority	Level 1	Level 2	Level 3										
Survey Area	Wolf	Mountain Lion	Bobcat	Black Bear	Coyote	White Tail Deer	Mule Deer	Moose	Domestic Cow	Striped Skunk	Snowshoe Hare & Smaller Mammals	Human	Domestic Dog
Kettle River Range	4	4	6	11	15		8	2		1	45	19	
Rossland Range			2		6	9	11	1			85		
Sherman Pass	1	2	3	3	20	1	13		68	6	145	1	1

RECOMMENDATIONS FOR FUTURE MONITORING

At the end of each season, we reflect on lessons learned as we begin the process of planning for the next one. Information and guidance from volunteers, project advisers, project partners and project staff helps us identify the best practices for remote camera monitoring in Washington. These recommendations improve the efficacy, efficiency and power of our work.

Our goals for the 2019 remote camera monitoring season are to:

1. Assess monitoring efforts for grizzly bears and other rare carnivores in the North Cascades Ecosystem. Evaluate volunteers' and teams' ability and commitment to long, arduous, off-trail navigation and site access, and commitment to retrieving these cameras. Continue to develop research relationships within the North Cascades National Park.
2. For wolverine sites with frequent target-species detections, establish alternate teams that can assist in maintaining a site in order to increase the likelihood of collecting viable genetic samples. We continue to

work on improving our coverage for difficult-to-access locations, so that bait and hair snares can be checked on a frequent interval when target species have been detected.

3. Increase coordination in planning, reporting, and processing results from efforts by the CWMP, Washington State University and Selkirk College researchers monitoring Canada lynx in northeast Washington and southeast British Columbia.
4. Provide expanded opportunities for connections between volunteers, other ongoing wildlife field research in our state, and field-skill trainings.
5. Provide a simplified process for reporting project results and more detailed and refined analysis of project findings, and facilitate sharing with project partners.

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