CITIZEN WILDLIFE MONITORING PROJECT

2017 FIELD SEASON REPORT

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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 Wilderness Awareness School and other groups and agencies, the Citizen Wildlife Monitoring Project is engaged in monitoring wildlife presence and activity in critical areas for wildlife connectivity, conservation, and habitat.

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, conservation groups, biologists, and other collaborators on our Advisory Council.

During the 2017 remote camera season, 86 volunteers contributed more than 3,500 hours to the Citizen Wildlife Monitoring Project by attending trainings, installing, and maintaining 72 remote camera installations in 30 survey areas in Washington state 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 season, 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 2017 remote camera monitoring year. Separate snow tracking reports are available on our website.

In 2017, we concentrated our study area in two distinct landscapes – the Cascade Mountains in Washington and the transboundary mountain ranges of northeast Washington and southern British Columbia, specifically the Kettle River Range and the Rossland Range. Within the Cascade Mountains, we have divided our study area into three regions:

1. Washington's North Cascades: North of I-90 to the U.S.-Canada border (North Cascades)
2. I-90 Corridor: Between Snoqualmie Pass and Easton along Interstate 90
3. Washington's South Cascades: South of I-90 to the Columbia River (South Cascades)

The main objectives for the 2017 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 wildlife species 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 based on our target species. Each survey area may contain multiple remote camera sites. Program volunteers managed two grizzly bear survey areas, eight wolf, eleven wolverine, and five 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.

Over the course of the 2017 season, we detected nineteen species that fall into our priority listing for this project. Highlights from this field season include:

- The continued documentation of wolverines in Washington's Cascade Mountains. Our citizen science teams documented wolverines in the southern portion of the North Cascades on eight separate occasions, including two individuals visiting a site together. 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.

- 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, and has developed a methodology for large-scale, long-term monitoring of lynx in Washington state (Appendix VI). Through the CWMP, Dr. Lui Marinelli's students at Selkirk College were successful in documenting Canada lynx in southern B.C.'s Rossland Range. 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 fisher reintroduction efforts have taken place in Washington led by the Washington Department of Fish and Wildlife (WDFW), National Park Service and Conservation Northwest. Fisher photo documentation provides 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, the lifespan of these devices will not provide information on the following generation[1]. In the coming years, we plan to expand our fisher monitoring 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 ten 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 I-90 Corridor survey areas for the 2017 season were of particular interest due to the completion of two large wildlife underpasses at Gold Creek in 2014, recent completion of several smaller undercrossings nearby, and the increased opportunity for movement of wildlife. CWMP's survey areas are located within close proximity to these new highway-crossing structures. Easton sites recorded presence of seven different species in habitat adjacent to the highway. The presence of this high number of species serves as an example of the crossing structures' utility for wildlife to travel safely under I-90. Since the underpass areas have transitioned to a restoration phase, we expect to see wildlife making more use of them and adjacent areas. As construction continues on the first wildlife overpass, we will continue to pay especially

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

close attention to wildlife activity nearby, including monitoring efforts after completion (expected in 2019).

The work of Conservation Northwest staff, interns, volunteers and partners through the Citizen Wildlife Monitoring Project increases our understanding of wildlife on Washington landscapes and in the transboundary regions of Washington and British Columbia. Not only does visual wildlife documentation influence research and policy decisions, these animal images create a narrative and face for our wildlands that informs and inspires both project participants and the public. The Citizen Wildlife Monitoring Project emphasizes the importance of monitoring and conservation efforts to ensure a stable future for wildlife species that call the Northwest home.

PROJECT OVERVIEW

Over a decade ago, Conservation Northwest began using citizen science as a way to advance our mission to protect, connect and restore wildlands and wildlife from the Washington Coast to the British Columbia Rockies. We continue to train and deploy over a hundred citizen scientists each year throughout our mission area with the Citizen Wildlife Monitoring Project (CWMP). 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, 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 wildlife 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 the fisher, gray wolf, grizzly bear, Canada 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, CWMP operates through a collaborative effort between Conservation Northwest and Wilderness Awareness School. Throughout each monitoring year, Conservation Northwest acts as the Project's administer, fiscal sponsor and volunteer coordinator for all efforts, as well as leading remote camera monitoring and equipment management. Wilderness Awareness School provides in-kind and financial support to the Project for activities associated with the I-90 Corridor, as well as important training resources and venues. Previously, the I-90 Wildlife Bridges Coalition also supported the Project. That coalition, administered and sponsored by Conservation Northwest, concluded its work at the end of 2017.

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; it also 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 results gained in the field, ranging from hair samples to tracks. 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.

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 (www.conservationnw.org/wildlife-monitoring/). This report focuses on our results from the 2017 remote camera monitoring year. Separate snow tracking reports are available on our website.

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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. These objectives are typically in response to current statewide priority species and habitat identified as important for these species. In 2017, 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 (Wolf Plan). Our sites were determined in response to identified 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, outside of the geographic scope of the ongoing North Cascades Wolverine Study.[2] 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*) or 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.[3]

[2] North Cascades Wolverine Study. Lead Principal Investigator: Keith Aubry (USDA Forest Service, Pacific Northwest Research Station, Olympia, WA)

[3] 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

5. Detect transboundary wildlife activity between northeast Washington and British Columbia with a specific 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 back in Washington in over 70 years, Conservation Northwest has played a major role in wolf recovery in Washington. As of December of 2016, Washington is home to 20 confirmed wolf packs, with the new Sherman pack confirmation in the spring of 2016 and the Touchet pack in late 2016[4]. WDFW updated their 2016 Annual Report in March of 2017 to reflect the state's most up-to-date wolf count, with a minimum of 115 wolves calling Washington state home at the end of 2017[5]. 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 which are used to better understand the distribution of wolves across the state.

The Wolf Conservation and Management Plan identifies three recovery zones in Washington: Eastern Washington, the North Cascades, and the Southern Cascades and Northwest Coast.[6] 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. As of 2017, none of Washington's 20 wolf packs have been documented in the Southern Cascades and Northwest Coast recovery zones, while 16 are present in the Eastern Washington recovery zone. In 2017, CWMP focused 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.

WOLVERINE MONITORING

The largest terrestrial members of the weasel family, wolverines are among the rarest carnivores in North America.[7] 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 over 900 km². This means they typically live in low densities across large landscapes.[8] After near eradication from the lower 48 states in the early 1900s, wolverines have begun to recover in areas such as the North Cascades, and, since 2005, state researchers have identified more than a dozen

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[4] http://wdfw.wa.gov/conservation/gray_wolf/packs/21/

[5] https://www.fws.gov/wafwo/articles.cfm?id=149489625

[6] 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).

[7] 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.

[8] Banci, Vivian. "Wolverine." In *The Scientific Basis for Conserving Forest Carnivores: American Marten, Fisher, Lynx, and Wolverine in the Western United States.*, edited by Leonard F. Ruggiero, Keith B. Aubry, Steven W. Bushkirk, Jack L. Lyon, and William J. Zielinksi, 99–127. Fort Collins, Colorado, USA: USDA Forest Service Technical Report, 1994.

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 USFWS published their final ruling on the listing status for wolverine nationwide and determined that the species did not warrant federal protections.[9] 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 factors[10]. 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, inform land management decisions, and build upon ongoing research in the Cascades. Our goals for wolverine monitoring in 2017 were to:

1) Document the presence of wolverines in the southern portion of the North Cascades and the South Cascades.
2) Collect definitive evidence 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 2017, our wolverine monitoring continued in the Chiwaukum, Chiwawa, and Union Gap survey areas where our remote cameras have contributed to individual wolverine documentation over the course of multiple years. We also established locations at Alaska Lake (I-90 Corridor) in response to high reliability sightings and Ethel Lake (Chiwaukum) by guidance of our Advisory Council. To ensure that our efforts add to existing research, we maintain sites that lie outside of the current study area established by the North Cascades Wolverine Study and focus on locations where ongoing researchers have made specific requests to complement their efforts. A few of our volunteers have also become involved and are sharing data with us from the Multi-State *Gulo gulo* Study through their survey area at Mountaineers Creek. All highlights and data associated with that project will be reported on and communicated through the Multi-State Study. We look forward to providing support and continued collaboration with larger regional studies such as this one.

GRIZZLY BEAR MONITORING

At one time grizzly bears (*Ursus arctos*) roamed throughout the wild areas of Washington. 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 1975[11]. In 1997, the North Cascades, along with five other recovery zones, was identified as a key

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

[10] 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

[11] Grizzly Bears and the Endangered Species Act, *National Parks Service:* http://www.nps.gov/yell/learn/nature/bearesa.htm

area for recovery of the endangered bear species and designated as a federal Grizzly Bear Recovery Zone.[12] Now, 20 years after the recovery plan was written, the National Park Service and the U.S. Fish and Wildlife Service are in the midst of an important public process to explore options for recovering grizzly bears in the North Cascades.[13]

Despite anecdotal reports of grizzlies in the North Cascades and recent confirmed sightings in British Columbia, no population or individual has been confirmed in the Washington portion of the ecosystem since 1996[14]. Based on expert opinion and a database of sightings, the U.S. Fish and Wildlife Service believe there are fewer than 10 grizzly bears remaining in Washington's North Cascades ecosystem[15]. As of 2012, the British Columbia Ministry of Environment estimates there are six grizzly bears in the Canadian North Cascades[16].

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)[17]. The efforts of the CCCP covered approximately 25% 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 National Park Service and the U.S. Fish and Wildlife Service in evaluating options for grizzly bear restoration in the region. 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).[18] 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. 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

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

[13] North Cascades Ecosystem Grizzly Bear Restoration Plan/Environmental Impact Statement: http://parkplanning.nps.gov/projectHome.cfm?projectId=44144

[14] http://wdfw.wa.gov/conservation/endangered/species/grizzly_bear.pdf

[15] U.S. Fish and Wildlife Service Species Assessment and Listing Priority Assignment Form: http://ecos.fws.gov/docs/species/uplisting/doc4748.pdf

[16] 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

[17] Cascades Carnivore Connectivity Project Grizzly Bear Survey: http://www.cascadesconnectivity.org/research/grizzly-bear-survey/

[18] 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. 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.

passage.[19] 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, are slated for construction within the next five years[20].

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, CWMP has provided valuable data informing the I-90 Snoqualmie Pass East Project throughout its planning and implementation phases. During the 2017 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 projected for 2019[21]. Our goals for CWMP in 2017 along I-90 were to document wildlife activity at habitat adjacent to the completed wildlife crossing structures as well as presence of wildlife in areas relevant to future phases of the project, as well as Conservation Northwest's I-90 Wildlife Corridor Campaign and Central Cascades Watersheds Restoration programs.

TRANSBOUNDARY LYNX MONITORING

Washington is home to one of the largest populations of Canada lynx in the continental United States.[22] Much like the history of wolverines in our state, lynx were targeted in the fur trade in the 1800s and early 1900s, 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. Based on the preferred habitat of lynx, Koelher et al. estimate that Washington has approximately 3,800 km^2 of available habitat.[23] Researchers have documented the dispersal of lynx across the Canadian border in northeastern Washington.[24] Since wildlife travel across political boundaries, Conservation Northwest works closely with U.S. and 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.

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

[20] I-90 Snoqualmie Pass East Project Final Environmental Impact Statement: http://www.wsdot.wa.gov/Projects/I90/SnoqualmiePassEast/Finaleis

[21] http://i90wildlifebridges.org/construction-begins-on-first-wildlife-overpass-on-i-90/

[22] Derek W. Stinson, *Washington State Recovery Plan for the Lynx* (Olympia, WA, USA: Washington Department of Fish and Wildlife, 2001).

[23] 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.

[24] 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.

The major objectives for 2017 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 towards 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.

In the fall of 2016, we collaborated with Dr. Lui Marinelli and students from Selkirk College in British Columbia, who maintained three lynx monitoring installations in Rossland Range, BC 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 eleven 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

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 have been used as a significant, non-invasive research tool in many projects worldwide.[25] 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.

STUDY AREA

In 2017, 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
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SURVEY AREA SELECTION

At the beginning of each season, we select and prioritize monitoring survey areas in collaboration with project partners and our Advisory Council. Survey areas are initially selected based on target species and core habitat with consideration of equipment inventory as well as staff and volunteer capacity. Our list of survey areas goes

[25] 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).

through numerous 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 within the general survey area they are charged with monitoring.

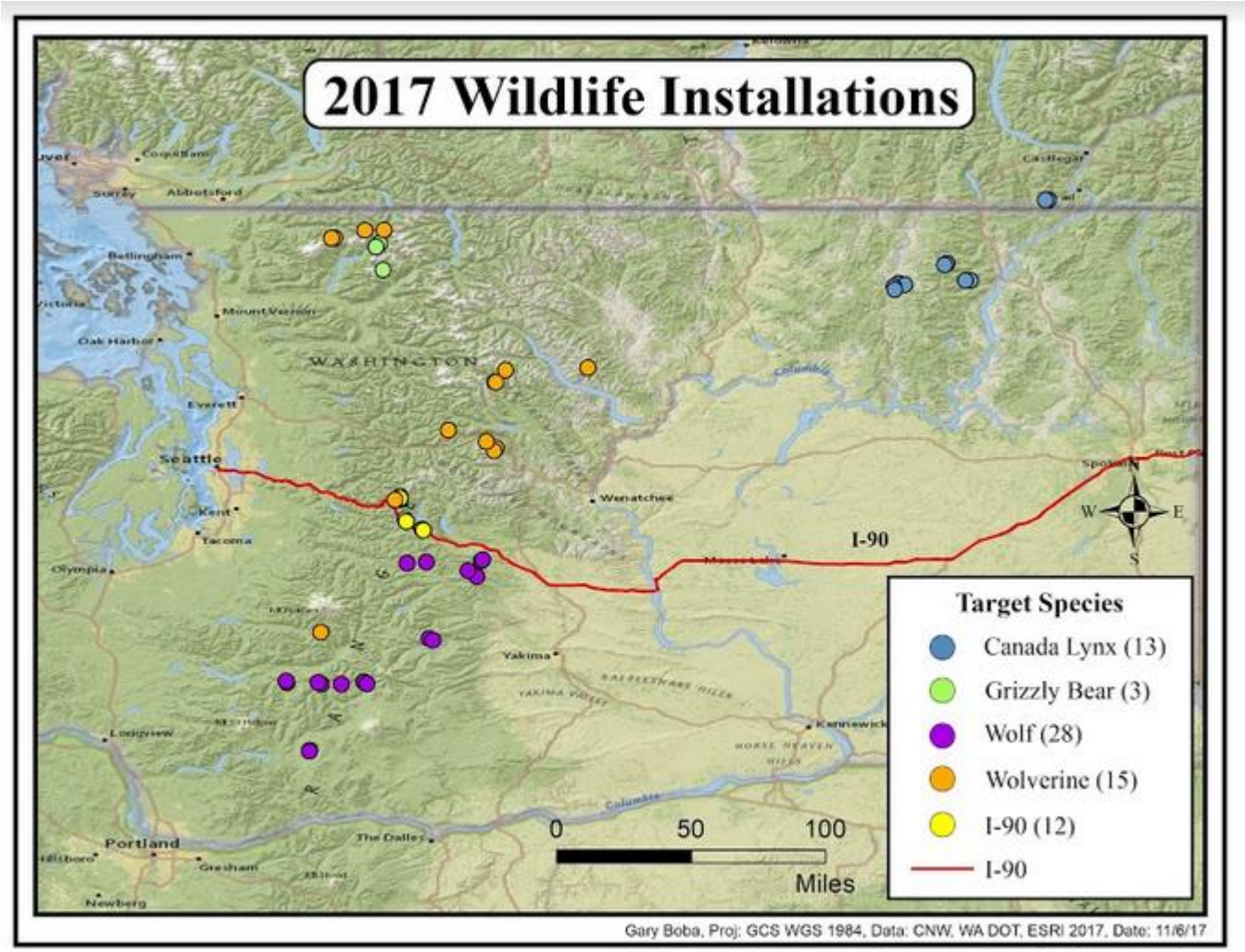

Figure 1: Locations of all 2017 camera installations specified by target species: Canada lynx, grizzly bear, I-90 wildlife corridor, wolf, and wolverine.

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 core habitat, volunteers provide invaluable feedback about the best survey area locations, current field conditions, and habitat.

Over the course of the 2017 field season, our volunteers placed 72 unique camera installations at 30 survey areas throughout our study area in the Cascade Mountains and in the Kettle River Mountain Range. Each survey area

had between one and eight discreet camera trap installations spread out spatially and/or temporally throughout the survey area. Based on guidance from our Advisory Council we had eight survey areas for wolves, eleven targeting wolverine, two for grizzly bear, five targeting multiple species along I-90, and four survey areas focused on detecting lynx.

CAMERA INSTALLATIONS

Depending on the target species and location of each survey area, remote camera installation setup can vary. 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.[26] 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.

All installations targeting wolves or I-90 structures have a similar setup that includes motion-triggered cameras secured to trees with scent lure applied nearby, unless specifically instructed otherwise (Appendix II & Appendix VII). In addition to scent attractants, wolf sets focus on travel such as junctions between game trails and closed or lightly traveled roads. Generally, two cameras are placed within a designated survey area, which can range in scale from ten to several hundred square miles, spaced far enough apart to potentially capture different individual animals (spacing varies depending on the target species or monitoring goals for the survey area), and potentially moved 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 wolverine 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 is important to confirm individuals and retrieve additional information. The hair snag system that CWMP employs consists of a gun brush belt with five gun brushes attached horizontally. This belt is attached just below the run-pole around the tree. In the field, if photographs from remote cameras indicate the

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

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 2017 season, the majority of our remote cameras were Bushnell Trophy Cam XLT, with a few installations employing Reconyx RC55 or RC60. 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 Washington species in order of significance to our project as established by project staff in consultation with our Advisory Council. 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 2017 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

Of note: while not one of our priority species, the Virginia opossum is a non-native mammal which we have detected over the years at various locations, and we have included it where detected.

RESULTS AND DISCUSSION

During the 2017 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 30 survey areas with 72 sites. These survey areas were defined through communications with Conservation Northwest program staff and scientists, our Advisory Council and distributed throughout the Cascade Mountain Range, northeastern Washington, and into the southern regions of British Columbia. 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. Only species falling within the three priority levels are included. Due to increasing interest in the interaction of wolves and livestock in Washington, any observed domestic livestock and human activity has also been included in this analysis.

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, as in 2015 and 2016. 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).

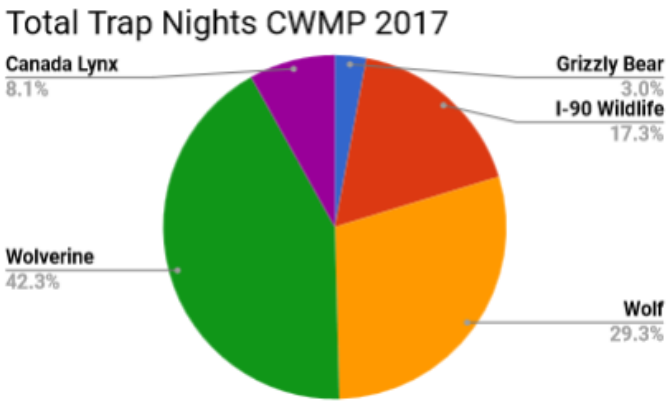

Figure 2: Total trap nights for CWMP by target species and percent of overall effort.

Total Trap Nights CWMP – 2017	
Grizzly Bear	280
I-90 Wildlife	1638
Wolf	2775
Wolverine	4004
Canada Lynx	768
Total Trap Nights	9465

Table 1. Total Trap nights for all target species survey areas in 2017.

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 in the North Cascades (Figure 3).

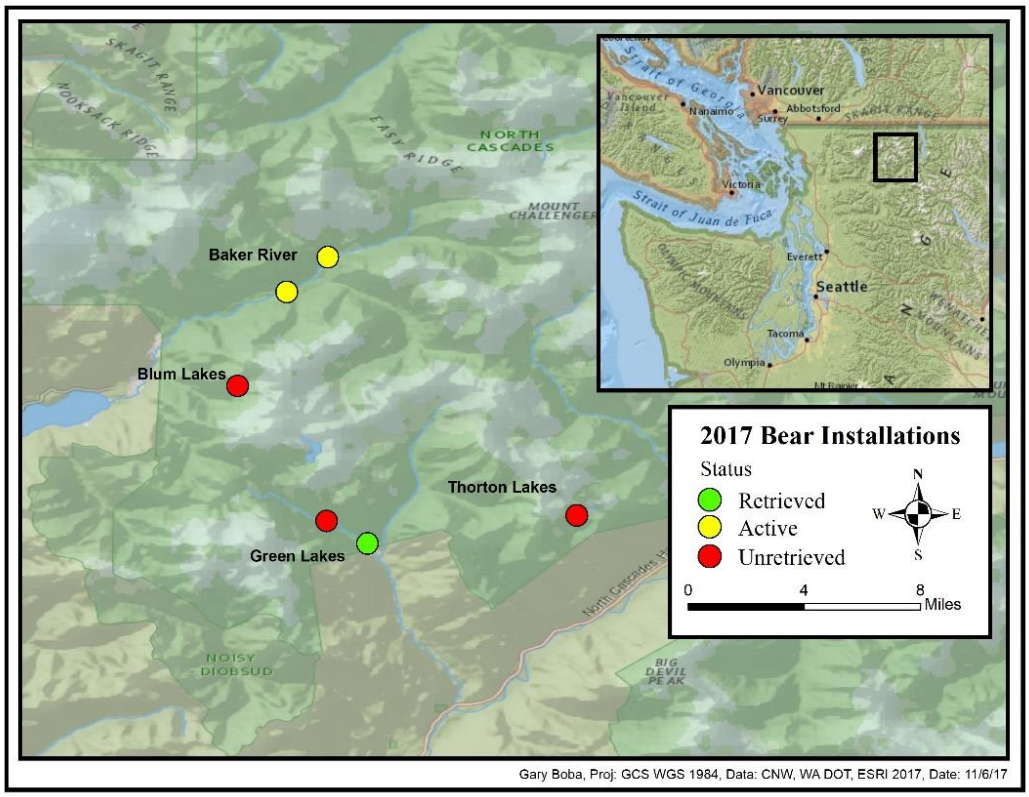

Figure 3: All grizzly bear installations for 2017 were located within the North Cascades National Park.

The Baker River survey area had two installations and volunteers revisited the site once, shortly after the initial set-up. Data will be incoming in the summer of 2018, once accessibility has improved. Volunteers retrieved the Green Lake camera, which was installed in 2015 and remained active for 267 days before the batteries died. Three cameras have been out for multiple seasons; two from the 2015 season (one at Thornton Lake and one at Green Lakes), and one from the 2016 season (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 Green Lakes 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 volunteers in the past have led to more careful thought on placement and team commitment prior to some camera installations. For 2017, limited effort of four installations, 280 trap nights and 3 percent or our total effort was focused on camera traps set to detect Grizzly bears in the North Cascades Complex (Table 2, Figure 2).

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

Grizzly Bear Camera Survey Areas 2017						
Survey Area	**General Region**	**# of Installations**	**Installation Date**	**Removal Date**	**Total Trap Nights**	**Lure**
Baker River	**NCNP**	**2**	**2017/09/03**	**2017/09/16***	**13**	**Grizzly Bear**
Green Lakes	**NCNP**	**1^**	**2015/07/18**	**2016/06/23****	**267**	**Grizzly Bear**

^One camera still on the landscape, no data received, *last revisit date, cameras still active, **retrieved in 2017

Four species were detected at Green Lake and during the short interval at Baker River: black bear, bobcat, coyote, spotted skunk, and many detections of snowshoe hare and smaller mammals (Table 3). Our cameras at Blum Lake, Thornton Lake and a 2nd at Green Lake set prior to the 2017 season have not yet been retrieved. Retrieval is expected during summer 2018.

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

Species Detection Events at Grizzly Bear Camera Survey Areas 2017					
Species Priority	Level 3				
Survey Area	**Black Bear**	**Bobcat**	**Coyote**	**Spotted Skunk**	**Snowshoe hare and smaller mammals**
Baker River	2				
Green Lakes	5	8	1	1	54

GRAY WOLF

There were eight survey areas that followed our species specific protocols for detecting gray wolves, all were located south of I-90 (Figure 4). Our monitoring efforts dedicated to detecting wolves consisted of twenty-nine installations and a total of 2,775 trap nights making up for 29 percent of the 2017 monitoring season (Table 4, Figure 2).

While no wolves were detected in this region, a fisher was captured on camera at Blue Lake Ridge and images have been shared with our project partners involved in recent fisher reintroduction efforts. Mountain lions were seen at seven of the eight survey areas. Twelve level three species, including black bear, bobcat, coyote, elk, mule deer, both striped and spotted skunks, porcupine, raccoon, snowshoe hare and smaller mammals, livestock and

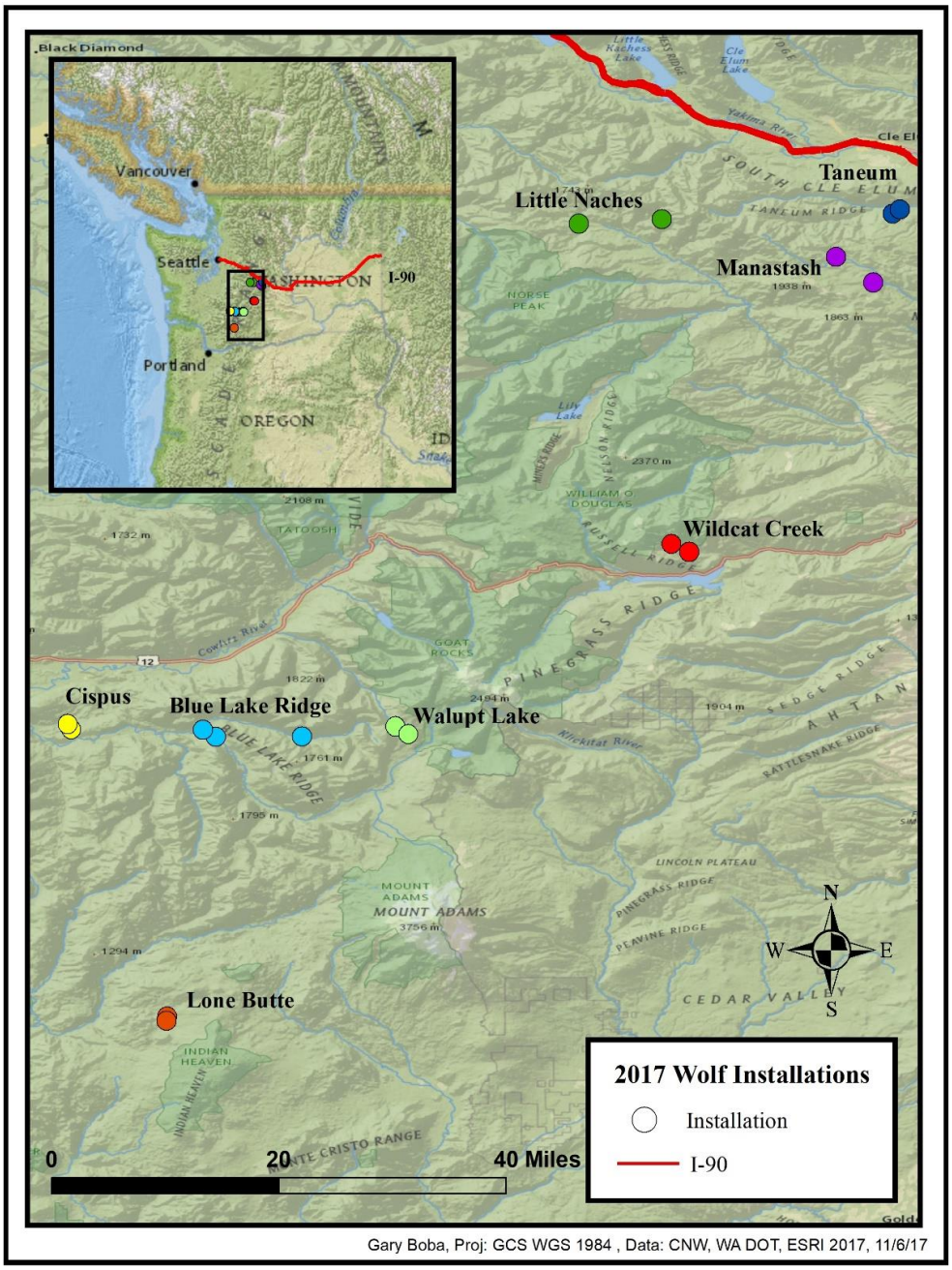

Figure 4: All gray wolf installations for 2017 were located south of the I-90 Corridor.

human (non-volunteer) (Table 5), were detected during the season. Of these species, Blue Lake Ridge detected eleven, nine were observed at Cispus and Little Naches, and eight at Manastash and Taneum. At the Blue Lake Ridge survey site, one Virginia opossum was detected and it is noted that while this species is not one of our priority species, the presence of a non-native species has been recorded.

Table 4. Information for all wolf 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.

Wolf Camera Survey Areas 2017						
Survey Area	General Region	# of Installations	Installation Date	Removal Date	Total Trap Nights	Lure
Blue Lake Ridge	GPNF	3	2016/11/04^	2017/10/08*	728	Gusto
Cispus	GPNF	3	2016/11/20^	2017/08/13	435	Gusto
Little Naches	OWNF	5	2017/06/11	2017/10/08	238	Gusto
Lone Butte	GPNF	3	2017/06/11	2017/09/10	164	Gusto
Manastash	OWNF	3	2016/10/29^	2017/10/22	679	Gusto
Taneum	OWNF	3	2017/05/25	2017/10/16	143	Gusto
Walupt Lake	OWNF	4	2017/06/03	2017/10/07	182	Gusto
Wildcat Creek	OWNF	6	2017/06/07	2017/10/11	206	Gusto

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

Species Detection Events at Wolf Camera Survey Areas 2017														
Species Priority	Level 1	Level 2	Level 3											
Survey Area	Fisher	Mountain Lion	Bobcat	Black Bear	Coyote	Elk	Mule Deer	Skunk*	Porcupine	Raccoon	Virginia Opossum	Snowshoe Hare and smaller mammals	Livestock	Human (non-volunteer)
Blue Lake Ridge	1	17	41	37	13	44	125	5**		3	1	39		10
Cispus		4	5	7	37	6	31	2~				2		42
Little Naches		3	20	1	18	45	23		3			16		14
Lone Butte		4		8	5	160	17					34		12
Manastash		12	18	11	62	35	11					77		18
Taneum		7	1		1	12	7	2~				5		14
Walupt Lake			4	4	9	16	24					6		
Wildcat Creek		3		3	5	45	3					5	58	1

GENERAL WILDLIFE ALONG THE INTERSTATE 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 2017 monitored previously established priority areas within close proximity to the freeway and wildlife crossing structures that have been completed, are under construction or have been planned as part of the I-90 Snoqualmie Pass East Project. Four of the survey areas (Gold Creek, Price Creek and Crystal Springs, and Easton) are in wildlife travel corridors leading to these crossing structures. These installations, established in the I-90 Corridor, detect general wildlife movement and presence in relation to the wildlife crossing structures. Our efforts totaled twelve discreet locations being monitored and 1,638 trap nights accounting for 17.3% of our monitoring efforts (Table 6, Figure 2).

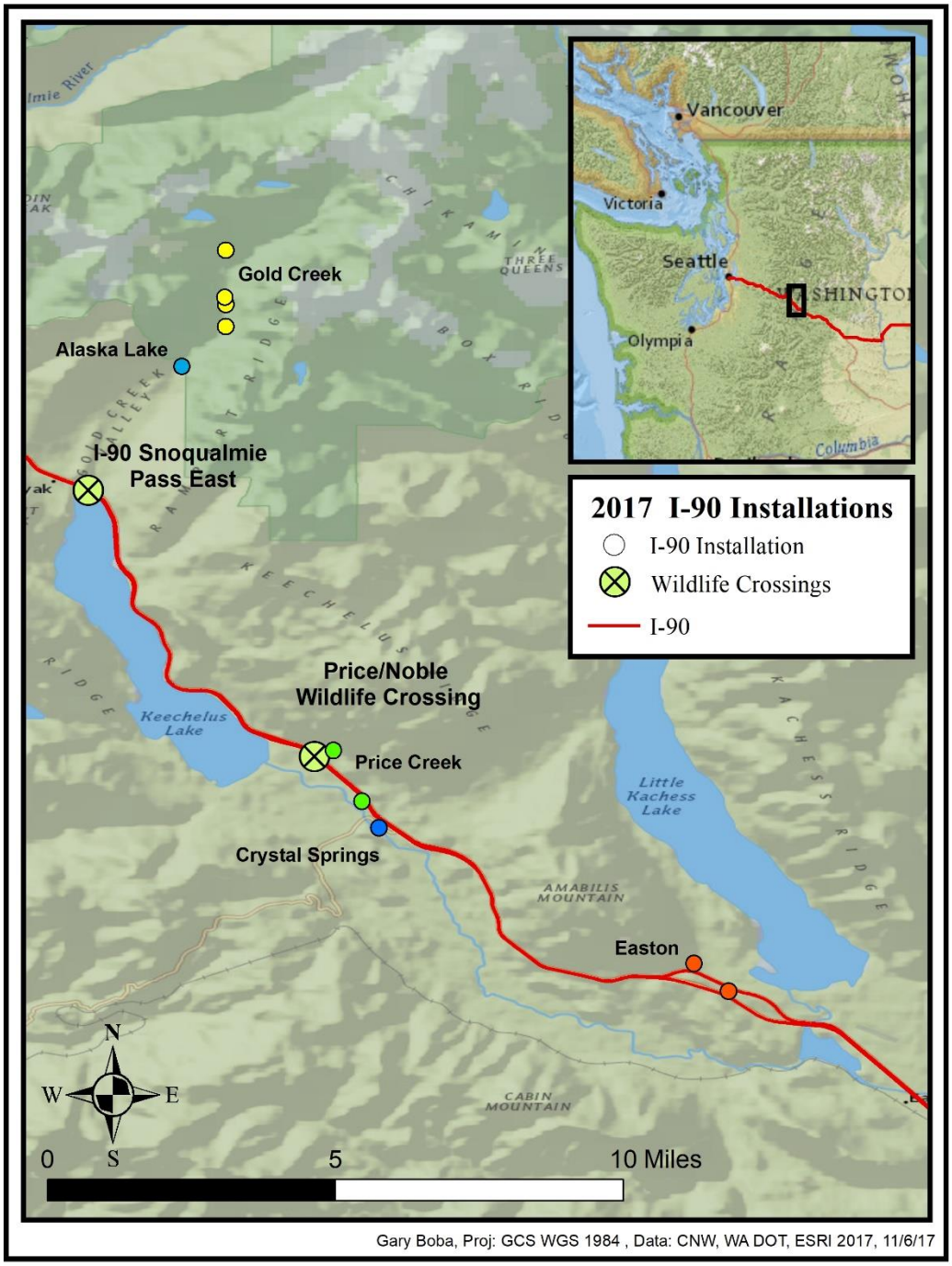

Figure 5: All general wildlife installations for 2017 were located between Hyak and Easton on the I-90 Corridor.

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 2017						
Survey Area	General Region	# of	Installation	Removal Date	Total Trap	Lure

		Installations	Date		Nights	
Alaska Lake	MBSNF	1	2017/01/20^	2017/05/25	125	None
Easton	OWNF	3	2017/01/07^	2017/09/06*	823	None
Gold Creek	OWNF	5	2017/06/04	2017/10/2	240	Gusto
Price Creek	OWNF	2	2017/06/04	2017/11/21	340	None
Crystal Springs	OWNF	1	2016/09/25^	2017/01/13	110	None

Over the course of the season, mountain lions, a level two species, were detected at both Gold Creek and Price Creek. Seven level three species, including black bear, bobcat, coyote, elk, mule deer, snowshoe hare and smaller mammals, and human (non-volunteer) were detected. All species were seen at Easton except the detection of a mountain lion (Table 7).

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

Species Detection Events at I-90 Camera Survey Areas 2017								
Species Priority	Level 2	Level 3						
Survey Area	Mountain Lion	Bobcat	Black Bear	Coyote	Elk	Mule Deer	Snowshoe Hare and smaller mammals	Human (non-volunteer)
Alaska Lake				5			51	3
Crystal Springs		3			1	1		1
Easton		6	2	9	17	17	15	13
Gold Creek	2		11	2	3		8	1
Price Creek	1			1	79	47	4	

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).

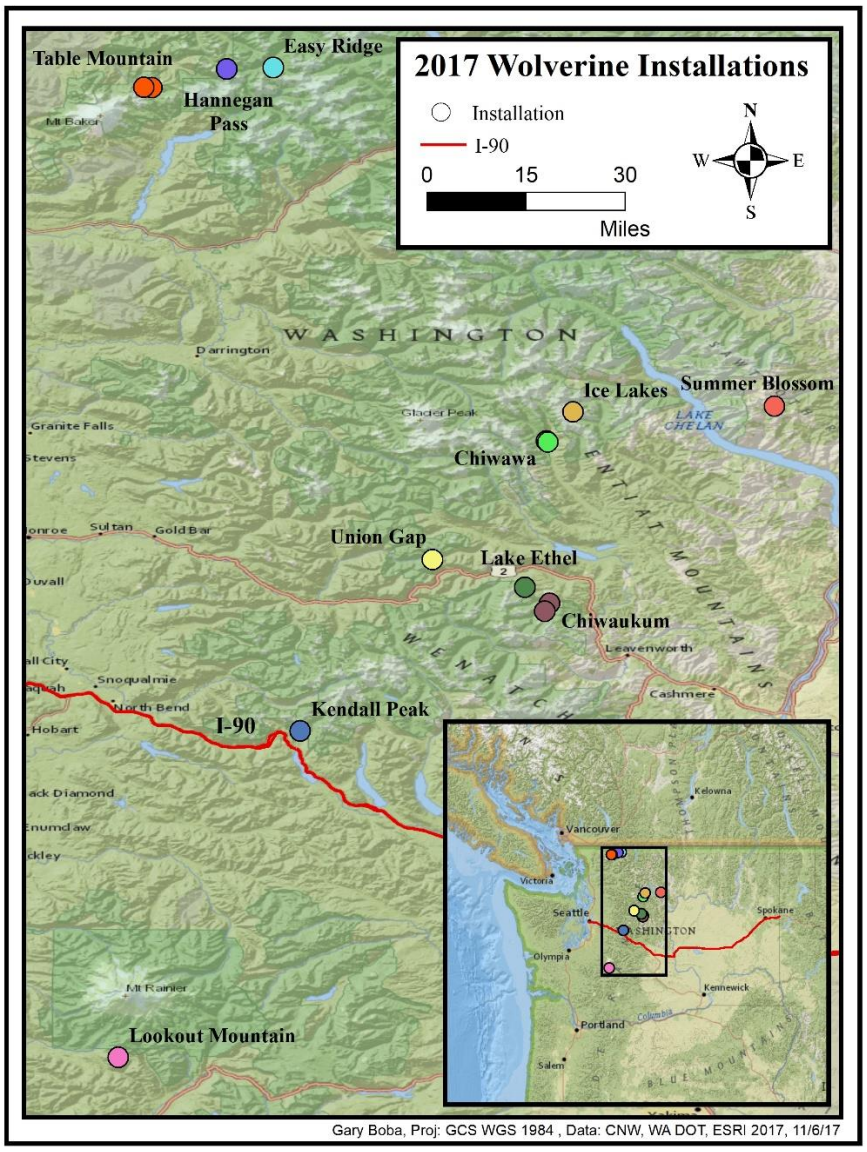

Figure 6: All wolverine installations for 2017 spanned between the Mount Baker Snoqualmie National Forest in the southwest and northwest to the Okanogan Wenatchee NF east of the cascade crest, to the North Cascades National Park in the northeast.

The wolverine monitoring included 11 distinct installations, 4004 trap nights, making up 42.3 percent of our total monitoring efforts for the year (Table 8, Figure 2). Four of our eleven wolverine survey areas were active all year in 2017: Chiwaukum, Union Gap, Lookout Mountain, and Ice Lakes. The Ice Lakes camera had not been visited since 2015, due to complications with access in 2016 due to wildfires, but was discovered active by our volunteer team and with 8 separate wolverine detections over the course of the monitoring period. Volunteers have re-baited and serviced the cameras. Numerous wolverine survey areas are currently being maintained over the winter season from 2017-2018. These active sites include: Chiwaukum, Union Gap, Lookout Mountain, and a Kendall Peak, and Lake Ethel.

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 2017 from survey areas left active over the

winter. *Denotes the last date cameras were checked, but survey area was not uninstalled. ~Cameras active over multiple years, data received in 2017.

Wolverine Camera Survey Areas 2017						
Survey Area	General Region	# of Installations	Installation Date	Removal Date	Total Trap Nights	Lure
Chiwaukum	OWNF	2	2016/12/04^	2017/09/10*	560	Gusto / Bait
Chiwawa	OWNF	2	2016/11/24^	2017/9/07	574	Gusto / Bait
Hannegan Pass+	NCNP	2	2017/08/26	2017/10/29*	64	Gusto / Bait
Ice Lakes~	OWNF	1	2015/06/19	2017/07/23*	765	Gusto / Bait
Kendall Peak+	MBSNF	1	2017/01/11^	2017/08/15*	145	Gusto / Bait
Lake Ethel	OWNF	1	2017/06/03	2017/10/18*	137	Gusto / Bait
Lookout Mountain	MBSNF	1	2016/10/29^	2017/10/28*	364	Gusto / Bait
Mountaineer Creek (Multi-St)	OWNF	1	2016/11/25^	2017/02/25	92	Gusto / Bait
Summer Blossom Ridge~	OWNF	1	2015/06/28	2017/09/25	820	Gusto / Bait
Table Mountain	MBSNF	2	2017/07/30	2017/10/15*	154	Gusto / Bait
Union Gap	OWNF	1	2016/11/19^	2017/10/14*	329	Gusto / Bait

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 run-pole can sometimes be over 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. Two survey areas did not have run-poles established; Hannegan Pass and Kendall Peaks had one camera each. The Ice Lakes and Summer Blossom Ridge cameras were installed in 2015 and data was collected in July and September, respectively, with both cameras still operational and detecting species presence.

Our cameras detected wolverines at Ice Lakes and a fisher at Lookout Mountain, both level one species. The Ice Lakes camera, which has detected wolverines in past years, was active from June of 2015 to July of 2017 and recorded eight separate detections, one with two individual wolverines passing through the site together. The wolverine detections at Ice Lakes spanned over four days in August 2016, in September a month later, again in December of 2016, and two visits eleven days apart in July of 2017. Because the site had not been rebaited in some time, the desired behavior needed to obtain photographs of an individual's unique chest blaze pattern or the act of rubbing on a hair snag for genetic samples were not achieved.

The small sample size of cells related to non-invasive genetic sampling (hair samples compared to blood or tissue) and the degradation of genetic samples from the elements, means that hair samples must be collected on frequent intervals to obtain a quality sample and put in desiccant to dry and preserve the sample from degradation [27]. In areas with high detection rates of target species, like Ice Lakes, we will be developing a plan for

[27] Correspondence with Cory Engkjer; Lab Technician; Forest Service Contractor, RMRS/Wildlife & Terrestrial Ecosystems, February, 2017.

volunteers to visit the site more frequently or have a backup team that can revisit the site.

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

Species Detection Events at Wolverine Camera Survey Areas 2017												
Species Priority	**Level 1**		**Level 2**		**Level 3**							
Survey Area	**Wolverine**	**Fisher**	**Mountain Lion**	**Marten**	**Bobcat**	**Black Bear**	**Coyote**	**Moose**	**Elk**	**Mule Deer**	**Snowshoe Hare and smaller mammals**	**Human (non-volunteer)**
Chiwaukum			1	67	10	49	9			32	193	
Chiwawa				40		31				11	77	
Hannegan Pass				8		1					7	
Ice Lakes	8		1	4		1				25	42	
Kendall Peaks				250		6					1	11
Lake Ethel			1			7	2		2	1	1	
Lookout Mountain		1	1	2	3	11	10		6	3	154	
Mountaineer Creek (Multi)				149								
Summer Blossom Ridge				9	1	3	1	3		7	71	1
Table Mountain				6		18				1	4	
Union Gap				383		2				2		

Marten and mountain lion, both level two species, were detected at ten and four of the eleven wolverine survey areas, respectively (Table 8). Eight level three species, including black bear, bobcat, coyote, moose, elk, mule deer, snowshoe hare and smaller mammals, and human (non-volunteer) were documented at the wolverine survey areas (Table 9). Marten, black bear, and snowshoe hare and smaller mammals were the most frequently detected across all wolverine survey areas, which is a similar trend as in past years (Table 9).

CANADA LYNX

Out of our four survey areas, three 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 eleven distinct camera installations on the Washington side of the border throughout the monitoring season and data was shared

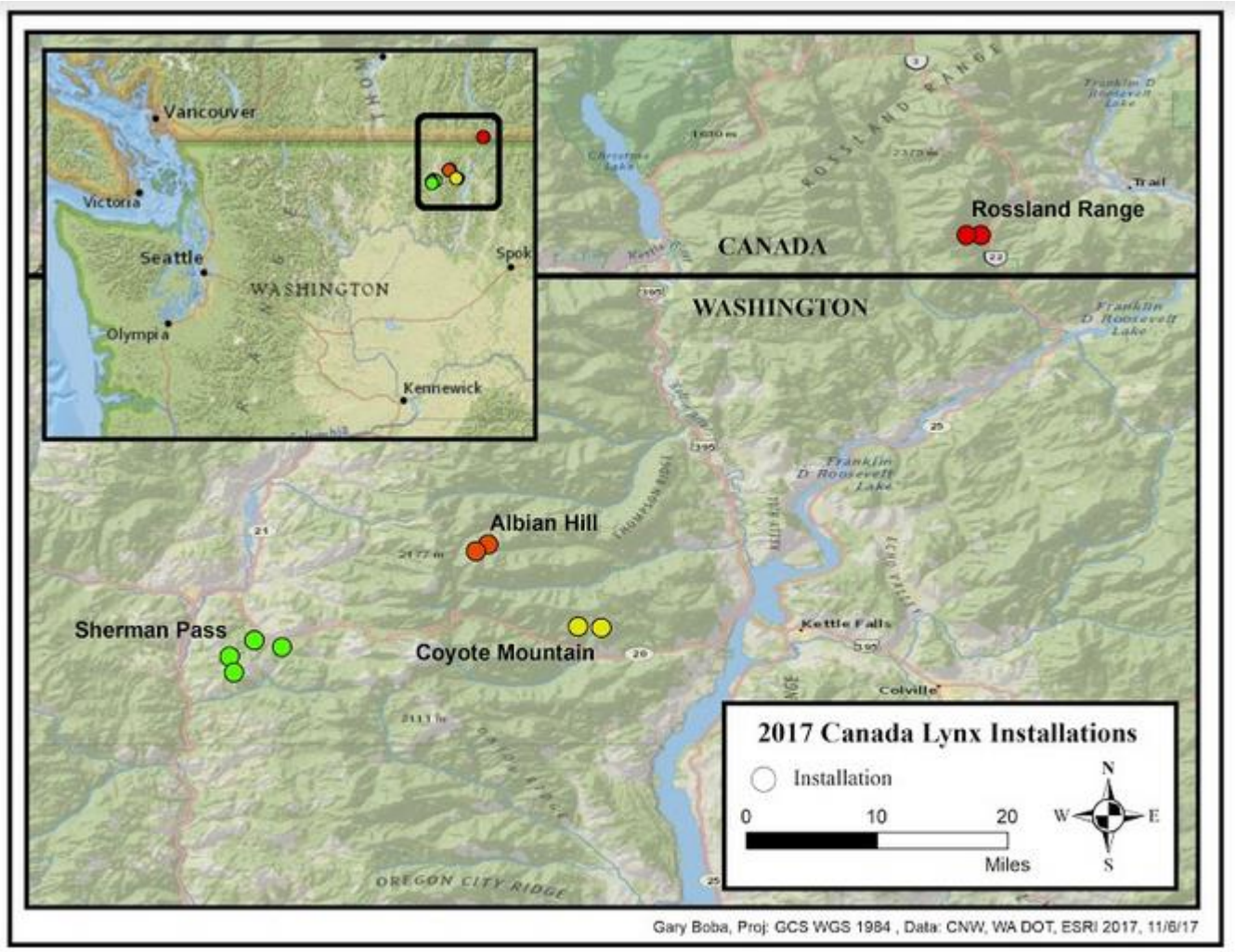

Figure 7: All Canada lynx installations for 2017 spanned from the Rossland Range to the North in British Columbia to the Kettle Range in the United States.

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

Canada Lynx Camera Survey Areas 2017						
Survey Area	**General Region**	**# of Installations**	**Installation Date**	**Removal Date**	**Total Trap Nights**	**Lure**
Albian Hill	**CNF**	**3**	**2017/06/20**	**2017/10/22**	**182**	**None**
Coyote Mountain	**CNF**	**4**	**2017/06/11**	**2017/10/07**	**236**	**None**
Rossland Range	**BCRR**	**2**	**2016/10/23**	**2017/01/14**	**166**	**Lynx**
Sherman Pass	**CNF**	**4**	**2017/06/14**	**2017/09/14***	**184**	**None**

* last revisit date/ no photos from removal date 10/14/2017

from two camera installations located in the Rossland Range in British Columbia, totaling 8.1 percent or our overall effort with 768 trap nights (Table 10, Figure 2). Our partners in BC have detected Canada lynx consistently each monitoring year since 2015 (Table 11). 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 the researchers at Selkirk College working on better understanding the lynx population within the B.C. Kettle and Rossland mountain ranges.

Of note are the gray wolf detections at the Sherman Pass and Albian Hill survey areas (Table 11). A pair travelling together, one collared and one non-collared were captured on camera, as well as two other detections of single wolves. There are 17 confirmed packs in the Eastern Washington recovery region, which means the likelihood of detecting a wolf is much higher than in the Southern Cascades and Northwest Coast recovery regions, where we have focused our wolf monitoring efforts.

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

Species Detection Events at Lynx Camera Survey Areas 2017												
Species Priority	**Level 1**		**Level 2**	**Level 3**								
Survey Area	**Wolf**	**Canada lynx**	**Mountain Lion**	**Bobcat**	**Black Bear**	**Coyote**	**White-Tailed Deer**	**Mule Deer**	**Moose**	**Striped Skunk**	**Snowshoe Hare and smaller mammals**	**Human (non-volunteer)**
Albian Hill	1		2	20	12	8	4	10	2		17	14
Rossland Range		1					4	3	1		36	
Sherman Pass	2			10	3	18	12	5		10	108	2
Coyote Mountain			5	9	15	8		29	11	1	265	123

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 2018 remote camera monitoring season are to:

1. Assess monitoring efforts for grizzly bears and other rare carnivores in the North Cascade 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. Continue to focus on wolverine monitoring in areas that are accessible safely year-round. Assess current methods for collecting hair samples at run-pole stations, establish alternate team members that can assist in maintaining a site if target species are present. Work with other research projects looking at additional monitoring methods for wolverine.
3. Reach out to colleges and universities to engage upcoming wildlife professionals in Washington wildlife monitoring and look for other opportunities to partner with ongoing efforts.
4. Develop a new strategy to obtain volunteers and coordination capacity in northeastern Washington in order to continue and improve our Canada lynx monitoring efforts in the Kettle River Range.
5. Increase coordination in planning, reporting, and processing results from efforts by CWMP, Washington

State University, and Selkirk College researchers monitoring Canada lynx in northeast Washington and southeastern British Columbia.

6. Ensure early coordination with other monitoring efforts throughout our coverage area, including professional and citizen-based research.
7. Evaluate our new data management system to facilitate data exchange between volunteers and project staff. Look for new methods of data collection that may ease data management for volunteers and project staff.
8. Provide expanded opportunities for connections between volunteers, other ongoing wildlife field research in our state, and field skill trainings.
9. Maintain clear communication with all team leaders in order to ensure that data is collected and submitted in an accurate and efficient manner. Ensure that all protocol materials are easily accessible and well-understood at the beginning of the season, particularly during the spring training.
10. Refine the training system for volunteers and develop new incentives for teams to submit data in a timely manner.
11. Continue inputting current and past year's data from the project into the new online relational database. Provide a simplified process for reporting project results and more detailed and refined analysis of project findings, and facilitate sharing with project partners.
12. Improve genetic sample collection techniques by recognizing key areas for potential sample collection and having a backup team that can visit specific sites if needed.
13. Advise volunteers to visit the site more frequently and retrieve the samples as soon as they can to ensure a high quality sample is collected to improve efficacy of analysis.

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