Kootenay Connect: Riparian Wildlife Corridors for Climate Change

Year 4 Summary Report

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All living things are connected. Kootenay Connect occurs in the beautiful, biologically diverse unceded traditional territories of the Ktunaxa, Secwépemc, Sinixt and Syilx Okanagan Nations.

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*For more information about Kootenay Connect and to access reports, maps, and videos featuring projects described in this document, visit https://kootenayconservation.ca/kootenay-connect/

Cover photo: Looking west across the Creston Valley Wildlife Management Area just south of Duck Lake to the South Selkirk Mountains. (Photo: M. Proctor).

EXECUTIVE SUMMARY

Riparian and wetland systems are biodiversity hotspots and climate refugia that also act as wildlife linkages across human-settled valleys in southern British Columbia. In the Kootenay region of southeastern BC, protecting riparian-wetland complexes is also the best opportunity for re-establishing fragmented grizzly bear populations and potentially other wildlife species. "Kootenay Connect," an initiative begun in 2019, integrates important habitats for large carnivores, ungulates, and species at risk with large riparian-wetland complexes mapped in Geographic Information Systems (GIS) to identify critical habitats and connectivity corridors at a regional scale. The premise behind Kootenay Connect is that landscape linkages focusing on large riparian-wetland complexes are essential for conserving biodiversity, habitat connectivity, species movement corridors, and ecological functions in a changing climate. This initiative has integrated the best available science and local knowledge to identify 12 focal wildlife and ecological corridors and landscape connectivity areas throughout the East and West Kootenays.

Our vision for Kootenay Connect is a regional network of ecological corridors connecting landscapes and ecosystems throughout the Kootenays.

The goals guiding Kootenay Connect are to:

1) Bring a regional connectivity dimension to conserving biodiversity by blending the best available science, local and Indigenous knowledge, and community-based approaches to large landscape conservation to identify connectivity areas throughout the East and West Kootenays focused on wildlife corridors, biodiversity hotspots, and climate change refugia.
2) Foster connectivity collaboratives throughout the Kootenays to identify priorities and opportunities for conserving biodiversity and ecological connectivity at the local scale that contribute to a regional network.
3) Assess conservation threats, and opportunities for addressing them, through strategies that will enhance the ability of networks of ecological corridors to connect different landscape elements and elevational gradients for all species.
4) Integrate climate change modelling to identify the highest priority areas in which to retain landscape connectivity as habitats shift over time, and to inform conservation and management efforts across ecosystems and jurisdictions that increase climate adaptive capacity in managed landscapes.
5) Initiate government and public recognition of the region's multi-species, multi-jurisdictional corridors as "Wildlife and Ecological Corridors" to influence policy and

management including, but not limited to, increased protected areas, establishment of park-to-park corridors, Indigenous Protected and Conserved Areas, Conservancies, Wildlife Management Areas, Wildlife Habitat Areas, private land trust acquisitions, private land habitat stewardship, and appropriate regional and provincial government land use regulations.

The Kootenay Connect Initiative evolved from a decade of research by the Trans-border Grizzly Bear Project that identified grizzly bear habitat fragmentation patterns and potential corridors across the region's human-settled valleys of southeastern BC. These findings informed targeted connectivity management that resulted in enhanced grizzly bear connectivity across the Creston Valley while protecting important endangered northern leopard frog breeding habitat.

This body of work highlighting the importance of cross-valley connectivity for multiple species in what has become known as Creston Valley's "Frog Bear Conservation Corridor," became the springboard and proof of concept for Kootenay Connect to investigate the role of riparian-wetland complexes throughout the region to provide for multiple species at risk, sensitive habitats, movement corridors, and ecological functions being influenced by climate disruption.

The lessons learned from the Creston Valley "Frog Bear Conservation Corridor" example are that scientific research can help confirm the most important locations for conservation measures across landscapes, inform specific solutions and actions, and monitor their effectiveness. Using this strategic approach, it is possible to develop conservation objectives that are compelling and lead to successful integration of multiple jurisdictions as different interests and mandates do their part to achieve a common vision for conserving ecological connectivity.

Connectivity conservation in BC relies upon 1) expanding the use of existing legal designations e.g., Conservancies, Wildlife Management Areas, and Wildlife Habitat Areas; and 2) creating a new designation of "Wildlife and Ecological Corridors" that recognizes the importance of protecting connectivity areas between existing protected areas. To advance the first point, we look to Kootenay Connect Community-Nominated Priority Places projects to provide the evidence and effort to expand the use of existing legal designations. To advance the second point, we look to the Kootenay Connectivity Working Group, a collaboration of Kootenay Connect with provincial and federal governments and First Nations that is developing an approach to recognizing and establishing Wildlife and Ecological Corridors across the Kootenay region.

Kootenay Connect has developed over four years between 2019-2023. In 2019-2020, our project focused on four focal corridors: the Creston Valley and Bonanza Biodiversity Corridor in

the West Kootenay, and the Columbia Wetlands and Wycliffe Wildlife Corridor in the East Kootenay. In 2020-2021, our focus grew to include the Duncan Lardeau Valley at the north end of Kootenay Lake and the Slocan River Valley in the West Kootenay, and Columbia Lake and Golden areas in the East Kootenay. In 2021-2022, we included the Retallack Corridor at the mountain pass on Highway 31A between Kaslo and New Denver and South Selkirks-Lower Columbia area in the West Kootenay, and the South Country located southeast of Cranbrook and Elk Valley in the East Kootenay. In 2022-2023, we supported corridor conservation planning and activities in all 12 focal corridors.

A key objective of Kootenay Connect is to develop new, or strengthen existing, partnerships by building on the growing capacity of conservation collaboratives comprised of diverse groups with a common interest in developing place-based solutions for local landscapes. We are working with Kootenay Conservation Program, a regional network of over 85 partners, and key agencies such as, BC's Together for Wildlife Program, Parks Canada, BC Parks, Ktunaxa Nation Council, and Shuswap Band, to develop a mosaic of corridor-specific conservation strategies, activities, and solutions that include private and public lands to improve management within and across Kootenay Connect's 12 focal corridors.

These collaborations have led to identifying areas for strategic private land acquisitions; farm stewardship plans; and enhancements to and possible expansions of Wildlife Management Areas and BC's protected areas system. We have also provided Regional Districts with scientific rationale for development permitting and zoning regulations; informed riparian-wetland restoration; supported landowner education and assistance for stewardship to help improve private land management; and contributed our results to fundraising efforts to benefit landscape-level conservation.

This Year 4 Summary Report of Kootenay Connect's activities and results is intended to update (and replace) our previous annual reports produced in 2019, 2020, and 2021. Here we report on an extensive body of results spanning 2019-2023 from the various streams of the Kootenay Connect Initiative including Kootenay Connect Community-Nominated Priority Places supported by $2 million from Environment and Climate Change Canada funding directed into on-the-ground habitat enhancement and restoration across the Kootenays; Kootenay Connect Workshops supported by approximately $80,000 from the Fish & Wildlife Compensation Program to develop coordinated approaches to assessing wildlife corridors and advancing connectivity conservation; and the Kootenay Connectivity Working Group supported by approximately $80,000 from a combination of Parks Canada, BC's Together for Wildlife Program, and the Sitka Foundation to develop multi-jurisdictional corridor conservation and management plans.

Kootenay Connect's collective on-the-ground conservation and management actions are supporting the recovery of 34 federally listed species at risk and working to help Canada achieve its goal of conserving 25% of its land and water by 2025, and an important milestone of conserving 30% by 2030.

To date, Kootenay Connect Community-Nominated Priority Places and our partners have collectively delivered over 50 subprojects. Below are examples of what's been achieved and the conservation impact.

Numerous field studies on species at risk
Annually monitoring North American Bat grid cells in all Kootenay Connect focal corridors for the 13 species of bats found in the region
Field surveys documenting Lewis's woodpecker and osprey nests, western painted turtle sites, and American badger burrows in and adjacent to the Columbia Wetlands
Continuing to add to an extensive species inventory in the Bonanza Biodiversity Corridor of 1,425 unique species being recorded with 55 of them federally listed species at risk
Examining 79 natural levee openings and 359 beaver dams to determine the critical importance of beaver activity for hydrological function of the Columbia Wetlands and its potential to mitigate the impacts from climate change
Key habitat restorations
Enhancing 5 km^2 of wetland & riparian habitat in the Creston Valley Wildlife Management Area that has benefitted the endangered northern leopard frog
Excavating a series of earthen swales to reconnect wetlands across a rail trail berm and installing a recreational walkway to permit water flow and protect vulnerable migrating western toadlets moving underneath
Completing over 90 ha of forest thinning projects to enhance grassland & dry forest habitat to benefit Williamson's sapsucker, Lewis's woodpecker and American badger
Planting over 2,000 native trees and shrubs in wetland and riparian areas
Managing over a dozen invasive plants to improve grasslands and riparian areas

Enhancement of habitat features
Installing 24 western painted turtle basking logs, securing 2 important turtle nesting beds, and constructing beaver dam analogues to retain water in vulnerable wetlands
Creating 29 tree roosts using artificial BrandenBark™ and wildlife tree roosts to mimic old growth and improve nearly 75,000 ha of habitat for bats
Installing 20 km of wildlife-friendly fencing to improve grassland and dry forest habitat
Mapping and assessments to inform project planning
Using LiDAR, Terrestrial Ecosystem Mapping (TEM), orthophotos, and remote sensing to produce some of the first landscape level maps and classified habitat types for the Columbia Wetlands and Bonanza Biodiversity Corridor
Identifying and assessing the hydrology of vulnerable wetlands and the need for enhanced hydrological connection between the Columbia River and Wetlands
Identifying multi-species corridors for six target carnivore and ungulate species
Identifying climate change refugia and corridors for Kootenay Connect's landscapes
Projects achieving important conservation measures
Submitting applications for designating Wildlife Habitat Features to protect mountain goat mineral licks and for registering 790 functioning badger burrows
Submitting applications for designating Wildlife Habitat Areas for great blue heron, American badger, and the rare alkali saltgrass–foxtail barley ecological community
Documenting new active Lewis's woodpecker nests informed our recommendations to expand critical habitat under the federal Species at Risk Act when the recovery strategy is revised
Acquiring 3 conservation properties in Kootenay Connect focal corridors totaling 126 ha by The Nature Trust of BC and Nature Conservancy of Canada

We found there are consistent and similar conservation values and threats within Kootenay Connect's 12 focal corridors yet with just enough variation to illustrate that there is no cookie-cutter approach to address connectivity in the region. Selection of specific tools and who could lead conservation and stewardship activities must consider both a place-based and regional understanding of threats to successfully address loss of biodiversity and habitat and to mitigate the impacts of climate change if ecosystems in the Kootenays are to become more resilient.

Looking across Kootenay Connect's 12 focal corridors at a high level, we recommend:

1. Including local First Nations' knowledge and perspectives into the visioning and planning of landscape level conservation in a manner that respects Indigenous leadership, values, rights, and practices.
2. Improving efforts to inventory species at risk and other locally and culturally important species to capture existing biodiversity.
3. Prioritizing the identification of critical habitats and biodiversity hotspots to increase opportunities for their protection.
4. Utilizing Kootenay Connect's mapping of connectivity areas that link valley bottoms with riparian-wetland areas to upland habitat to guide protection of species whose inter-seasonal and inter-generational life cycles and migrations span the riparian-upland interface, such as western toad, western painted turtle, great blue heron, and western screech-owl.
5. Examining where pinch point locations occur across roadways that could be addressed with wildlife crossing structures and continuing to work with researchers who bring forward new data to optimize locations of wildlife corridors and highway crossing hotspots.
6. Increasing the effectiveness of measures to reduce recreational access and pressures impacting species at risk, high-quality habitats, and connectivity by identifying access management areas in and adjacent to Kootenay Connect's focal corridors.
7. Assessing landscapes in terms of conservation opportunities for both private and public land, for example, being creative about how land trust acquisitions can complement provincial conservation land designations such as Wildlife Management Areas and Wildlife Habitat Areas that benefit species at risk.
8. Viewing landscape-scale processes such as fire dynamics, forest regeneration, invasive species management, predator-prey cycles, hydrologic fluctuations, and climate change as necessitating the integration of private and public land management solutions.
9. Ensuring all conservation strategies are developed through a climate change adaptation lens so there are a variety of options that will allow management actions to be more adaptive to unpredictable consequences such as catastrophic fires.
10. Enhancing riparian-wetland hydrologic connectivity throughout the region to increase climate resilience and mitigate drought such as, reconnecting wetlands within floodplains, reopening vegetation-choked channels, and beaver enhancement through reintroduction or dam analogues.
11. Identifying and developing, where needed, best management practices for target species in corridors to guide human behaviours and activities that are compatible and support coexistence with wildlife.

12. Developing a communications package that summarizes for the public and politicians the benefits and necessity of establishing Ecological Corridors for the health of ecosystems, biodiversity conservation, and resilience to climate change impacts.
13. **Facilitating dialogues between all levels of government and First Nations to advance a multi-agency landscape approach to connectivity conservation that will secure safe passage for wildlife and enhance climate change resilience.**
14. **Developing a collaborative process to develop a Wildlife and Ecological Corridors Plan that leads to formal designation of Wildlife and Ecological Corridors in landscapes important for connectivity in the Kootenay region.**

Conserving connectivity is critical to maintaining the biological and ecological resilience of the Kootenay region. Our last two recommendations are bolded because based on the past four years of research, workshops, and meetings throughout the Kootenays, we believe it's imperative to begin envisioning a process to formally designate a network of Wildlife and Ecological Corridors with federal, provincial, First Nation, and regional district governments, and land trusts. This type of cooperation is necessary to develop and implement a connectivity conservation strategy and best management practices for the Kootenay region as a model for British Columbia and Canada that will elevate connectivity into legislative, policy, and regulatory arenas for the benefit of nature and humanity.

Grizzly bear using valley bottom riparian habitat in a Kootenay Connect corridor. (Photo: G. MacHutchon).

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DEFINITION OF ACRONYMS

ALR	Agricultural Land Reserve
BBC	Bonanza Biodiversity Corridor
BCO	Biodiversity Conservation Opportunity
BMP	Best Management Practices
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CNPP	Community-Nominated Priority Places
CVWMA	Creston Valley Wildlife Management Area
CWWMA	Columbia Wetlands Wildlife Management Area
CWS	Canadian Wildlife Service
CWSP	Columbia Wetlands Stewardship Partners
EDPA	Environmental Development Permit Area
EKWA	East Kootenay Wildlife Association
ESA	Environmentally Sensitive Area
ESCLWMA	East Side Columbia Lake Wildlife Management Area
FRPA	Forest and Range Practices Act
FWCP	Fish & Wildlife Compensation Program
GIS	Geographic Information System
IPCA	Indigenous Protected and Conserved Areas
IUCN	International Union for Conservation of Nature
KC	Kootenay Connect
KCP	Kootenay Conservation Program
MOF	Ministry of Forests
MWLRS	Ministry of Water, Lands and Resource Stewardship
NCC	Nature Conservancy of Canada
NGO	Non-governmental Organization
NTBC	The Nature Trust of British Columbia
OCP	Official Community Plan
OECM	Other Effective Area-based Conservation Measures
OGMA	Old Growth Management Area
ONA	Okanagan Nation Alliance
RDCK	Regional District of Central Kootenay
RDEK	Regional District of East Kootenay
RSF	Resource Selection Function
SIFCo	Slocan Integral Forestry Cooperative
SLSS	Slocan Lake Stewardship Society
SRS	Slocan River Streamkeepers
SWAMP	Slocan Wetlands Assessment & Monitoring Project
TBGBP	Trans-Border Grizzly Bear Project
TWA	Trail Wildlife Association
WHA	Wildlife Habitat Area
WHF	Wildlife Habitat Feature

1 INTRODUCTION

Riparian and wetland systems are biodiversity hotspots and climate refugia that also act as wildlife linkages across human-settled valleys in southern British Columbia. In the Kootenay region of southeastern BC, protecting riparian-wetland complexes is also the best opportunity for re-establishing fragmented grizzly bear populations and potentially other wildlife species. "Kootenay Connect," an initiative begun in 2019, integrates important habitats for large carnivores, ungulates, and species at risk with large riparian-wetland complexes mapped in Geographic Information Systems (GIS) to identify critical habitats and connectivity corridors at a regional scale. The premise behind Kootenay Connect is that landscape linkages focusing on large riparian-wetland complexes are essential for conserving biodiversity, habitat connectivity, wildlife movement corridors, and ecological functions in a changing climate. This initiative has integrated the best available science and local knowledge to identify 12 focal wildlife and ecological corridors throughout the East and West Kootenays.

Our vision for Kootenay Connect is a regional network of ecological corridors connecting landscapes and ecosystems throughout the Kootenays.

1.1 GOALS GUIDING KOOTENAY CONNECT

The goals guiding Kootenay Connect are to:

1) Bring a regional connectivity dimension to conserving biodiversity by blending the best available science, local and Indigenous knowledge, and community-based approaches to large landscape conservation to identify connectivity areas throughout the East and West Kootenays focused on wildlife corridors, biodiversity hotspots, and climate change refugia.
2) Foster connectivity collaboratives throughout the Kootenays to identify priorities and opportunities for conserving biodiversity and ecological connectivity at the local scale that contribute to a regional network.
3) Assess conservation threats, and opportunities for addressing them, through strategies that will enhance the ability of networks of ecological corridors to connect different landscape elements and elevational gradients for all species.
4) Integrate climate change modelling to identify the highest priority areas in which to retain landscape connectivity as habitats shift over time, and to inform conservation and

management efforts across ecosystems and jurisdictions that increase climate adaptive capacity in managed landscapes.

5) Initiate government and public recognition of the region's multi-species, multi-jurisdictional corridors as "Wildlife and Ecological Corridors" to influence policy and management including, but not limited to, increased protected areas, establishment of park-to-park corridors, Indigenous Protected and Conserved Areas, Conservancies, Wildlife Management Areas, Wildlife Habitat Areas, private land trust acquisitions, private land habitat stewardship, and appropriate regional and provincial government land use regulations.

Throughout this document we refer to *ecological connectivity* – the unimpeded movement of species and flow of natural processes that sustain life on Earth[1] – as an essential part of nature and necessary for the functioning of ecosystems, survival of wild animals and plant species, persistence of genetic diversity, and adaptation to climate change across all biomes and spatial scales. *Connectivity conservation* is dependent upon maintaining, enhancing, or restoring ecological connectivity. It is a direct response to the degradation and fragmentation of habitats and loss of species and is key to safeguarding habitats, biodiversity, and ecosystem processes such as migration, predator-prey cycles, fire dynamics, hydrology, nutrient cycling, pollination, seed dispersal, forest regeneration, climate resilience, and disease resistance.

This Year 4 Summary Report of Kootenay Connect's activities and results updates (and replaces) our previous years' reports (Proctor and Mahr, 2019, 2020, 2021). Here we report on an extensive body of results spanning 2019-2023 from the various streams of the Kootenay Connect Initiative including:

- **Kootenay Connect Community-Nominated Priority Places** supported by $2 million from Environment and Climate Change Canada funding directed into on-the-ground habitat enhancement and restoration in 4 of Kootenay Connect's 12 focal corridors, i.e., Creston Valley, Bonanza Biodiversity Corridor, Wycliffe Wildlife Corridor, and Columbia Wetlands.
- **Kootenay Connect Workshops** supported by approximately $80,000 from the Fish & Wildlife Compensation Program to develop coordinated approaches to assessing wildlife corridors and advancing connectivity conservation in all 12 Kootenay Connect focal corridors which included the 4 corridors (from above) in Year 1 (2019-2020); the Duncan Lardeau Valley, Slocan Valley, Columbia Lake, and Golden added in Year 2 (2020-2021); and the Elk Valley, South Country, Retallack Corridor, and South Selkirks-Lower Columbia added in Year 3 (2021-2022) (Figure 1).

[1] https://www.cms.int/en/topics/ecological-connectivity

- **Kootenay Connectivity Working Group** supported by approximately $80,000 from a combination of Parks Canada, BC's Together for Wildlife Program, and the Sitka Foundation to develop multi-jurisdictional corridor conservation and management plans.

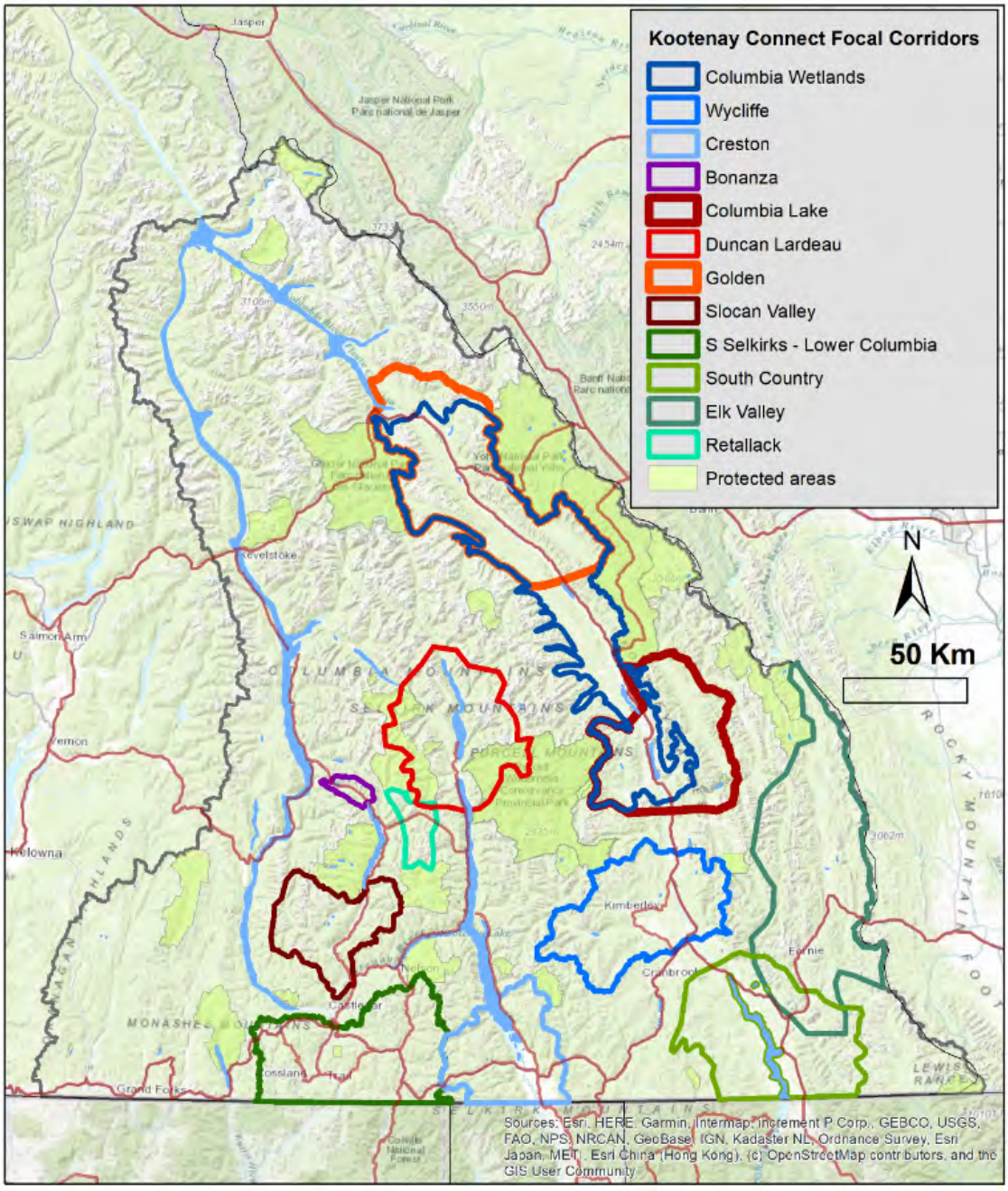

Figure 1. Kootenay Connect's 12 focal corridors across the Kootenay region encompassing 18,000 km^2. (Source: Kootenay Connect).

1.2 HOW THIS REPORT IS ORGANIZED

This Year 4 Summary Report is organized into two main parts, Background and Results, and broken down into the following sections.

BACKGROUND

1. **Section 2.1** discusses the successful components of the Creston Valley's Frog Bear Conservation Corridor and considers how the Creston Valley "proof of concept" is being applied to other potential landscapes in the region that have high biodiversity within wildlife movement corridors.
2. **Section 2.2** explores the intellectual, scientific, and conservation rationale for the concept of Kootenay Connect.
3. **Section 2.3** describes how the original Kootenay Connect concept was expanded to identify 12 connectivity corridors with conservation targets and ecological threats, as well as local champions to develop initial conservation management frameworks.
4. **Section 2.4** highlights global and regional initiatives that illustrate how Kootenay Connect aligns with strategies and goals operating in a larger context, and how this initiative can help the Kootenay region contribute to these broader conservation initiatives.
5. **Section 2.5** identifies potential conservation tools, such as protections, laws, policies, regulations, and management plans that could be applied to conservation and management of wildlife corridors and areas of high biodiversity within a variety of jurisdictions, both public and private.

RESULTS

6. **Section 3** provides results of Years 1-4 activities in 12 focal corridors, and proposes a framework for identifying, prioritizing, and implementing conservation actions. The results of the four Kootenay Connect Community-Nominated Priority Places focal corridors are presented first followed by progress on the eight remaining focal corridors.
7. **Section 4** identifies key outcomes from projects discussed in Section 3 and recommendations to effectively deliver Kootenay Connect in the future.

This report updates and replaces our previous reports (Proctor and Mahr, 2019, 2020, 2021) and highlights the results of scientific analysis, mapping, and local engagement we have accomplished to advance connectivity conservation in 12 focal corridors.

It also incorporates on-the-ground conservation actions accomplished with our Canada Nature Fund Community-Nominated Priority Places project funded by Environment and Climate Change Canada which provides an excellent example of the realization of Kootenay Connect's impact on conservation.

NOTE TO READER: This multi-year, geographically broad initiative has accumulated many results over the past four years. Here we briefly provide the background, scientific justification, and rollout of the Kootenay Connect Initiative. Due to the extensive results, we recommend that readers use the Table of Contents to navigate to the background sections and focal corridor results relevant to their interests.

2 BACKGROUND

2.1 WHERE IT BEGAN: CRESTON VALLEY 'PROOF OF CONCEPT'

In 2005, researchers from the Trans-border Grizzly Bear Project (TBGBP) radio-collared an adult male grizzly bear in the South Purcell Mountains, high in the Kidd Creek watershed east of the town of Creston. The next April, this bear frequented the north end of the Creston Valley, just south of Duck Lake. Each evening he would leave the mountains, moving west across Highway 3A, the Kootenay River, and much of the Creston Valley to reach good spring habitat in the Creston Valley Wildlife Management Area (CVWMA), and returned to the mountains during daylight. With a remote camera, TBGBP documented that he was using a very well-used wildlife trail that was also being utilized by many other large wildlife that shared time between the rich productive valley bottom habitats and adjacent upland forests. This male bear's movements inspired TBGBP to include the Creston Valley and the 7,000-ha (17,000-acre) CVWMA – originally established in 1968 for wildlife and waterfowl conservation and flood control – as integral to their transboundary grizzly bear research program.

Over the following decade, TBGBP collected ample evidence that the riparian-wetland complexes of the CVWMA (which covers 41% of the valley bottom between Kootenay Lake and the US border; Figure 2) were important seasonal and connectivity habitats for grizzly bears from the South Selkirk and Purcell Mountains (Proctor et al., 2015), and were part of a regional solution to reconnect a metapopulation of grizzly bears that had been extensively fragmented (Proctor et al., 2012). Not only did TBGBP's connectivity habitat modelling suggest the Creston Valley would be important for re-establishing movements between mountain ranges, but the bears were also validating their predictions. The TBGBP therefore chose the Creston Valley to focus connectivity management efforts on what amounted to an experimental question: *Could we reconnect the decades-long isolated South Selkirk grizzly bear population to the larger healthier population in the South Purcell Mountains?*

From 2005-2017, TBGBP's management activities in the Creston Valley centred on grizzly bear connectivity, with the idea that conserving an umbrella species such as grizzlies might be a useful strategy for protecting the needs of other species. Therefore, one of their primary activities was to expand the conservation utility of the CVWMA as the centrepiece for east-west inter-mountain connectivity. Although the north-south ecosystem and species connectivity is equally important in this transborder region, particularly in terms of climate change, the TBGBP had to act immediately on conserving this cross-valley linkage area at the south end of Kootenay Lake as the best opportunity to maintain resilient grizzly bear populations in the area into the future. And as we now know, north-south and east-west habitat connectivity is

required for promoting biological resilience under climate change in the transboundary Creston Valley region.

a) b)

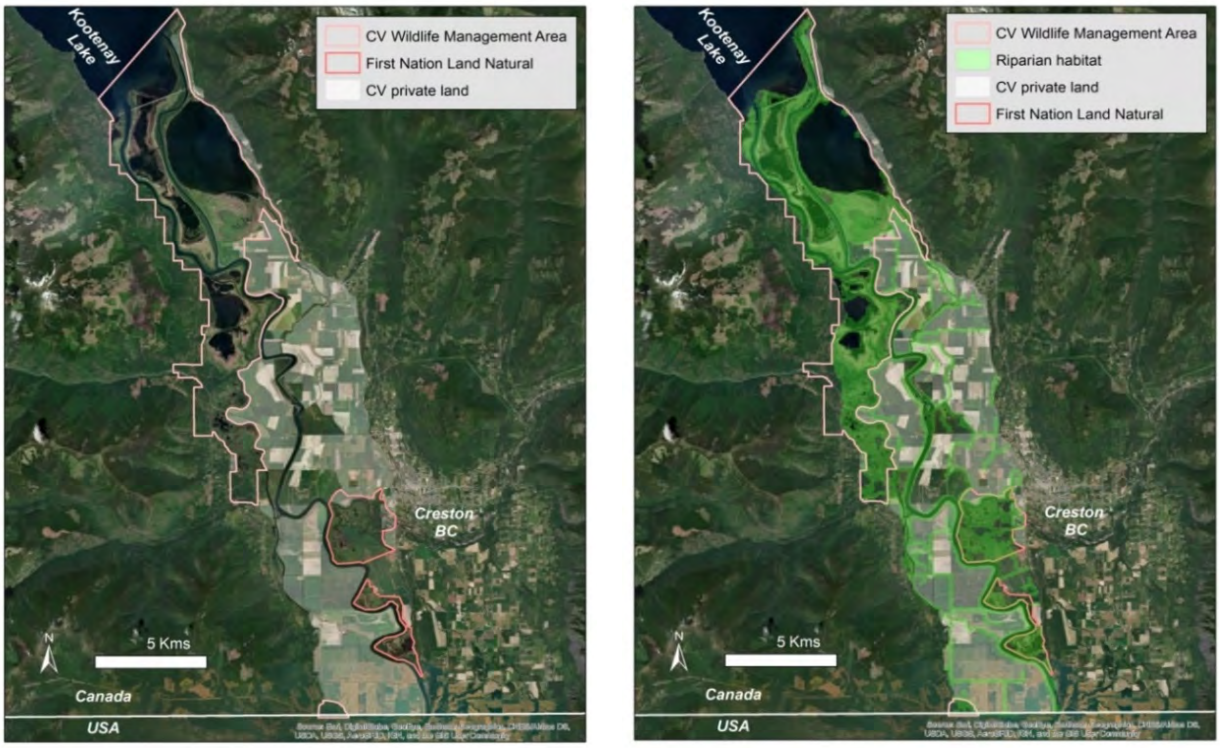

Figure 2. a) The Creston Valley matrix of private lands and farms and the Creston Valley Wildlife Management Area; and b) same landscape with the extensive riparian-wetland habitats indicated in lighter green. (Source: Kootenay Connect).

With data and maps of actual and predicted grizzly bear movement in hand, TBGBP started working with the Nature Conservancy of Canada (NCC) and Yellowstone to Yukon Conservation Initiative (Y2Y) in 2009 to strategically purchase land and establish conservation covenants[2] with willing landowners that would enhance ecological connectivity in the east-west dimension across the human-settled valley bottom. Because some of the purchased properties were being used for agriculture and were included in BC's Agricultural Land Reserve (ALR), TBGBP and NCC acquired a variance from the BC Agricultural Land Commission to place restrictions on

[2] A conservation covenant or easement is a voluntary legal agreement between a landowner and a conservancy or land trust which is registered on the land title to ensure conservation values are protected in perpetuity and enforced by the agreement.

agricultural activities to be “wildlife friendly.” Currently, these purchased lands are managed for wildlife connectivity and northern leopard frog conservation.

To support coexistence with wildlife, TBGBP worked with local farmers and ranchers to integrate wildlife-friendly activities and use electric fencing to secure wildlife attractants. The primary goal of this community-based management effort was to reduce human-wildlife conflict, ultimately resulting in improved human safety, decreased property damage (of crops, livestock, fences, etc.), and increased tolerance by humans. After a decade of conservation management, TBGBP documented an increase in inter-mountain movement and breeding of grizzly bears across the valley in the “Frog Bear Conservation Corridor” (Proctor et al., 2018). After four more years of research and management, the once isolated South Selkirk grizzly bear population appears to be fully connected across the Creston Valley. As of 2023, 9 grizzly bears have immigrated into the population and have spawned 27 offspring (12 females, 15 males). This significant increase in population size supported the idea that this once small, isolated, and threatened Canadian grizzly bear population is likely recovered (Proctor et al., 2023).

The lessons learned from the Creston Valley “Frog Bear Conservation Corridor” example are that scientific research can help confirm the most important locations for conservation measures across landscapes, inform specific solutions and actions, and monitor their effectiveness. Using this strategic approach, it is possible to develop conservation objectives that are compelling and lead to successful integration of multiple jurisdictions as different interests and mandates do their part to achieve a common vision for conserving ecological connectivity.

In the case of the Creston Valley, TBGBP engaged provincial, regional, and municipal governments, private landowners, conservation organizations, and research scientists to facilitate improved landscape-level connectivity and enhanced conservation benefits of the CVWMA. This result has not only reconnected an isolated grizzly bear population and increased protection for an endangered amphibian’s breeding area, but it has also led to a local culture of conservation as residents fence fruit orchards and manage bear attractants in an effort to coexist with grizzly bears and avoid driving their vehicles on dike roads adjacent to northern leopard frog breeding ponds. (See Section 3: Results for more information about projects in the Frog Bear Conservation Corridor in the Creston Valley).

2.2 SCIENTIFIC RATIONALE FOR KOOTENAY CONNECT

The impetus for developing Kootenay Connect is based on ecological principles, with downstream social, political, and economic implications. As described in Section 2.1, the TBGBP identified corridors for grizzly bears using telemetry and modelling for over 20 years across the

Kootenay region (Proctor et al., 2015) in response to evidence of extensive population-level fragmentation due to human-settled valleys with major highways (Proctor et al., 2012). Based on this work, the TBGBP developed a connectivity management approach focused on the Creston Valley and over time successfully re-established connectivity between the South Selkirk and South Purcell Mountains in that area (Proctor et al., 2018, 2023). The main linkage area was the northern end of the Creston Valley, which is dominated by a large world-class riparian-wetland complex that is also a regional biodiversity hotspot[3] (Figure 3). It became clear that many of the predicted grizzly bear connectivity areas in Proctor et al. (2015) also clearly overlapped with valley bottom riparian-wetland complexes. These findings led Proctor and Mahr (2019) to consider other important regional linkage areas and develop a landscape-scale approach to identifying a regional network of corridors.

The Kootenay Connect initiative was designed to build on conservation success in the Creston Valley by investigating the role of riparian-wetland complexes throughout the region to provide for multiple species at risk, sensitive habitats, movement corridors, and ecological functions being influenced by climate change. Figure 3 shows overlap areas between predicted grizzly bear linkages and riparian habitat. The overlap area were preliminary riparian-wetland biodiversity hotspot corridors that became candidates for connectivity conservation within Kootenay Connect.

2.2.1 WILDLIFE CORRIDORS AND RIPARIAN-WETLAND AREAS

We know that riparian-wetland areas often have higher species richness and abundance than adjacent upland habitats (Klein et al., 2009; Kinley and Newhouse, 1997; Hauer et al., 2016) as well as different suites of species (Sabo et al., 2005). These areas also provide many ecosystem services and facilitate ecological processes including species migration along their lengths and across their widths as connections to important upland habitats (Naiman et al., 1993; Klein et al., 2009; Hauer et al., 2016). Several ecological processes spill over from riparian-wetland areas into adjacent uplands to capture seasonal habitat requirements of species that rely on riparian habitats for some portion of their annual needs (Semlitsch and Bodie, 2003; Hauer et al., 2016), particularly for amphibians (Todd et al., 2009; Cushman, 2006; Bull, 2006) as is the case for the Creston Valley northern leopard frog population and the region's grizzly bears (Proctor et al., 2012, 2015).

[3] https://www.crestonwildlife.ca/wetlands/biodiversity

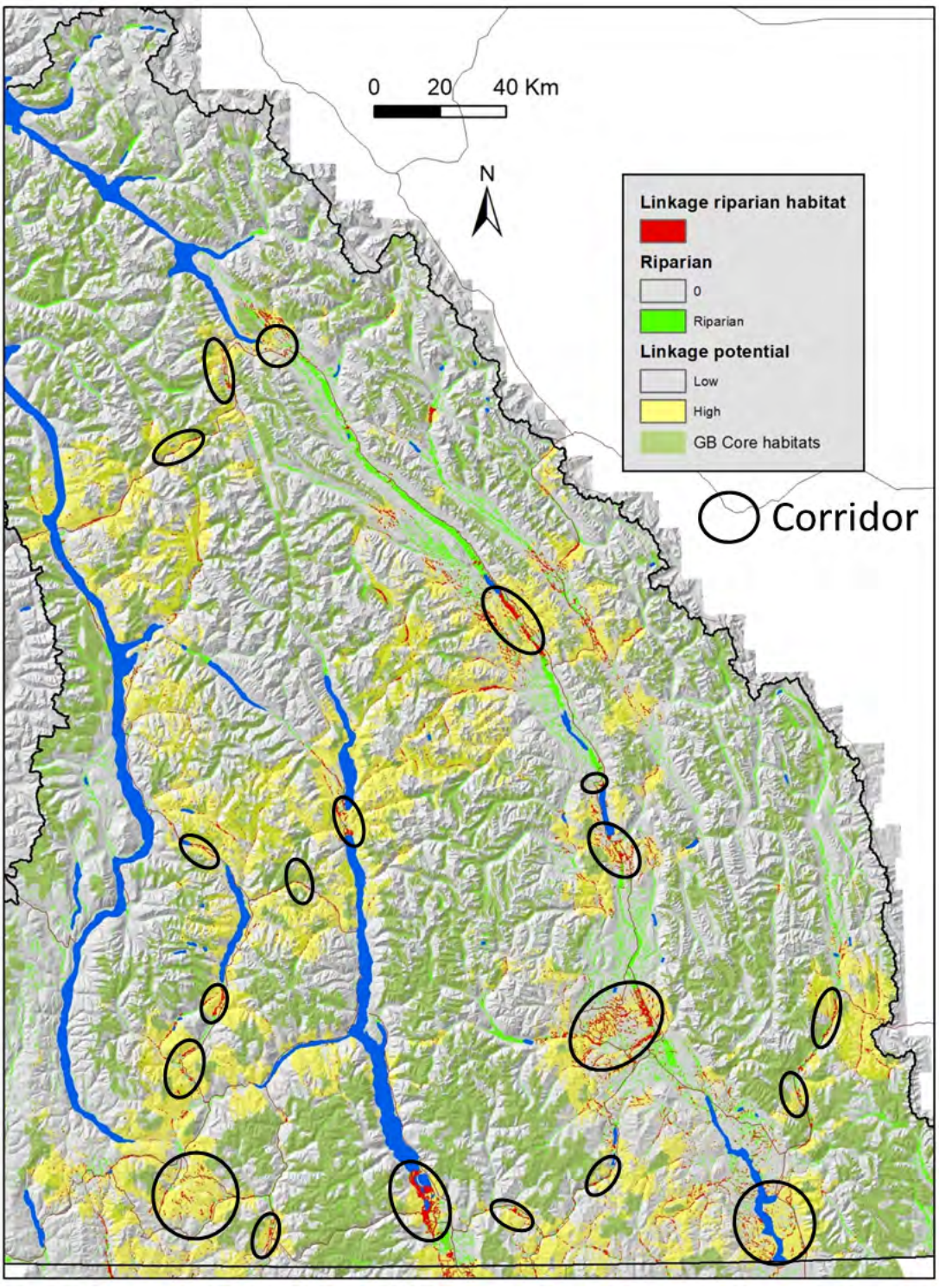

Figure 3. Map of the Kootenay region that illustrates the overlap areas (red) between predicted grizzly bear linkages (yellow) and riparian habitat (bright green) that are potential focal corridors for Kootenay Connect. (Source: Kootenay Connect).

These riparian-wetland complexes are also excellent biodiversity hotspots and potential refugia from the impacts of climate change (Capon et al., 2013; Davies, 2010). It has been suggested that to effectively manage for biological diversity (including ecological processes and ecological diversity), a landscape perspective is required (Naiman et al., 1993) that integrates adjacent upland habitats with adjacent valley bottom riparian-wetland areas (Hilty et al., 2020; Strahlberg et al., 2020) and agricultural lands (Harvey et al., 2008). Thus, moving from the concept of landscape connectivity into management involves identifying and protecting areas of high biological diversity, linking upland habitats with riparian-wetland ones to benefit multiple species of interest (Olson et al., 2007), and establishing recognized wildlife corridors across landscapes (Hilty and Merenlender, 2004; Todd et al., 2009).

Considering the entire landscape, grizzly bears are a useful umbrella species in our region because they have large home ranges and use almost all habitat types throughout a year (Steenweg et al., 2023). Thus, to maintain regionally healthy grizzly populations, it is necessary to maintain a wide variety of habitats in reasonably natural condition and with connectivity areas linking mountain ranges. Given the impacts of human-caused and natural fragmentation in the Kootenays, areas with both suitable habitats and connectivity are limited and must be protected to secure a large-scale grizzly bear metapopulation (Proctor et al., 2012; Hauer et al., 2016). Coupling this scientific rationale with the fact that grizzly bears are iconic and can be used politically to generate conservation action and funding, is exactly what occurred in the Frog Bear Conservation Corridor of the Creston Valley (Proctor et al., 2018), in which a diversity of partners leveraged grizzly bear conservation to establish an east-west wildlife corridor across the north end of the Creston Valley.

Given the mosaic of landownership in the Frog Bear Conservation Corridor (Figure 4), employing a variety of conservation strategies and actions that considered private and public landownership and were relevant to the local jurisdictional landscape (Gallo et al., 2008; Miller and Hobbs, 2002; Miller et al., 2003) was essential to TBGBP's success.

The paradigm underpinning Kootenay Connect is that landscape linkages focusing on low-elevation large riparian-wetland complexes are essential for conserving biodiversity, habitat connectivity, species movement corridors, and ecological functions in a changing climate in the Kootenay region of British Columbia.

TBGBP has continued to work with a network of organizations applying a suite of conservation strategies within the Creston Valley for over a decade. These efforts have resulted in the re-establishment of connected grizzly bear populations (Proctor et al., 2018, 2023) and expanded the conservation significance of the CVWMA in an east-west dimension for wildlife connectivity.

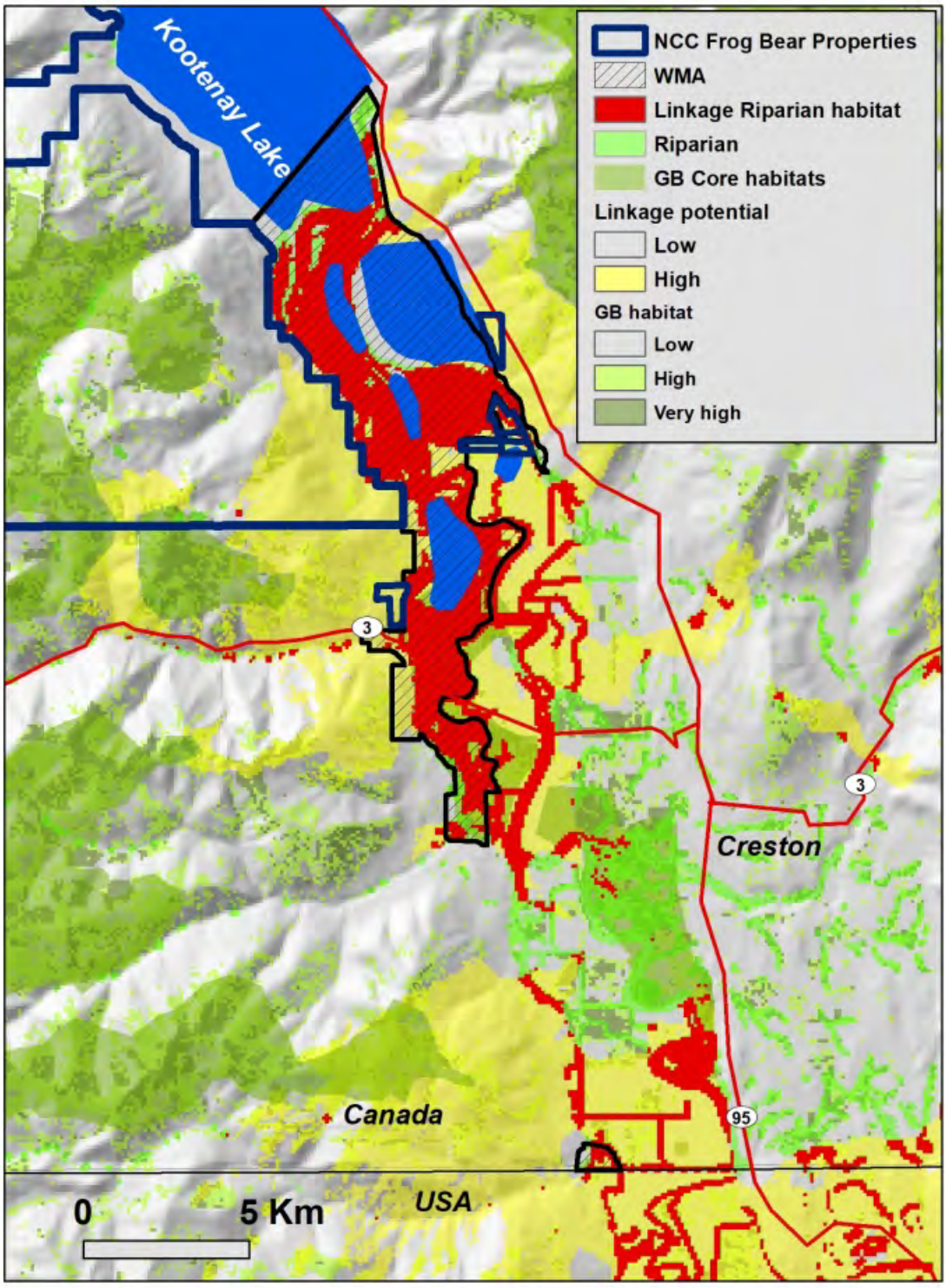

Figure 4. Close-up of the overlap of riparian-wetland habitats and grizzly bear linkages (red) in the Creston Valley that reveals the mosaic of land ownership of the provincial Creston Valley Wildlife Management Area and private land conservation properties owned by Nature Conservancy of Canada (Proctor, 2019).

An essential component of connectivity management is the protection of important habitat on private land that dominates the valley bottom. Key forest and agricultural lands adjacent to the CVWMA have been purchased by the Nature Conservancy of Canada to enhance and expand the conservation benefits of the wildlife management area in an east-west direction (Figure 5).

Figure 5. Graphic developed by the Nature Conservancy of Canada for public communications illustrating the landscape view of the Frog Bear Conservation Corridor. (Source: NCC).

When you add together the benefits to wildlife provided by protected Crown land (CVWMA), land trust conservation properties, and environmental farm practices adopted on adjacent agricultural lands, these collaborative actions have measurably improved grizzly bear connectivity between the South Selkirk and South Purcell Mountains (Proctor et al., 2018, 2022) while also helping to secure a critical breeding area for endangered northern leopard frogs.

2.2.2 CLIMATE CHANGE REFUGIA

Climate change is having a major impact on global and local biodiversity (Bellard et al., 2012; Stein et al., 2013), resulting in shifts in species ranges (Chen et al., 2011), and a possible dramatic increase in the global extinction rate (Pimm, 2008). Stressors from climate change

likely exacerbate impacts on natural systems from habitat loss and degradation (Brook et al. 2008; Segan et al., 2016). The necessity for habitat refugia in a changing climate is strong and well-documented (Seavy et al., 2009; Keppel and Wardell-Johnson, 2012; Morelli et al., 2016). Identifying, recognizing, and managing components of landscapes to function as "climate refugia" can allow nature to slowly adapt to the expected but unpredictable shifting conditions, which will allow existing flora to hold on longer and provide wildlife with a safe haven while adjusting to a changing environment. Refugia have been defined by many and we favour definitions that include properties that promote species and ecological community persistence, sustain long-term population viability, ecological services (Sweeney et al., 2004), and ecological and evolutionary processes (Klein et al., 2009; Keppel et al., 2012; Reside et al., 2014).

Refugia are often comprised of habitats of higher species richness and abundance and diverse ecological processes (Keppel and Wardell-Johnson, 2012; Keppel et al., 2012). Riparian-wetland complexes act as climate refugia in many places around the world (Croonquist and Brooks, 1991; Maeve et al., 1991; Sweeney et al., 2004; Sabo et al., 2005; Lees and Peres, 2008; Klein et al., 2009; Reside et al., 2014; Selwood et al., 2015; Morelli et al., 2016; Nimmo et al., 2016) and for a large portion of ecosystems in the Kootenays (Kinley and Newhouse, 1997; Hauer et al., 2016). We are not suggesting that riparian-wetland habitats represent the entire suite of climate change refugia for the Kootenay region; however, we reason they are likely one critically important component of a refugia system in a region that is expected to get hotter and drier (Holt et al., 2012) and are therefore a relevant management objective for climate adaptation in the Kootenays.

Given that climate change is upon us, is projected to intensify in the coming decades, and will have profound impacts on our region's ecosystems, one of our best strategies to ensure nature's resilience is to manage landscapes to ensure connectivity for the full spectrum of species and processes in order to facilitate adaptation to changing and shifting habitats (Cross et al., 2012; Holt et al., 2012; Utzig and Holt, 2015b; Ayram et al., 2016; Hilty et al., 2020; Elsen et al., 2020). In addition to riparian-wetland areas proving good insurance for sustaining refugia of current biodiversity, our research suggests they are also important areas for landscape-level wildlife connectivity along waterways and across valleys. Riparian corridors link mountain ranges in our region where extensive hydrological developments of dams and reservoirs have transformed many of our valley bottoms (e.g., Columbia River, Arrow Lakes, Duncan and Koocanusa reservoirs) eliminating many terrestrial and riparian habitats and fundamentally altering inter-mountain connectivity (Utzig and Schmidt, 2011). The pattern of dams and large reservoirs has created a series of terrestrial pinch-points of connectivity at the north and south ends of reservoirs, exacerbating a similar pattern that was already extensive with our natural valley lakes (e.g., Kootenay, Slocan, Arrow, Columbia, and Windermere). These hydrologic

systems have steered human settlement into these terrestrial pinch-points, which further fragments habitat connectivity within and across valleys, and places development pressure on the remaining un-flooded riparian-wetland habitats (Utzig and Holt, 2015a).

The Kootenay region's remaining valley bottoms are therefore especially important both as potential climate refugia and arenas for connectivity (Hauer et al., 2016). Therefore, we integrated climate adaptation modelling by local landscape ecologist G. Utzig (unpublished data) into our assessment of important corridors for Kootenay Connect. Utzig's climate modelling results of south to north and cross-valley climate corridors help validate our proposed ecological corridor sites and complement our corridor selections. There is no better time than the present to develop comprehensive conservation strategies to protect and improve management in some of the most important valley-bottom habitats in the Kootenays.

The importance of ecological corridors in conservation is gaining global recognition, for example, as presented in a report recently published by the IUCN World Commission on Protected Areas (Hilty et al., 2020; see more below). Kootenay Connect is an initiative whose time has come and is in line with many efforts across the globe to interconnect ecosystems and protect biodiversity. Kootenay Connect is a real-world example that is implementing guidelines for preserving connectivity. Kootenay Connect is serving as a catalyst for collecting, analysing, and packaging a diversity of independent science and stewardship efforts throughout the Kootenay region over the past decade and bringing them together to holistically address ecological connectivity and landscape-level conservation challenges. There is growing interest in participating in connectivity conservation from a broad range of organizations.

2.3 PROJECT DESCRIPTION

2.3.1 FROM GRIZZLY BEARS TO BIODIVERSITY

Thinking how best to advance Kootenay Connect beyond grizzly bears, we expanded TBGBP's concept of landscape connectivity management by identifying other important places where diverse partners might work together to: 1) protect areas of high biological diversity, 2) link upland habitats with riparian-wetland ones to benefit multiple species of interest, and 3) establish recognized wildlife and ecological corridors across the Kootenays. Since nature does not recognize private and public land ownership, we envision these biodiversity and wildlife corridors to be some combination of land ownership types with a mosaic of potential management and conservation actions that are relevant to the local jurisdictional landscapes across the Kootenays. We consider existing provincial and local laws, regulations, and management strategies in both the private and government sectors to accomplish our

conservation goals, such as strategic land acquisitions and conservation easements, enhancements and possible expansion of provincial Wildlife Management Areas, additions to BC's protected areas system, Regional District development permitting and zoning regulations, riparian-wetland restoration projects, targeted landowner education and assistance to improve private land stewardship, and more. (See Section 2.5 and Appendix E) for more information on conservation tools).

In 2020, we introduced the idea that BC begin recognizing corridor habitats that currently connect isolated protected areas by: 1) expanding the use of existing legal designations (e.g., Conservancies, Wildlife Management Areas, Wildlife Habitat Areas), and 2) creating a new designation of "Wildlife and Ecological Corridors" that recognizes the importance of protecting connectivity areas between existing protected areas, with special attention to connecting mountain ranges across human-settled valleys in order to integrate riparian-wetland areas.

Connectivity conservation in BC relies on 1) expanding the use of existing legal designations e.g., Conservancies, Wildlife Management Areas, Wildlife Habitat Areas; and 2) creating a new designation of "Wildlife and Ecological Corridors" that recognizes the importance of protecting connectivity areas between existing protected areas.

To advance the first point, we look to Kootenay Connect Community-Nominated Priority Places projects (CNPP) to provide the evidence and effort to expand the use of existing legal designations. To advance the second point, we look to the Kootenay Connectivity Working Group, a collaboration of Kootenay Connect with provincial and federal governments and First Nations that is developing an approach to recognizing and establishing Wildlife and Ecological Corridors across the Kootenay region. (Learn more about these two branches of Kootenay Connect in this Section 2.3).

2.3.2 OVERVIEW OF ACTIVITIES

The following activities were pursued during 2019-2023 of Kootenay Connect:

1. **Mapping**. We developed an extensive GIS database to help us map carnivore/ungulate/ species at risk/riparian-wetlands/climate change corridors to be considered for enhanced protection and connectivity management. Our GIS data includes 15 themes: 1) riparian and wetlands habitats; 2) grizzly bear habitat and connectivity models; 3) wolverine density and food models; 4) American badger habitat models; 5) seasonal elk

habitat use and movement routes; 6) mountain goat habitat models; 7) bighorn sheep occurrence data; 8) ungulate winter range; 9) all available SAR spatial data including a thorough species at risk review in the Columbia Wetlands and extensive field inventories in the Bonanza Biodiversity Corridor; 10) information gathered from several regional wildlife and habitat experts; 11) ecological and geophysical GIS layers; 12) regional ecological climate-response modelling; 13) old growth and high conservation value forest delineations used by the timber industry; 14) human-related land use layers; and 15) jurisdictional land use designations, private and public protected lands, land ownership.

2. **Integrated GIS layers.** We integrated the above GIS layers to identify specific conservation targets and strategies that included a climate adaptation perspective provided by a regional climate change model and relevant biologically-based mapping layers (e.g., northern leopard frog breeding ponds and migration routes, western painted turtle and western toad breeding habitats, great blue heron rookeries, relevant species at risk information, ungulate winter range) with land ownership patterns to help identify potential threats and conservation opportunities.
3. **Produced detailed GIS maps for each of Kootenay Connect's 12 focal corridors.** We have mapped all focal corridors with the above attributes to inform connectivity conservation planning for the suite of target carnivore and ungulate wildlife species as well as important species at risk and species of local concern.
4. **Identified private land conservation opportunities**. We assessed private lands within and adjacent to riparian-wetland complexes within our 12 focal corridors for their potential conservation by Nature Conservancy of Canada or The Nature Trust of BC or other private land conservation options (e.g., restoration by local stewardship groups, rod and gun clubs, Farmland Advantage).
5. **Worked with conservation champions in all Kootenay Connect's focal corridors.** We used our experiences from Year 1 (2019-2020) Kootenay Connect workshops in the Wycliffe Wildlife Corridor, Columbia Valley, Creston Valley, and Bonanza Biodiversity Corridor to refine and improve our approach to designing and delivering in eight subsequent workshops during 2020-2022. In 2020, we hosted (or co-hosted) workshops in the Duncan Lardeau, Columbia Lake, and Golden corridors. In 2021, we added two workshops focused on the Slocan Valley to complete this cohort of four focal corridors. From late 2021 through 2022, we hosted (or co-hosted) workshops in the Elk Valley, Retallack Corridor, South Country, and South Selkirks-Lower Columbia. For each workshop, we consulted with local stewardship groups, local, regional, and provincial land managers, First Nations, land trusts, rod and gun clubs, and other local and regional

experts to review maps and identify corridor-specific threats and conservation opportunities available in both the public and private sectors. See Appendix A for a list of partners.

6. **Analyzed case studies.** In all 12 focal corridors, we applied our framework of data-gathering, interpretation, and mapping to inform the identification, prioritization, and implementation of conservation actions.
7. **Compiled existing resources.** We researched and packaged the best available information and resources for each of our focal corridors, such as GIS data layers, maps, conservation targets and threats tables, and relevant journal articles and reports. We also developed a matrix of Kootenay Connect corridor-specific needs, efforts, and conservation tools to guide the approach we are applying to corridors.
8. **Reported out to partners and funders.** The results of these activities are presented in this report entitled, *Kootenay Connect: Riparian Wildlife Corridors for Climate Change – Year 4 Summary Report.* Previous versions of this report include *Kootenay Connect: Riparian Wildlife Corridors for Climate Change – A Preliminary Analysis* (Proctor and Mahr, 2019) in addition to follow-up annual reports documenting progress in Year 1 (Proctor and Mahr, 2020) and Year 2 (Proctor and Mahr, 2021). The purpose of this Year 4 Summary Report is to showcase this initiative as an inspiring blueprint for connectivity conservation across the region as well as share the incredible results that have been achieved in over 50 subprojects during this time to benefit wildlife and the habitats they depend upon.

2.3.3 FOCAL CORRIDORS & LOCAL CHAMPIONS

Kootenay Connect is a long-term vision that is being developed over many years. In 2019-2020, we integrated grizzly bear connectivity mapping with riparian-wetland complexes, climate change adaptation modelling, and expert opinion to form the basis for identifying 12 of the most important connectivity areas across the Kootenays (Figure 6), hence forward referred to as “12 focal corridors”. Throughout our approach, we have identified conservation targets, ecological threats, and conservation opportunities, as well as local champions who are already working to develop initial conservation management frameworks. These 12 focal corridors have become case studies for local, regional, and provincial resource agencies and stewardship groups to develop a mosaic of strategies that encompass both private and public lands. (See Section 3: Results for more information on case studies.)

In addition to the four focal corridors funded through Kootenay Connect CNPP, we have been supporting separate investigations and activities in the remaining eight Kootenay Connect focal

corridors in the Duncan Lardeau, Columbia Lake, Golden Area, South Country, Slocan River Valley, Elk Valley, Retallack Corridor, and South Selkirks-Lower Columbia.

Through these investigations, Kootenay Connect has been building on the growing capacity of conservation collaboratives that exist or are emerging across the Kootenay region. A key objective of Kootenay Connect is to develop new, or strengthen existing, landscape-scale partnerships comprised of diverse groups with a common interest in developing place-based solutions for local landscapes. We are working with Kootenay Conservation Program (KCP), a network of over 85 partners, and other key stakeholders to develop a mosaic of conservation activities, strategies, and solutions that include private and public lands to improve management across Kootenay Connect's 12 focal corridors connecting the Kootenays.

In Years 1-4, Kootenay Connect coordinated the delivery of and co-hosted workshops with Kootenay Conservation Program when advantageous. For example, of the 12 focal corridors workshops that Kootenay Connect has held in the region from 2019-2022 (Figure 6), Kootenay Connect teamed up with KCP to deliver four Conservation Action Forums[4] (Forums), i.e., Creston Valley (January 2020), Golden (November 2020), South Country (January 2022), and South Selkirks – Lower Columbia (November 2022). In each of these Forums, new scientific information and maps of focal corridors and connectivity areas were shared and Kootenay Connect facilitated a corridors and connectivity action group (Figure 7).

This type of collaborative approach to identifying and addressing landscape-scale issues is exactly what's needed for Kootenay Connect to succeed. Working with KCP and its diverse partners, we have engaged key stakeholders with interests in private and public (Crown) lands within each focal corridor to develop a mosaic of conservation activities, strategies, and solutions that are informing how Kootenay Connect's science will result in on the ground conservation. By combining our efforts, Kootenay Connect and KCP have synergistically strengthened collaborative conservation in the Kootenays.

[4] KCP developed the Conservation Neighbourhood approach to bring together diverse conservation perspectives, leading scientists and other knowledge keepers to identify conservation priorities in local landscapes or "Conservation Neighbourhoods". Conservation Action Forums are special workshops that have brought together partners from a particular neighbourhood where there is local interest and leadership to learn from the latest science in the region to inform the development of shared action priorities. These Forums have helped inform Kootenay Connect.

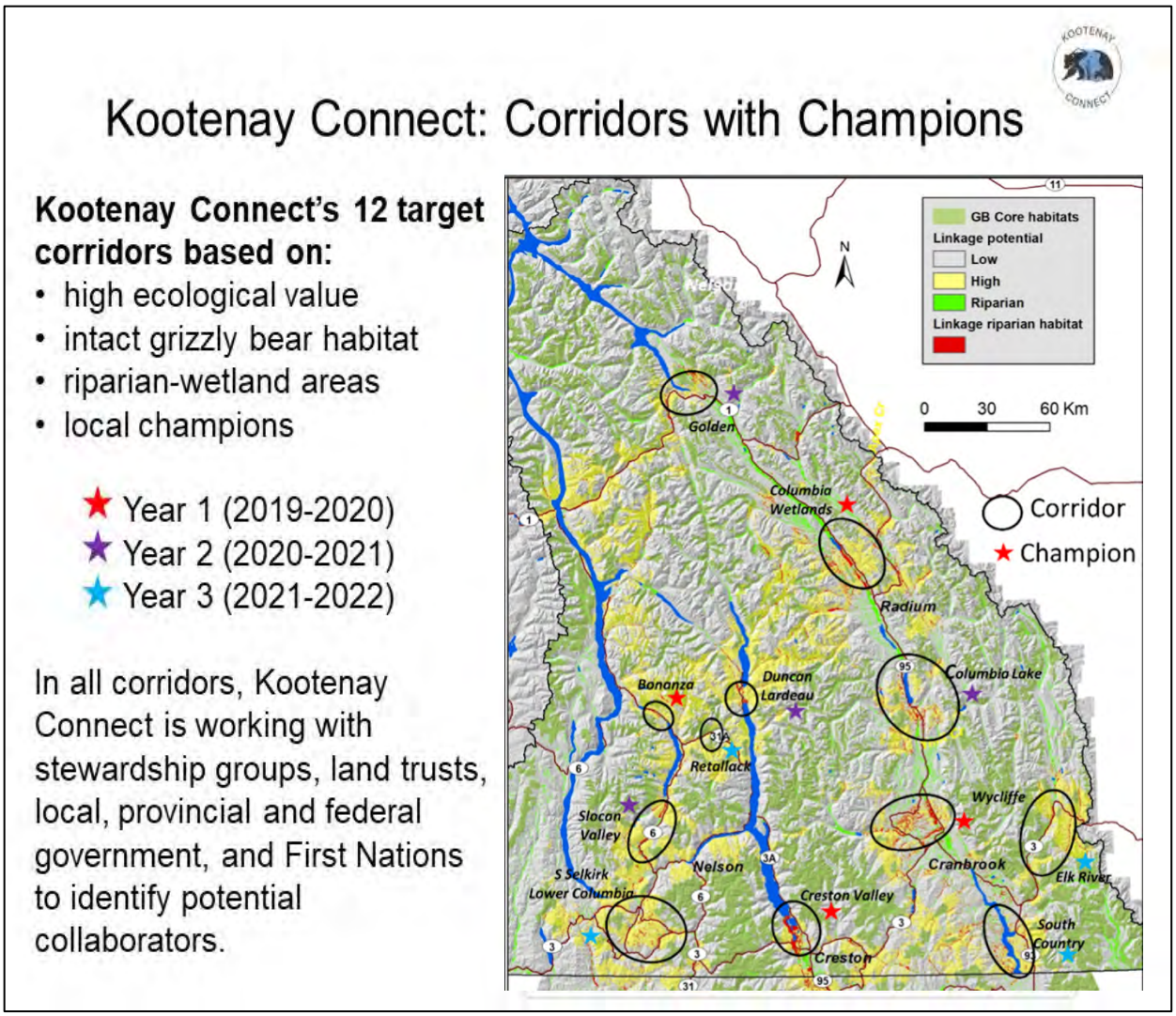

Figure 6. Kootenay Connect's 12 focal corridors represented as cohorts Years 2019-2022 and identified by color-coded stars. (Source: Kootenay Connect).

2.3.4 WORKSHOPS HELD IN 12 FOCAL CORRIDORS IDENTIFIED PRIORITY ACTIONS

Between 2019 and 2022, we held Kootenay Connect workshops in all 12 focal corridors. Participants included local species at risk biologists and recovery team members, independent and government biologists, conservation groups and land trusts, municipal and regional planners, elected officials, First Nations, and agricultural producers. Most of the workshops

were organized and delivered by Kootenay Connect with a local co-sponsoring group. Several were co-hosted with KCP as a Conservation Action Forum[5].

Figure 7. Kootenay Connect Workshop co-sponsored by the Slocan Lake Stewardship Society focused on the Bonanza Biodiversity Corridor (BBC). Participants identified important ecological values, threats, and opportunities in the BBC. March 6, 2020, Silverton, BC. (Photo: M. Proctor).

The purpose of these workshops was to discuss the ecological values, threats, and opportunities for enhancing conservation and stewardship of habitat connectivity; employ a climate change lens to identify potential impacts on existing habitat cores and connectivity; and begin to explore new connectivity needs for climate-induced shifts in species ranges. The goal of each workshop was to develop specific conservation strategies for each area and encourage collaboration among conservation leaders in each corridor on local stewardship and management priority actions.

Table A-1 through A-5 in Appendix B summarize specific ecological values including species of interest, important habitat types and features, important ecological processes, and key ecological threats each area faces. These data are summarized through extensive information gathering from local experts at workshops, in consultations with regional researchers, and GIS database development of biological, ecological, and human-influence layers. The focal corridors were centred on important low-elevation, wetland-riparian areas, and we found there was significant similarity in the conservation values and threats across corridors.

[5] As discussed in Section 2.1, joint sessions with KCP provided participants with an innovative way to approach conservation by working in the context of a local "Conservation Neighbourhood" to identify common priorities and objectives for on-the-ground conservation and stewardship activities. 'Ecological connectivity' was a reoccurring theme among others that guided priority action planning.

Within the workshops, *conservation target* was defined as a biological attribute or value that is the focus of conservation activities such as species at risk, important habitat types, wildlife habitat features, special landscape elements, and ecological processes that are priorities for protective action. The values represent the biological diversity and unique habitats of each focal area that sustain its ecological integrity and healthy functioning. Although listed independently, conservation targets are interconnected and may nest under each other hierarchically. For example, habitat features may be embedded in particular habitat types or may be the result of certain ecological processes.

Threat was defined as negative impacts that may significantly stress or impair conservation values and directly impact species viability, habitat quality, or ecological functioning. These impacts are activities or processes that are causing or may cause the destruction, degradation, and/or impairment of one or more of the identified conservation values. Many, and likely all, of the conservation targets will face combined threats. Cumulative impacts are difficult to quantify and even more difficult to predict. Therefore, a precautionary approach to management and further development will be important to minimize the non-climate stressors on conservation values.

Given that a changing climate adds an amplifying dimension to impacts, workshop participants agreed that applying a climate change lens was essential to designing conservation actions that consider an unprecedented range of ecological conditions that have no reliable historical basis. Actions must account for changing temperature and precipitation, which will disrupt habitats, move home ranges, bring diseases, increase impacts of invasive species, and change hydrologic patterns. Thus, Kootenay Connect's message underscores that we must respond to existing impacts on habitat connectivity while also anticipating a range of impacts brought by a changing climate.

Kootenay Connect contributed a series of new GIS data layers and maps developed for each of the focal corridors that included layers of human disturbance, ecological attributes, topographic, geophysical, species-specific habitat use models, species-specific connectivity models, habitat types (e.g., wetland, riparian, etc.), ownership and land use designation, private conservation lands, and more. A list of spatial coverage across all focal corridors is found in Appendix C. These layers are kept as a Kootenay Connect GIS database for use by teams working within each focal corridor, in addition to conservation and research planning and decision-making, knowledge gap analyses, and more.

In the following section we report on an extensive body of results spanning 2019-2023 from the various streams of the Kootenay Connect Initiative including Kootenay Connect CNPP, Kootenay

Connect Workshops, and the Kootenay Connectivity Working Group (an important branch of Kootenay Connect discussed below and identified in Figure 8).

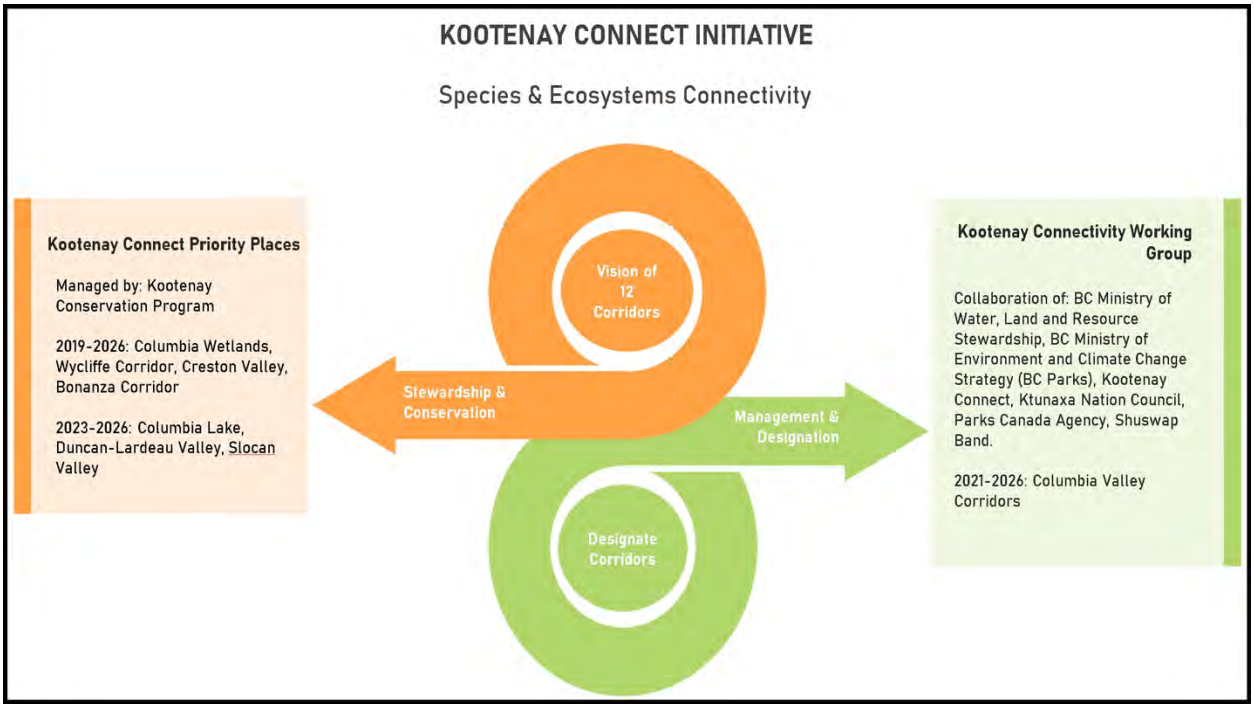

Figure 8. Diagram of Kootenay Connect's branches of influence include (left) Kootenay Connect Community-Nominated Priority Places with the purpose of protecting species at risk and enhancing and restoring habitats they depend upon; and (right) Kootenay Connectivity Working Group with the purpose of identifying and designating multi-jurisdictional ecological corridors.

2.3.5 MULTI-JURISDICTIONAL APPROACH TO CONNECTIVITY CONSERVATION

There is a growing recognition that ecosystem connectivity requires a collaborative approach to bringing diverse information, policies, and practices together. Multi-jurisdictional corridors require participation from all levels of government, First Nations, land trusts, stewardship groups, agricultural producers, and more.

Throughout Kootenay Connect's development, KCP has provided a diverse partnership and trusted venues for collaboration (e.g., KCP Fall Gatherings 2017–2022 and KCP co-sponsored Forums). Our Kootenay Connect-sponsored workshops have addressed ecological connectivity and the impacts of climate change within KCP's subregions, referred to as "Conservation Neighbourhoods" (Figure 9), which focus on a specific local landscape or geography, such as a watershed or valley.

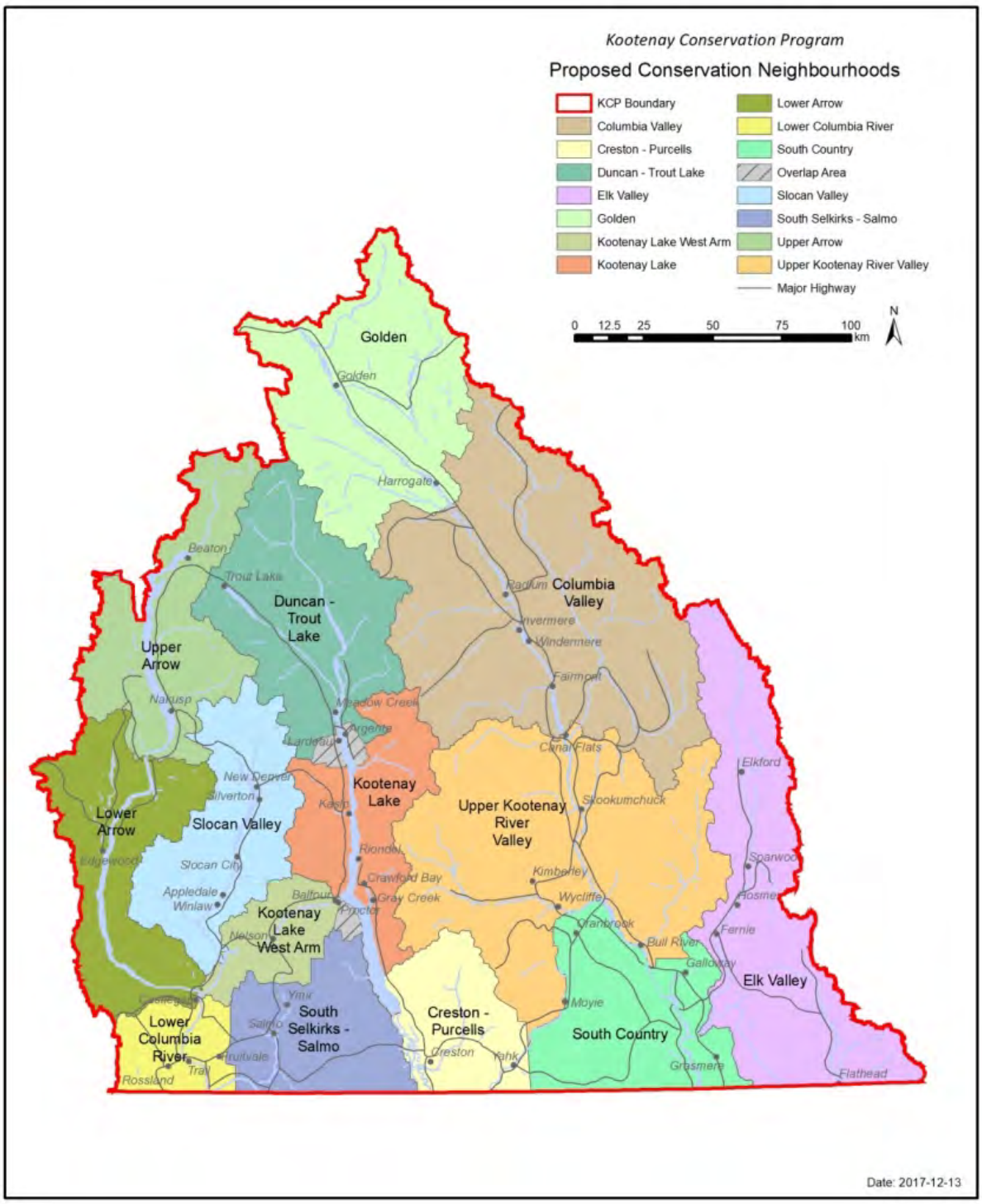

Figure 9. Kootenay Connect is addressing corridors and connectivity within and between Kootenay Conservation Program's 14 Conservation Neighbourhoods in the East and West Kootenays. (Source: KCP).

KCP's Conservation Neighbourhoods have provided a landscape framework for Kootenay Connect to explore corridors within and between these subregions. The benefit of Kootenay Connect has been to develop an ecological network that links up the Kootenay region (and KCP's Conservation Neighbourhoods), emphasizing the importance of landscape connectivity and cross-boundary collaboration from multiple partners and stakeholders. Kootenay Connect has created unique project teams including a Kootenay Connectivity Working Group that are essential to addressing the mosaic of land ownership and management objectives inherent in landscape-scale conservation within and between subregions.

A goal of Kootenay Connect is to develop new, or strengthen existing, landscape-scale partnerships comprised of diverse strategies with a common interest in developing place-based solutions for local landscapes.

What unites these diverse stakeholders is their shared commitment to a place and desire to address overarching, large-scale issues such as habitat fragmentation, declining biodiversity, invasive species, recreational pressure, fire fuel management, and climate change. Participants in Kootenay Connect workshops acknowledge that resolution of these long-term, systems-level problems will require developing collective conservation goals and actions that transcend organizational, land ownership, political, and jurisdictional boundaries, and leverage diverse approaches, strong partnerships, and dedicated resources.

2.3.6 KOOTENAY CONNECTIVITY WORKING GROUP

As Kootenay Connect CNPP was making progress in the valley bottoms, interest was growing within other agencies to consider entire landscapes. Parks Canada's Mount Revelstoke-Glacier and Lake Louise-Yoho-Kootenay National Parks began exploring how Kootenay Connect could help advance objectives within their Nature Legacy Program to identify high conservation value, multi-species corridors that provide connectivity in the Columbia Valley between Glacier and Yoho-Kootenay National Parks. At the same time, BC's Together for Wildlife Program was interested in exploring how Kootenay Connect could inform their approach to wildlife connectivity and safe passage across multiple jurisdictions (Figure 10).

Consequently, in the fall of 2021, a new branch of Kootenay Connect began budding in the form of a working group that consisted of representatives of Parks Canada field units, provincial government, Ktunaxa Nation Council, and Shuswap Band. Parks Canada provided initial seed money for the first two years (2021-2023) of this working group; and the Sitka Foundation and the Ministry of Water, Land and Resource Stewardship contributed additional funding for years two and three (2022-2024).

Given that nature knows no borders and large animals need room to roam, the purpose of the Kootenay Connectivity Working Group is to engage multiple agencies and First Nations to align management objectives and activities to explore solutions that will create secure areas and safe passage across jurisdictions so wildlife can thrive. The overall goal of the Kootenay Connectivity Working Group is to:

> *Collaboratively conserve wildlife and their habitats across different land ownerships by enhancing ecological connectivity and establishing inter-jurisdictional recognition of specific ecological corridors. This initiative is providing a space for research, conservation actions, and connectivity planning to meet government policy and set management objectives.*

Ecological corridors aren't parks. They are landscapes inhabited by people and wildlife and include both private and public lands as linkages across human-settled valleys to adjacent upland mountainous habitats (typically east—west) and along the intervening valley lengths (typically north—south). Because regional connectivity is influenced by species at risk recovery and landscape-level initiatives between neighboring landowners and managers, it's essential to have federal, provincial, and First Nations governments around the same information-sharing table. It is also essential that we have a shared vision for how to apply our results and our methods for getting there.

Figure 10. Mountain goats at a mineral lick in Kootenay National Park. (Photo: J. Arndt).

The Kootenay Connectivity Working Group has identified priority ecological corridors for wildlife in the Columbia Valley landscape and, specifically, within the Columbia Lake Corridor as a starting place. By taking a landscape-level approach, the group is developing a process to address and overcome a lack of inter-agency coordination of land use and management in

multi-jurisdictional landscapes through identifying, prioritizing, and establishing (through some yet-to-be determined regulatory mechanism) ecological corridors that work for regional, provincial, and federal governments; First Nations; residents residing within and around these corridors; and interest groups promoting habitat conservation and coexistence with wildlife.

2.3.7 THE TIME IS RIGHT FOR KOOTENAY CONNECT

Following the initial Kootenay Connect focal corridor workshops and associated projects, there has been great interest from partner organizations in integrating project-level information into a larger landscape context. Our collaborators agree the time has come for addressing the landscape holistically by incorporating multiple species, habitat complexes, movement corridors, and ecological processes to inform on-the-ground conservation actions. Further affirmation of Kootenay Connect came in spring of 2022, with Parks Canada's announcement of their new National Program for Ecological Corridors mentioning Kootenay Connect as a great example of ecological corridors in Canada[6].

The Kootenays have experienced substantial conservation efforts around our regional wetland complexes, but with minimal emphasis on connectivity with adjacent upland habitats. Protected areas across the upper Columbia Basin were created with minimal emphasis on connecting Wildlife Management Areas with Provincial and National Parks, and prior to "connectivity" becoming a focus of landscape-level conservation. With over two decades of connectivity research under our belts, locally and across the globe, we now know that linking habitats are essential to realizing ecological integrity and supporting nature's ability to adapt to climate disruption.

The Kootenay Connect initiative is designed to focus on – and add the connectivity dimension to – the existing base of conservation lands and efforts across the Kootenays. Importantly, Kootenay Connect is stitching together upland habitats with riparian-wetland habitats for the benefit of multiple species of interest. We endeavour to integrate each realm into a composite effort that bridges jurisdictional, management and protection priorities, and results in connecting suites of species and ecological processes that require multiple habitat types currently and into the foreseeable future with climate change.

It is our intention to work with and expand upon existing riparian and wetland-based conservation initiatives that are underway across the Kootenays. We are working closely with conservation leaders such as the Columbia Wetland Stewardship Partners, Slocan Lake

[6] https://www.canada.ca/en/parks-canada/news/2022/04/government-of-canada-launches-new-national-program-for-ecological-corridors.html

Stewardship Society, Slocan River Streamkeepers, Creston Valley Wildlife Management Area, Columbia Lake Stewardship Society, Farmland Advantage, Wildlife Conservation Society of Canada, Nature Conservancy of Canada, The Nature Trust of BC, Wildsight Golden, Okanagan Nation Alliance, Ktunaxa Nation, Shuswap Band, and many others, to connect habitats in multiple dimensions, i.e., north-south within mountain ranges and along valley bottoms, east-west between mountain ranges, and elevationally between valley bottom and upland habitats.

2.3.8 CANADA NATURE FUND'S SUPPORT FOR KOOTENAY CONNECT COMMUNITY-NOMINATED PRIORITY PLACES

Due to the increasing global imperative for interconnected ecosystems and protected areas described above, Kootenay Connect's focal corridors proved to be a good fit for Environment and Climate Change Canada's (ECCC) Canada Nature Fund CNPP program. In 2019, four of Kootenay Connect's 12 focal corridors were the centrepiece of a successful 4-year grant with ECCC for the Kootenay Connect CNPP project [7]. These four focal corridors included the Columbia Wetlands, Wycliffe Wildlife Corridor between Cranbrook and Kimberley, Creston Valley, and Bonanza Biodiversity Corridor in the north Slocan Valley. These corridors were selected because at the time they were the most promising connectivity areas for conservation action with local champions who were already working collaboratively to advance stewardship and conservation at a landscape scale. (These four focal corridors are discussed in detail in Section 3: Results.)

After successfully completing the initial 4-year project, in fall of 2022, ECCC extended their funding of Kootenay Connect for an additional three years (2023-2026). This enabled us to expand geographically beyond the original four focal corridors to seven areas with the addition of Columbia Lake at the headwaters of the Columbia River and Wetlands, the Duncan Lardeau Valley at the north end of Kootenay Lake, and the Slocan Valley south of Slocan Lake.

Kootenay Connect CNPP, coordinated by KCP, now includes 35 partners and specialists in the East and West Kootenays and over 50 subprojects that are contributing to provincial, national, and global goals to protect biodiversity, improve habitats for species at risk, and increase inter-ecosystem connectivity. The success of Kootenay Connect is a direct consequence of its vision and timing and has been made possible by regional organizations and funders joining our initiative.

[7] https://kootenayconservation.ca/kootenay-connect/

Kootenay Connect's collective on-the-ground conservation and management actions are supporting the recovery of 34 federally listed species at risk and working to help Canada achieve its goal of conserving 25% of its land and water by 2025, and an important milestone of conserving 30% by 2030.

The schematic in Figure 8 illustrates how Kootenay Connect has evolved from its original vision of 12 focal corridors into implementation across the Kootenay region. The original concept of Kootenay Connect funded by the Fish & Wildlife Compensation Program (FWCP)-Columbia Region has grown into a reality through a combination of ECCC funding for Kootenay Connect CNPP plus regional funders such as the Columbia Basin Trust and Habitat Conservation Trust Foundation and local sources such as the Columbia Valley Local Conservation Fund which collectively brought matching funds to partners' projects.

2.4 CONTRIBUTING TO GLOBAL TARGETS

Many ongoing global, national, and provincial conservation opportunities and initiatives are complementary to the purposes of Kootenay Connect, within which Kootenay Connect can contribute conservation outcomes that will result in more protected land strategically located across the Kootenays (Appendix D).

Kootenay Connect aligns well with, and takes inspiration from, the IUCN World Commission on Protected Areas guidance document on conserving ecological connectivity (Hilty et al., 2020), with examples of initiatives being developed in all corners of the globe (Figure 11). Furthermore, Kootenay Connect is aligned with other global, national, and regional calls to increase the proportion of protected lands and waters, and to also ensure those ecosystems are functionally connected (Heller and Zavaleta, 2009; Morelli et al., 2016; Dinerstein et al., 2017, 2020; Pollock et al., 2017; World Wildlife Fund, 2018, 2020; IPBES, 2019; Theobald et al., 2020). These calls have inspired global institutions and federal and provincial governments within Canada.

For example, global initiatives include the United Nations Convention on Biodiversity Aichi Biodiversity Target 11[8] which was recently updated in a *Post-2020 Biodiversity Framework*[9] with goals set for 2030 and 2050, and designation of Key Biodiversity Areas[10]. Nationally, the 2020

[8] https://www.cbd.int/sp/targets/rationale/target-11/
[9] https://www.cbd.int/doc/decisions/cop-15/cop-15-dec-04-en.pdf
[10] http://www.keybiodiversityareas.org/about-kbas

Biodiversity Goals and Targets for Canada[11] has led to the Target 1 Challenge Fund of the Canada Nature Fund. Canada and the United States[12] are currently taking inspiration from the *Post-2020 Global Biodiversity Framework* and a 60-nation summit on global conservation designed to implement that Framework[13]. Canada's current Liberal government platform has integrated this idea as evidenced on their 2020 website[14] and role to advocate for the rest of the globe to participate:

> *To protect more of Canada for our kids and grandkids to enjoy, we will move forward with an ambitious plan to* ***conserve 25 per cent of Canada's land and 25 per cent of Canada's oceans by 2025****, working toward* ***30 per cent in each by 2030****. We will ground these efforts in science, Indigenous knowledge, and local perspectives, and will advocate for countries around the world to set a 30 per cent conservation goal as well.*

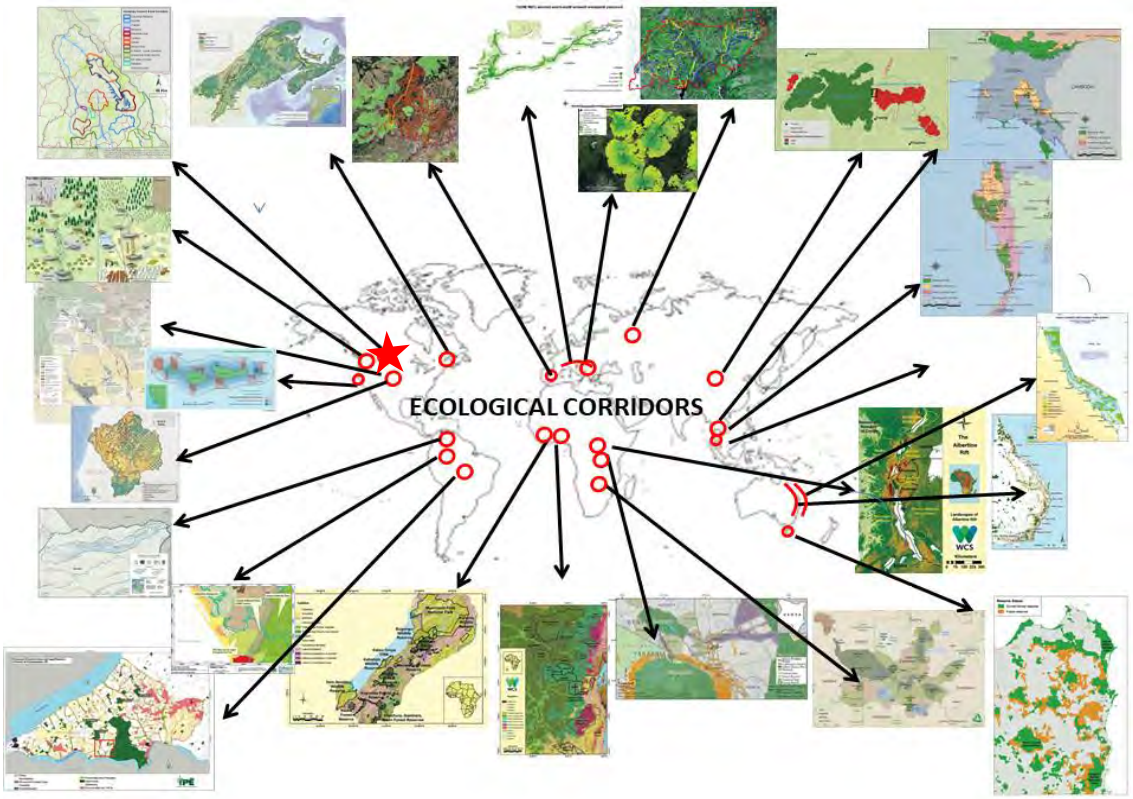

Figure 11. Ecological Corridors being established across the globe as detailed in Hilty et al. (2020) and including Kootenay Connect (red star) in Western Canada.

[11] https://www.canada.ca/en/parks-canada/news/2016/12/2020-biodiversity-goals-targets-canada.html
[12] https://www.wri.org/news/statement-biden-administration-commits-protect-30-us-land-and-ocean-2030
[13] https://www.hacfornatureandpeople.org/
[14] https://liberal.ca/our-platform/more-conservation/

This 30% by 2030 target (aka 30x30) was agreed upon by 193 nations at the 15th Conference of the Parties (CoP-15) to the Convention on Biological Diversity with the adoption of the Kunming-Montreal Global Biodiversity Framework in December 2022. This Framework emphasizes the fundamental contribution that ecological connectivity makes to healthy functioning ecosystems and species, and its benefit to people, by including connectivity in several goals and targets (emphasis added by authors). For example,

> *Goal A: The integrity, **connectivity** and resilience of all ecosystems are maintained, enhanced, or restored, substantially increasing the area of natural ecosystems by 2050; Human induced extinction of known threatened species is halted, and, by 2050, extinction rate and risk of all species are reduced tenfold and the abundance of native wild species is increased to healthy and resilient levels… .*
>
> *Target 2: Ensure that by 2030 at least 30 per cent of areas of degraded terrestrial, inland water, and coastal and marine ecosystems are under effective restoration, in order to enhance biodiversity and ecosystem functions and services, ecological integrity and **connectivity**.*
>
> *Target 3: Ensure and enable that by 2030 at least 30 percent of terrestrial, inland water, and of coastal and marine areas... are effectively conserved and managed through ecologically representative, **well-connected** and equitably governed systems of protected areas and other effective area-based conservation measures.*
>
> *Target 12: Significantly increase the area and quality and **connectivity** of, access to, and benefits from green and blue spaces in urban and densely populated areas sustainably, by mainstreaming the conservation and sustainable use of biodiversity, and ensure biodiversity -inclusive urban planning, enhancing native biodiversity, ecological **connectivity** and integrity, and improving human health and well-being and connection to nature and contributing to inclusive and sustainable urbanization and the provision of ecosystem functions and services.*

Increasing ecological connectivity is also the goal of the National Program for Ecological Corridors[15] launched by Parks Canada in April 2022 to support the identification of key ecological corridors to connect habitats and conserve biodiversity throughout Canada. This Parks Canada-led program builds on the Pathway to Canada Target 1 (discussed above) by supporting other jurisdictions and organizations to develop connectivity between protected and conserved areas. Kootenay Connect's coordination of a Kootenay Connectivity Working Group is aligned with this program by working with local Parks Canada field units, provincial government, First Nations, and other partners to identify and designate ecological corridors in the Kootenays that will benefit biodiversity and ecosystems, and support climate resilience.

[15] https://parks.canada.ca/nature/science/conservation/corridors-ecologiques-ecological-corridors

At the provincial level, the BC Provincial Wildlife Management Plan 2020 is an opportunity that will guide provincial priorities in the coming years. One of the priority mandates[16] for the current BC Minister of Environment and Climate Change Strategy states:

> *Work with the Minister of Forests, Lands, Natural Resource Operations and Rural Development, the Minister of State for Lands and Natural Resource Operations, and with neighbouring jurisdictions to cooperatively develop and invest in new strategies aimed at* ***better protecting our shared wildlife and habitat corridors****, including work to implement the Together for Wildlife Strategy.*

In December 2022, the new BC government integrated protection of wildlife, species at risk, biodiversity, old growth, and the 30% protection by 2030 goal into the BC Minister of Water, Lands and Resource Stewardship's mandate letter[17]:

> *Protect wildlife and species at risk, and work collaboratively with First Nations, other ministries, and the federal government to protect and enhance B.C.'s biodiversity through implementing recommendations of the Old Growth Strategic Review, and the Together for Wildlife Strategy.*
>
> *Partnering with the federal government, industry, and communities, and working with Indigenous Peoples, lead the work to achieve the Nature Agreement's goals of 30% protection of BC's land base by 2030, including Indigenous Protected and Conserved Areas.*

As a starting place for understanding the trends in the establishment and status of protected lands and waters in British Columbia, a recent report states[18]:

> *Protected lands and waters cover 15.4% of its land base. In the terrestrial realm, 15.0% is in provincial and federal parks and protected areas, while the remaining 0.4% is in other provincial and federal designations such as Wildlife Management Areas and National Wildlife Areas, and private conservation lands.*

By our calculation, the Kootenay region has approximately 10% protected lands comprised of 4% provincial, 5% federal, and 1% private. Establishing "Wildlife and Ecological Corridors" across the Kootenays would be a strategic addition to BC's protected area system and help both the Province and Canada reach their commitments for protected and connected ecosystems.

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[16] https://www2.gov.bc.ca/assets/gov/government/ministries-organizations/premier-cabinet-mlas/minister-letter/heyman_mandate_2020.pdf

[17] https://www2.gov.bc.ca/assets/gov/government/ministries-organizations/premier-cabinet-mlas/minister-letter/wlrs_-_cullen_-_w_ps.pdf

[18] http://www.env.gov.bc.ca/soe/indicators/land/protected-lands-and-waters.html

2.5 CONSERVATION TOOLBOX

After identifying high-priority regions for conservation protection and actions, it is important to know what mechanisms or tools can be applied to a mosaic of land ownerships and multiple jurisdictions. To increase our collective knowledge of available conservation tools (i.e., land designations, legislation, policies, and regulations), we put together the *Land Use Designations, Laws, and Policies to Protect Biodiversity Toolbox* (Table A-8 and Table A-9 in Appendix E) that applies to federal, provincial, and local levels of government and private land. This matrix is a work in progress and will be expanded and improved upon as Kootenay Connect and others begin assessing how best to designate new lands for conservation and influence government management plans and practices that protect SAR and habitat connectivity into the future.

Over the course of Kootenay Connect's work, we envision using a selection of tools from this multi-jurisdictional toolbox, integrating all levels of government, and private land conservation and stewardship activities to reach common conservation goals. Where relevant, we will integrate and expand on existing complementary initiatives discussed above and in Appendix D, and utilize various tools that we have summarized in Appendix E.

For example, it may be appropriate to apply for the expansion of existing (or creation of new) Wildlife Management Areas on public lands that are important riparian-wetland habitats; or through a land trust direct purchase (or place under conservation covenant) of private lands that are adjacent to an important riparian-wetland habitats that connect to adjacent upland habitats; or embark on wetland restoration on private or public lands to reclaim degraded habitat; or help develop guidelines for wildlife corridors and connectivity in Environmental Development Permit Areas (EDPAs) designated by Regional Districts[19]. The Regional District of Central Kootenay (RDCK) designates EDPAs and Regional District of East Kootenay (RDEK) designates Environmentally Sensitive Areas (ESAs) for development permits. Moving forward in this document, ESA/EDPA is used to represent Development Permit Areas for Environmentally Sensitive Areas in both regional district planning jurisdictions. We envision that such specific activities will be undertaken in cooperation with local stewardship groups and land managers and planners who already know their landscapes well.

[19] *Environmental Development Permit Area* (EDPA*)* is a land use management tool that ensures proposed developments comply with objectives and policies in an Official Community Plan. The Local Government Act establishes what development permits can be used for. An *Environmentally Sensitive Area* (ESA) is an area that because of its unique characteristics plays a critical role in supporting productive and diverse plant and animal populations. In the case of ESAs, a development permit ensures protection of the natural environment, ecosystems, and biological diversity.

3 RESULTS OF KOOTENAY CONNECT

This section provides the results of Years 1-4 activities in 12 focal corridors and proposes a framework for identifying, prioritizing, and implementing conservation actions. We begin with the **four original** focal corridors that received ECCC Community-Nominated Priority Places funding from 2019-2023 (Sections 3.1 Creston Valley, 3.2 Bonanza Biodiversity Corridor, 3.3 Columbia Wetlands and 3.4 Wycliffe Wildlife Corridor), and then move on to discussing the other **eight** focal corridors (Sections 3.6 through 3.13). Two of these corridors, Columbia Lake and Duncan Lardeau were added to the Community-Nominated Priority Places projects when the ECCC extended its funding until 2026.

FOUR KOOTENAY CONNECT COMMUNITY-NOMINATED PRIORITY PLACES CORRIDORS

3.1 CRESTON VALLEY

3.1.1 GEOGRAPHIC DESCRIPTION

The Creston Valley is part of Kootenay Connect Community-Nominated Priority Places. This valley is located at the south end of Kootenay Lake and lies between the South Selkirk and South Purcell Mountains. The 69 km^2 Creston Valley Wildlife Management Area (CVWMA), an internationally recognized Ramsar site that covers approximately 41% of the valley bottom (Figure 12), is situated primarily in the northern and western portions of the valley along the Kootenay River (Figure 13). The productivity of the Creston Valley is expressed in its diversity of habitats in a mosaic of shallow lakes, sloughs, wetlands, and riparian areas and the large number of species that depend upon them.

The CVWMA has 19 SARA-listed species, 34 COSEWIC-listed species, and 43 BC-listed species (Table A-1 in Appendix B), including the grizzly bear, a species of special concern, and the endangered northern leopard frog. This productivity also supports diverse agricultural production that contributes to the overall conservation potential of this landscape.

Figure 12. Creston Valley Wildlife Management Area (left) and northern leopard frog (right). (Photos: CVWMA).

3.1.2 LEADING CONNECTIVITY CONSERVATION GROUPS & ALLIES

Groups engaged in conserving and managing biodiversity and habitat connectivity in the Creston Valley include: CVWMA, Nature Conservancy of Canada, Yaqan Nukiy (Lower Kootenay Band), Northern Leopard Frog Recovery Team, BC Ministry of Forests, Trans-border Grizzly Bear Project, Kootenay Conservation Program, Farmland Advantage, Kootenay Boundary Farm Advisors, Creston Beef Growers Association, Wildsight Creston Valley, Yellowstone to Yukon Conservation Initiative, and Regional District of Central Kootenay. The centrepiece of the Creston Valley Corridor is the CVWMA, and considerable effort has been made to link the riparian-wetland valley bottom to adjacent upland habitats (as discussed above in Section 2.2, Creston Valley Case Study). The Nature Conservancy of Canada has purchased several strategic lands for grizzly bears and northern leopard frogs that also benefit other species at risk.

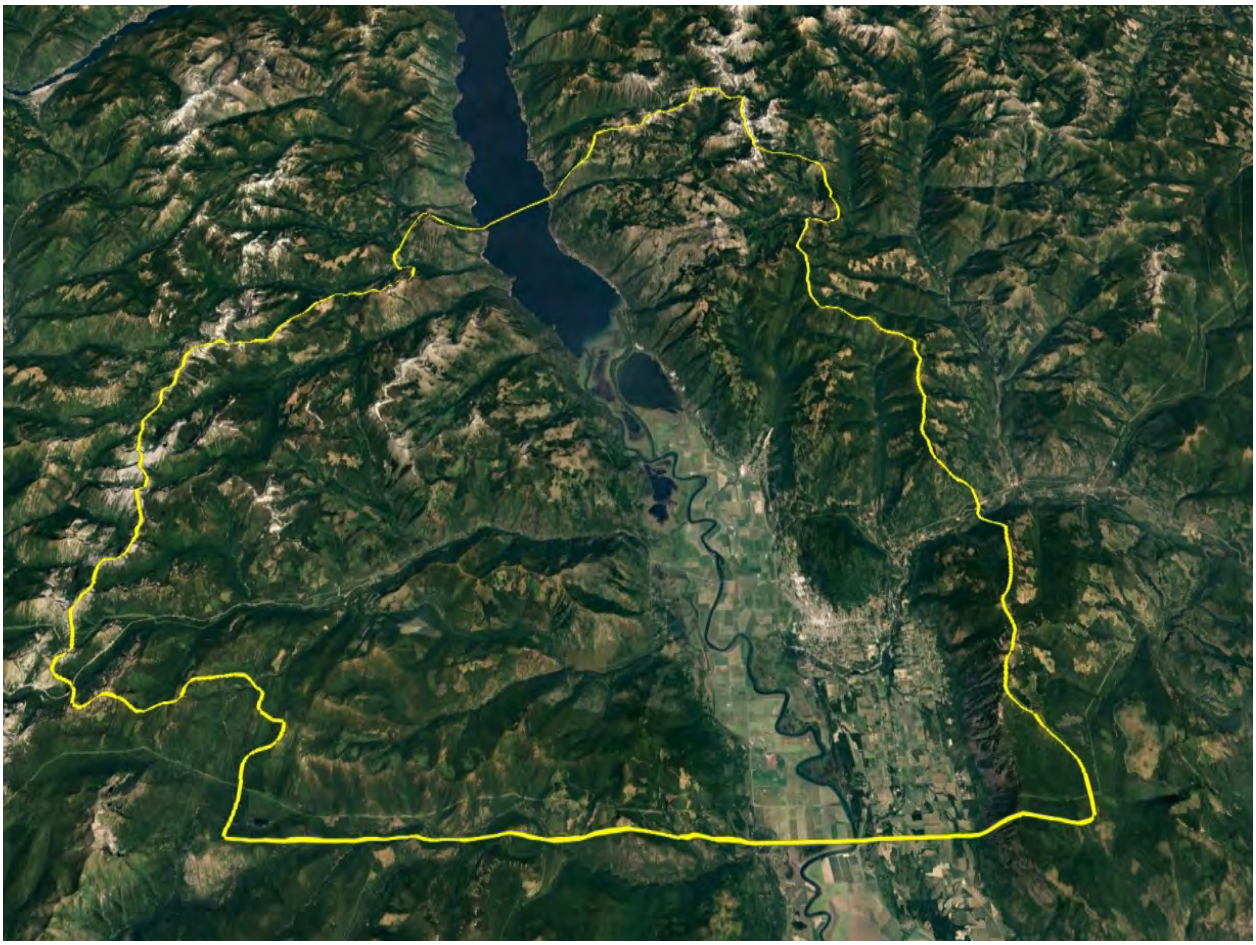


Figure 13. Google Earth image of the Creston Valley focal corridor at the south end of Kootenay Lake connecting the Purcell and Selkirk Mountains (east-west) and the Kootenay River and Kootenay Lake (north-south). (Source: Kootenay Connect).

3.1.3 CRESTON VALLEY CONSERVATION ACTION FORUM AND KOOTENAY CONNECT WORKSHOP

In January 2020, Kootenay Connect co-hosted an in-person Conservation Action Forum in conjunction with KCP and the CVWMA focusing on the Creston Valley. Twenty-seven participants participated and collectively identified ecological threats, conservation opportunities, and collaborative strategies for the valley. We briefly report on the results here. For more details, refer to *Creston Valley Conservation Actions Summary Report*[20].

[20] For more details visit https://kootenayconservation.ca/wp-content/uploads/Creston-Valley-CAF-Summary-Report_FINAL-27Feb2020.pdf

Through this Forum, we identified there is more work to be done to ensure both inter-mountain connectivity across this valley and longitudinally with north-south connectivity along the transboundary Kootenay/Kootenai River. Discussion about healthy floodplains and migrating wildlife underscored the importance of the considering conservation actions that include northern Idaho in terms of a south to north movement of seasonal migrants and species with shifting ranges due to climate change (Figure 14).

During this workshop, scientific recommendations led to identifying *conservation targets* including species at risk (Table A-1); habitat types (Table A-2); habitat features (Table A-3); ecological process (Table A-4); and *ecological threats* (Table A-5) in Appendix B. This group process of identifying important biological and ecological elements and forces within the Creston Valley provided a robust foundation for setting common conservation priorities.

Since this Forum, a diverse group of partners have continued collaborating on conservation land acquisitions, restoration and enhancement projects, and farm tours that are contributing to realizing Kootenay Connect in the Creston Valley.

Of particular interest to Kootenay Connect in the Creston Valley were priorities that incorporated both connectivity conservation and climate adaptation strategies. Key priorities for action identified were:

1. To protect the north-south climate corridor connecting northern Idaho on the west side of the Kootenay River Valley and continuing up to Kootenay Lake on the east side of the Valley. This north-south connectivity would be bridged by the east-west connectivity established across the northern portion of the valley in the Frog Bear Corridors just south of Duck Lake.
2. To restore inter-wetland and river floodplain connectivity to enhance the water storage function of the wetlands and floodplains through the dry summer months.
3. Identify and protect tributaries that have the potential to deliver cold water throughout the summer through their high elevation reach and snowmelt potential.
4. To identify and protect wet, cool old-growth patches throughout the area as fire-resistant patches that may act as climate refugia.
5. To apply fire management activities to reduce intensity, frequency, and extent of fires on ecosystems in areas north and south of the main Creston Valley in the immediately adjacent lower mountain slopes.

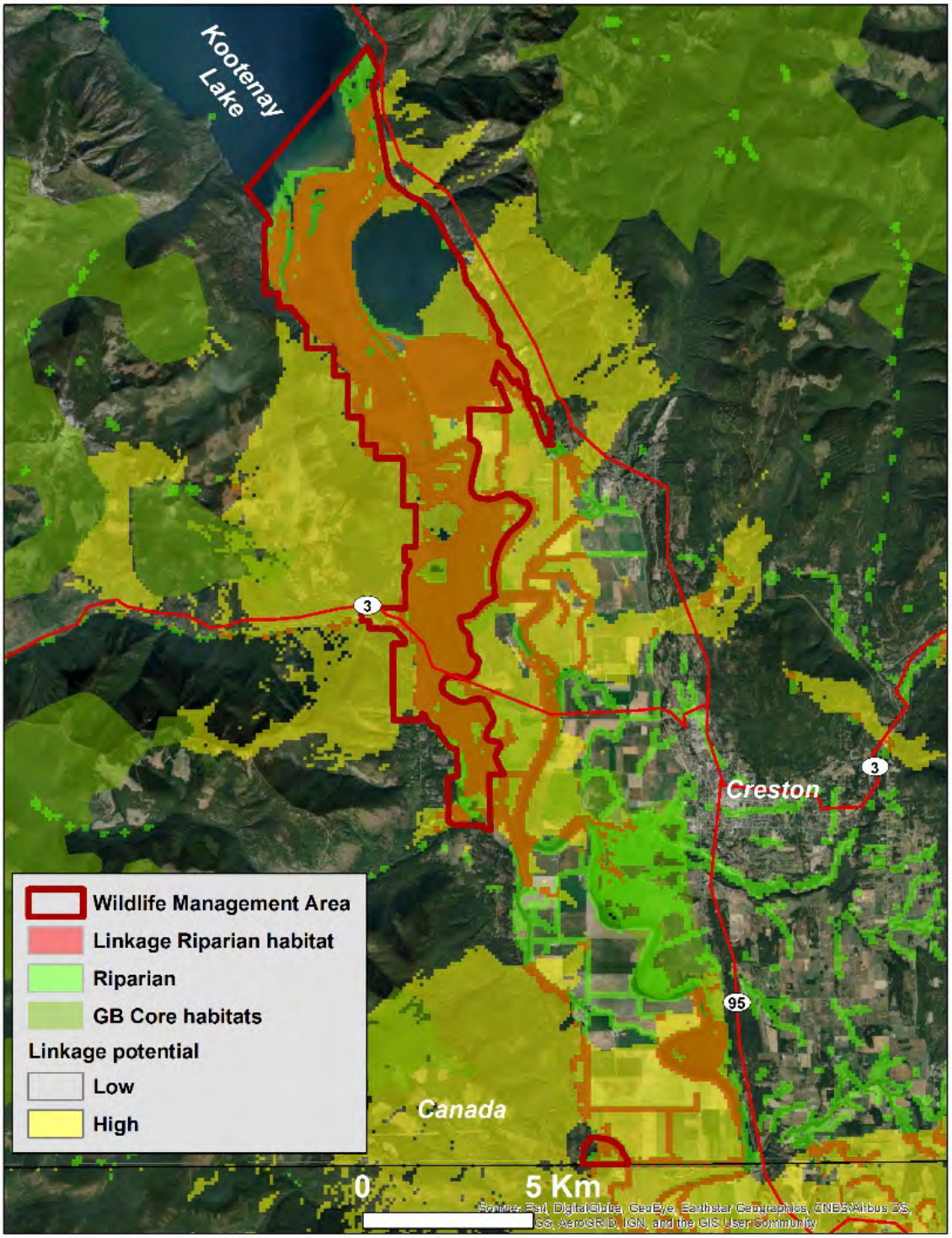


Figure 14. Creston Valley Corridor at the south end of Kootenay Lake connecting the Purcell and Selkirk Mountains with grizzly bear core (green) and linkage (yellow) habitats overlaid with riparian habitats (orange) in the valley bottom (Proctor, 2019).

3.1.4 KOOTENAY CONNECT COMMUNITY-NOMINATED PRIORITY PLACES PROJECT

From 2019-2023, CVWMA used Kootenay Connect CNPP funding along with matching funds from other sources to carry out the following projects.

3.1.4.1 NORTHERN LEOPARD FROG HABITAT RESTORATION

Restoration projects supported by Kootenay Connect CNPP in Year 1 (2019-2020) occurred at the Duck Lake Nesting Area, Six Mile Slough, and Corn Creek Marsh and benefited northern leopard frog and western painted turtle. In the Duck Lake Nesting Area, encroaching emergent vegetation was removed from shallow wetlands and channels to increase open water breeding habitat for leopard frogs and re-established the flow of water between components of the Duck Lake wetland complex (Figure 15, 16).

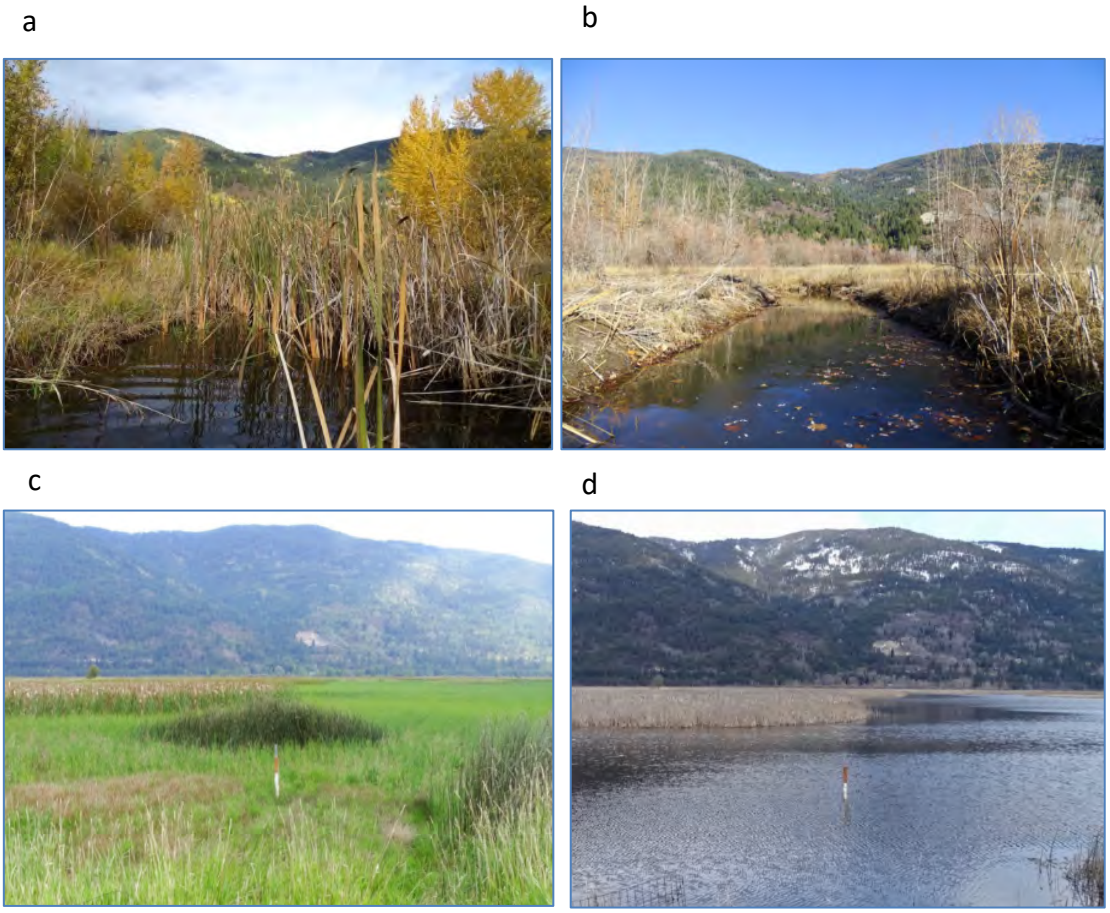


Figure 15. Before and after photos of restoration of northern leopard frog habitat in the Creston Valley: a) vegetation-choked channel; b) same channel with vegetation cleared for better hydrologic connectivity; c) target northern leopard frog breeding area; and d) newly created shallow open water pond the following spring. (Photos: Marc-Andre Beaucher).

Opening-up shallow wetlands and restoring hydrologic connectivity between wetlands and the Kootenay River floodplain is expected to enhance water storage during dry summer months. This and other projects targeting the northern leopard frog population occurred in conjunction with the provincial Northern Leopard Frog Recovery Team. These restoration activities are anticipated to benefit other species including western toad, Columbia spotted frog, long-toed salamander, Pacific chorus frog, western painted turtle; and secondarily, short-eared owl, red-necked phalarope, rusty blackbird, barn swallow, and long-billed curlew.

Figure 16. Intra-wetland hydrologic connectivity work (red areas) supported by Kootenay Connect's ECCC funding to the Creston Valley Wildlife Management Area to improve northern leopard frog foraging, breeding, and overwintering habitat, and connectivity routes between seasonally important habitats. (Source: CVWMA).

In Year 2 (2020-2021), work to improve water control at the Duck Lake Nesting Area resulted in replacement of aging water control infrastructure to enhance overall hydrologic flow in the northern portion of the valley, ultimately benefiting 300 hectares (ha) (67%) of the overall 450-ha Duck Lake Nesting Area.

In Year 3 (2021-2022), CVWMA and NCC teamed up to improve habitat for the northern leopard frog between their overwintering and breeding areas. This was accomplished through wetland creation on NCC's land adjacent to the CVWMA that included reclaiming an agricultural field by excavating three small areas for new wetlands as well as re-contouring an agricultural ditch to make it more frog-friendly (Figure 17, 18). Native tree seedlings and shrubs were planted, and invasive plants were controlled to improve northern leopard frog habitat and also benefit western painted turtles. Two of the three ponds have lower water tables and provide variation in water retention throughout the seasons.

Figure 17. Design of the project area for three new constructed wetlands and recontouring of a drainage ditch on the Nature Conservancy of Canada's Frog Bear property (CVWMA, 2021).

Figure 18. A wetland pond created on NCC's property in 2021-2022 Frog Bear Corridor within the Creston Valley. This is the most westerly pond in the design of Figure 18 above. (Photo: Marc-Andre Beaucher).

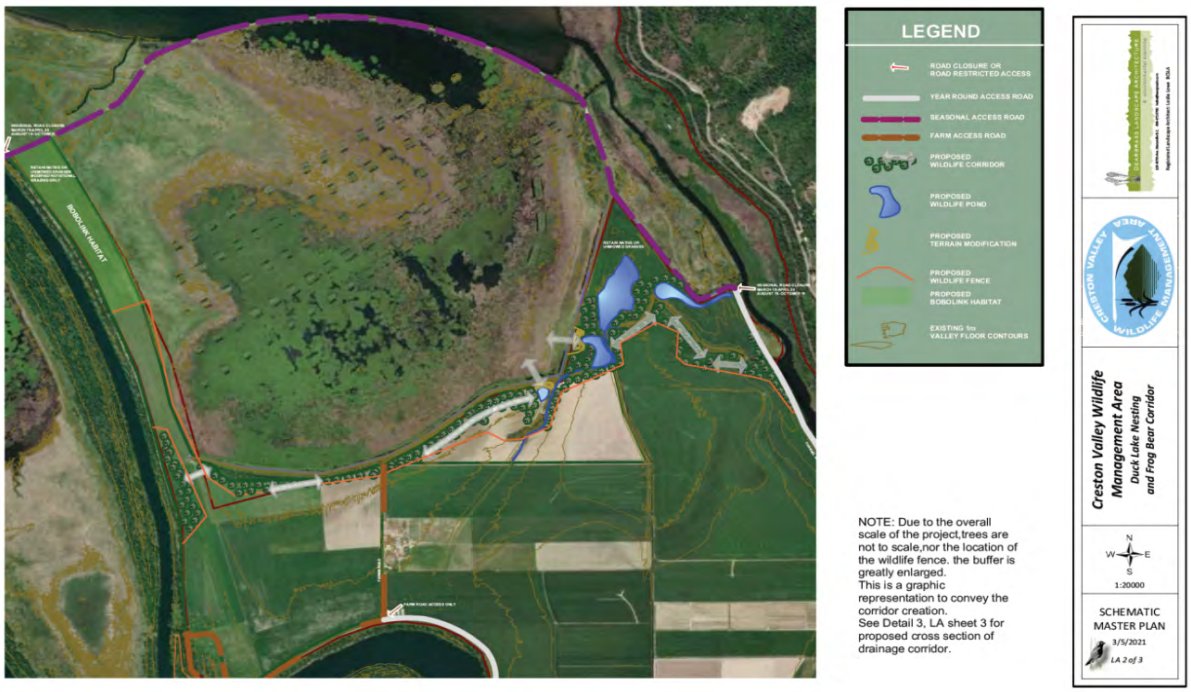
3.1.4.2 CROSS-VALLEY CONNECTIVITY

Concurrently, the CVWMA led a planning exercise to assess cross-valley connectivity just south of the Duck Lake Nesting Area for large and small mammals in the Frog Bear Conservation Corridor described earlier in Section 2.1. The result was a Landscape Connectivity Restoration Plan (Lowe, 2021; Figure 19) that contained several landscape designs for on-the-ground restoration activities that were carried out in Year 3 (2021-2022). Projects included enhancing a habitat buffer of riparian and upland shrub and forest land along the south side of the Duck Lake Nesting Area to benefit cross-valley connectivity for wildlife.

a


GRAZED UPLAND AREA CONFLICTS WITH BOBOLINK NESTING
BOBOLINK HABITAT
RIPARIAN MATRIX
FRAGMENT DOGWOOD THICKETS
RIPARIAN EDGE DEGRADED BY CATTLE
FRAGMENT BLACK COTTONWOOD FOREST UNDERSTORY REMOVED BY CATTLE
BIKE, LINEAR CORRIDOR BARRIER BETWEEN WETLANDS AND UPLAND HABITAT
FRAGMENT BLACK COTTONWOOD FOREST UNDERSTORY REMOVED BY CATTLE
CHANNELIZED STEEP BANKED DRAINAGE DITCHES
ROAD LINEAR CORRIDOR
FARMLAND MATRIX
RURAL DEVELOPMENT
FOREST MATRIX
RIPARIAN CORRIDOR
RIPARIAN MATRIX
ROAD LINEAR CORRIDOR
RIPARIAN CORRIDOR
Creston Valley Wildlife Management Area
Duck Lake Nesting and Frog Bear Corridor
1:20000
FRAGMENTATION MASTER PLAN
3/5/2021
LA 1 of 3

b


BOBOLINK HABITAT
LEGEND
ROAD CLOSURE OR ROAD RESTRICTED ACCESS
YEAR ROUND ACCESS ROAD
SEASONAL ACCESS ROAD
FARM ACCESS ROAD
PROPOSED WILDLIFE CORRIDOR
PROPOSED WILDLIFE POND
PROPOSED TERRAIN MODIFICATION
PROPOSED WILDLIFE FENCE
PROPOSED BOBOLINK HABITAT
EXISTING 5m VALLEY FLOOR CONTOURS
NOTE: Due to the overall scale of the project,trees are not to scale,nor the location of the wildlife fence. the buffer is greatly enlarged.
This is a graphic representation to convey the corridor creation.
See Detail 3, LA sheet 3 for proposed cross section of drainage corridor.
Creston Valley Wildlife Management Area
Duck Lake Nesting and Frog Bear Corridor
1:20000
SCHEMATIC MASTER PLAN
3/5/2021
LA 2 of 3

c

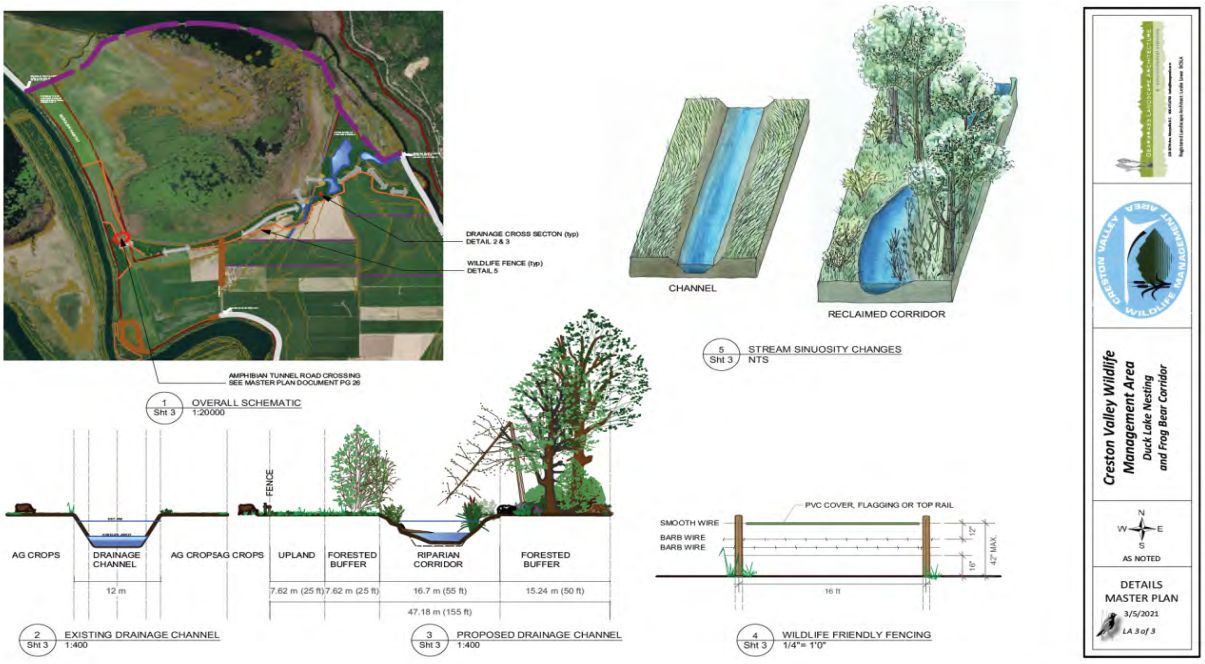


Figure 19. Designs a, b and c developed for CVWMA to inform large mammal and species at risk landscape connectivity habitat enhancement in the Frog Bear Corridor. (Source: Lowe, 2021).

Habitat restoration and enhancement in Year 4 (2022-2023) improved 38 ha of connected habitat within the Frog Bear cross-valley corridor. Activities included recontouring the slopes along over 1,000 m of agricultural drainage channel to improve mobility for leopard frogs and other amphibian species and results in improving approximately 2 ha of habitat (Figure 20). Another project to enhance and extend a channel will provide 4.6 ha of riparian habitat that connects with existing cottonwood riparian forest.

Installation of 2,929 m of cattle exclusion wildlife-friendly fencing to create a 45-m buffer along a cottonwood riparian forest that has been functioning as a wildlife movement corridor (Figure 21). This fencing also protects a 16-ha bobolink nesting area, approximately 7 ha of existing riparian habitat, 1 ha of wet sedge riparian habitat, and 1,800 m of riverbank and shoreline though cattle exclusion from the Kootenay River.

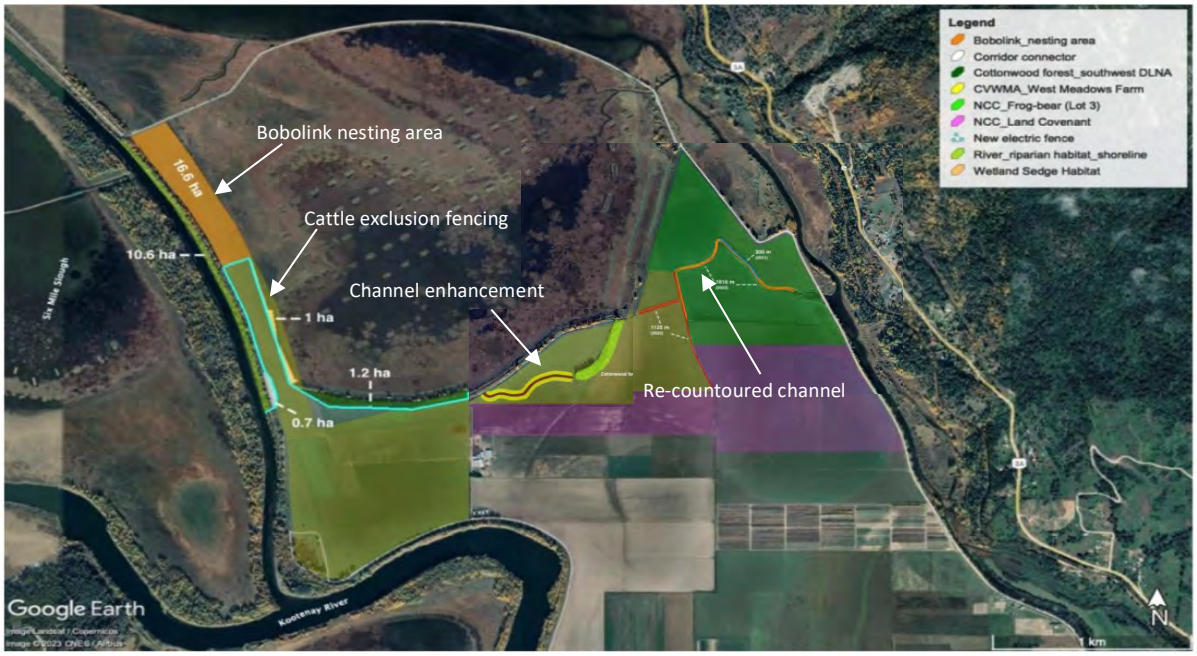


Figure 20. Enhanced connectivity corridor across the Creston Valley south of Duck Lake in the Frog Bear Corridor enhancements included maintain a cottonwood buffer with wildlife-friendly fencing, excavating a new channel, and re-contouring an agricultural drainage channel to accommodate seasonal hydrologic changes. (Source: CVWMA).

a b

Figure 21. a) Wildlife-friendly fencing to exclude b) cattle accessing and trampling riparian habitat. Improvements are designed to protect a riparian cottonwood buffer within Frog Bear Corridor across Creston Valley. (Photos: Marc-Andre Beaucher).

3.1.4.3 PRIVATE LAND MAPPING

Private land stewardship in the Creston Valley is an important contributor to maintaining wildlife habitat and connectivity. Given the extensive agriculture in the valley bottom and the intersection of sensitive wetland-riparian habitat and agricultural land, encouraging environmental farming practices and human-wildlife coexistence can provide important benefits.

During the winter of 2022, Kootenay Connect partners scoped potential large agricultural land for conservation and restoration projects in the Creston Valley between the northern conservation anchor of NCC's Frog Bear properties at Duck Lake and the southern anchor of the Yaqan Nukiy lands north of the U.S. border. Kootenay Connect provided a high-level GIS tour of the Creston Valley to identify farms and other private land parcels with interesting and productive-looking riparian, cottonwood, and wetland habitats. This information has provided Farmland Advantage[21] with a strategy for contacting farmers to discuss their interest and willingness to explore incentives for incorporating environmental practices into the operations (Figure 22).

Then in spring of 2022, Farmland Advantage, Kootenay-Boundary Farm Advisors, Yaqan Nukiy, CVWMA, NCC, and KCP hosted a field tour for Creston area farmers in the Frog Bear Conservation Corridor to discuss agricultural practices in wetland-riparian habitats. These discussions led to the CVWMA's restoration and wildlife-friendly fencing in the heart of this corridor that is discussed above (refer to Figure 20 and 21).

[21] Farmland Advantage is a payment for ecosystem services program which partners with farmers and ranchers in BC to protect and conserve critical lands, streams, and habitats.

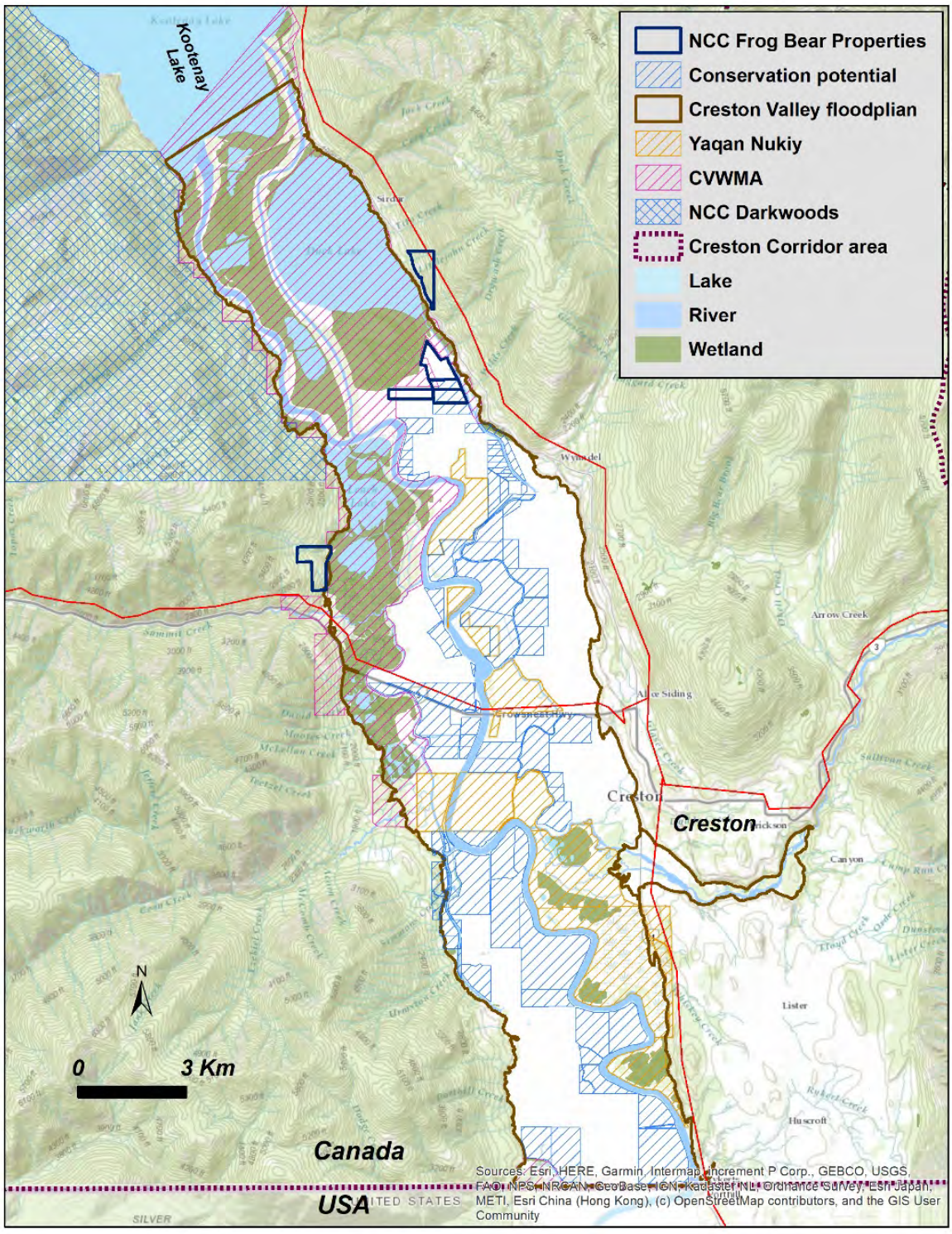


Figure 22. Private land conservation opportunities in the Creston Valley adjacent to wetland-riparian habitats with conservation potential to be pursued by Farmland Advantage. (Source: Kootenay Connect).

3.1.5 CLIMATE ADAPTATION RECOMMENDATIONS FOR THE CRESTON VALLEY

In 2020, Utzig further outlined a potential approach to incorporating changes associated with climate disruption into threat assessments and management planning for the Creston Valley[22]. Important components of climate disruption adaptation will be: a) a trend to warmer and drier conditions at the lower elevations – shifts from climates associated with mixed closed and open forests to those of open savannah forests or even grasslands/steppe; b) almost complete disappearance of climate envelopes associated with Engelmann spruce-subalpine fir (ESSF) forests; c) increased incidence of extreme events in the form of high-intensity precipitation, heat waves/drought, windstorms, freeze/thaw events, floods and landslides will result in further types of disturbance; d) increased occurrence of winter precipitation as rain rather than snow, especially at lower elevations; and e) significance of potential cool refugia and/ or wildfire refugia. The results of the bioclimate shift analysis and projected wildfire increases suggest that increasing resilience to drought and wildfire are likely the highest priorities for adaptation in forested ecosystems. Building resilience into wetland water management is also a priority to consider.

The Creston Valley area is an important cross-valley component of a climate change corridor running up the west side of the Kootenai Valley in Idaho, extending to the Darkwoods Conservation Area on the west side of Kootenay Lake, connecting across the CVWMA, to a further linkage zone up the east side of Kootenay Lake (Figure 23).

[22] https://kootenayconservation.ca/wp-content/uploads/2020/05/Bonanza-Creston-Climate-Adaptation-Strategies-Report.pdf

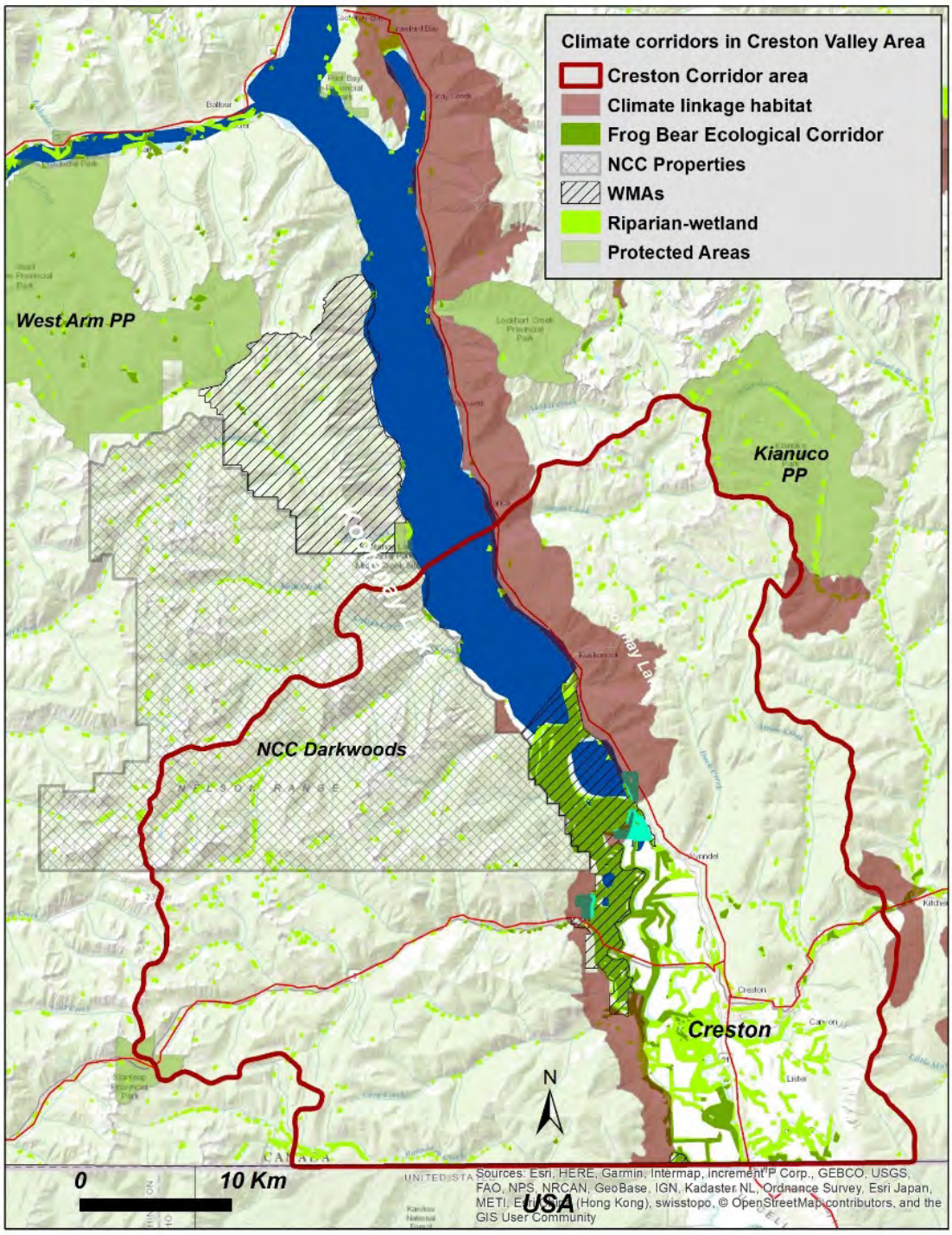


Figure 23. The Creston Valley is an important cross-valley component of a regional climate change corridor running from the Kootenai Valley in Idaho through the Creston Valley Wildlife Management Area to the east side of Kootenay Lake (Utzig, 2020).

3.2 BONANZA BIODIVERSITY CORRIDOR

3.2.1 GEOGRAPHIC DESCRIPTION

The Bonanza Biodiversity Corridor (BBC) is part of Kootenay Connect Community-Nominated Priority Places. The 140 km^2 BBC encompasses an area of 12,865 ha that link Slocan and Summit Lakes within the upper Slocan Lake Watershed (Figure 24, 25). At a landscape scale, the BBC has great potential to be a significant wildlife and ecological corridor connecting the Valhalla and Central Selkirk Mountain ranges, and thus linking Valhalla and Goat Range Provincial Parks. The BBC's wetland and riparian areas are sensitive ecosystems with high biodiversity values. These ecosystems support a wide range of aquatic and terrestrial habitats and contribute significantly to the hydrologic functioning of the Slocan Lake Watershed (Mahr, 2018b). The historic Canadian Pacific Railway berm that runs the length of the BBC's 15-km-long valley bottom acts as a linear dam and over time has negatively impacted the dynamic wetland-riparian-floodplain system of Bonanza Creek and its tributaries.

KCP conducted a high-level assessment of the BBC's conservation values and habitat connectivity areas that underscored the ecological values of this biodiverse corridor within the Interior Temperate Rainforest (Mahr, 2018b). In 2013, the BC Wildlife Federation (Schott, 2013) sponsored a BioBlitz of Bonanza Marsh and Hunter Siding Wetland, and from 2015-2017, SWAMP (Slocan Wetlands Assessment & Monitoring Project surveyed, classified, and mapped wetlands throughout the BBC including provincially rare cedar-skunk cabbage wetlands and several botanically interesting fens. SWAMP's 2017 report on species at risk identified many unique native flora and fauna not found elsewhere in the Columbia Basin (Durand and MacKenzie, 2017).

The conservation anchor at the southern end of the BBC and at the head of Slocan Lake is Bonanza Marsh. In 2017, the Valhalla Foundation for Ecology (VFE) acquired the 14-ha (35-acre) private parcel of the upper Marsh, referred to as Snk'mip Nature Preserve. VFE is restoring hydrologic connectivity to reclaim areas impacted by human disturbance and enhancing the diversity of wetland types surrounding the core of shallow open water. In 2022, a 5-ha (12-acre) parcel containing the lakeshore portion of the Marsh and bordering Snk'mip was donated to NCC by the landowners. The wetlands support a rich diversity of wildlife and sensitive ecosystems and play an important role in maintaining water quality in Slocan Lake. NCC's parcel includes the confluence of Bonanza Creek and Slocan Lake where kokanee salmon spawn and migratory and resident birds nest and feed.

Figure 24. Looking south from Hunter Siding Wetland to Slocan Lake in the Bonanza Biodiversity Corridor with Bonanza Creek on the right and the linear railway berm on the left extending along the valley bottom. (Photo: Ryan Durand).

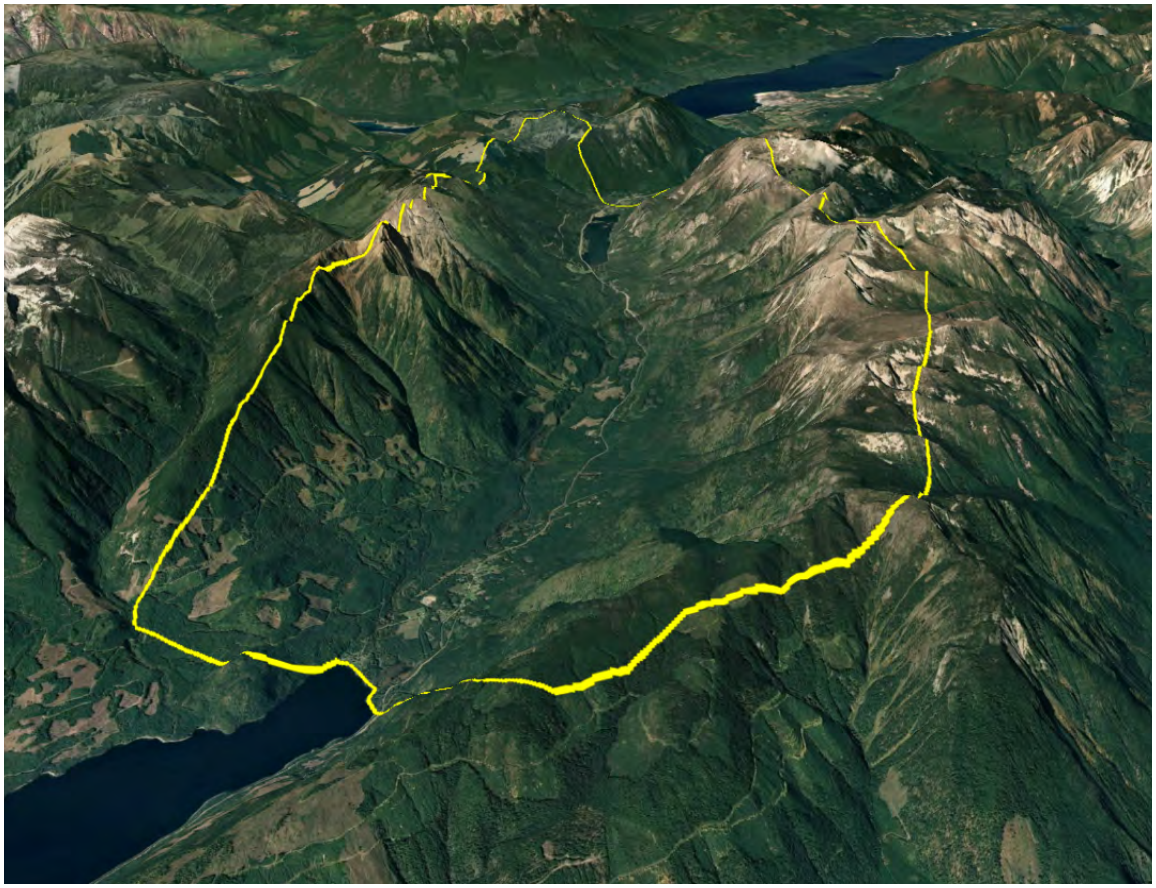


Figure 25. Bonanza Biodiversity Corridor (yellow polygon) extending along BC Highway 6 between Slocan and Summit Lakes connecting the Valhalla and Central Selkirk Mountain ranges. (Source: Kootenay Connect).

At the northern end of the BBC is Summit Lake, which has possibly BC's largest breeding hotspot for the endangered western toad. Over a dozen years of field research have informed highway mitigation strategies that have significantly reduced vehicle-caused mortality of thousands of breeding adult toads and hundreds of thousands toadlets that use a series of underpasses under Highway 6 during their annual migrations (Dulisse et al., 2012, 2015).

3.2.2 LEADING CONNECTIVITY CONSERVATION GROUPS & ALLIES

Groups engaged in conserving and stewarding biodiversity and habitat connectivity in the Bonanza Biodiversity Corridor include the Slocan Lake Stewardship Society, Slocan Wetlands Assessment & Monitoring Project, Summit Lake Western Toad Project, Okanagan Nation Alliance, Valhalla Foundation for Ecology, Valhalla Wilderness Society, and Nature Conservancy of Canada.

The Slocan Lake Stewardship Society (SLSS), who leads Kootenay Connect's projects in this corridor, is a non-profit stewardship organization that is dedicated to retaining the ecological integrity of the Slocan Lake Watershed through applied scientific research, education, and advocacy. At the 2017 Conservation Action Forum co-hosted by SLSS and KCP, the BBC was recognized as a unique ecosystem in need of conservation (Mahr, 2017a, 2017b). The BBC was also identified as a grizzly bear corridor (Proctor et al., 2015; Figure 26), and recently a radio-collared bear used this area to move across the valley between the two mountain ranges.

3.2.3 SLOCAN LAKE WATERSHED CONSERVATION ACTION FORUM AND KOOTENAY CONNECT WORKSHOP

A strategic multi-year approach to conservation planning for the BBC was developed during two workshops held in Silverton. The first workshop, a Conservation Action Forum held in 2017 and hosted by SLSS and KCP, identified seven priority actions for the Slocan Lake Watershed:

1. Pursue Wildlife Habitat Area (WHA) designation for bull trout spawning areas.
2. Identify and conserve remaining old growth forest.
3. Map Critical Habitat for suites of Species at Risk.
4. Propose designation of the "Bonanza Biodiversity Corridor."
5. Manage and monitor invasive species to protect sensitive areas.
6. Implement species-specific actions to prevent impacts of invasive species on native biodiversity.
7. Develop an Ecosystem Climate Change Adaptation Strategy for the Slocan Lake Watershed.

The fourth action, is to provide the ecological justification for designating the “Bonanza Biodiversity Corridor” to formally recognize its ecological significance to providing landscape connectivity, protecting critical habitat and old growth forest, and mediating the impacts climate change from the north end of Slocan Lake to Summit Lake.

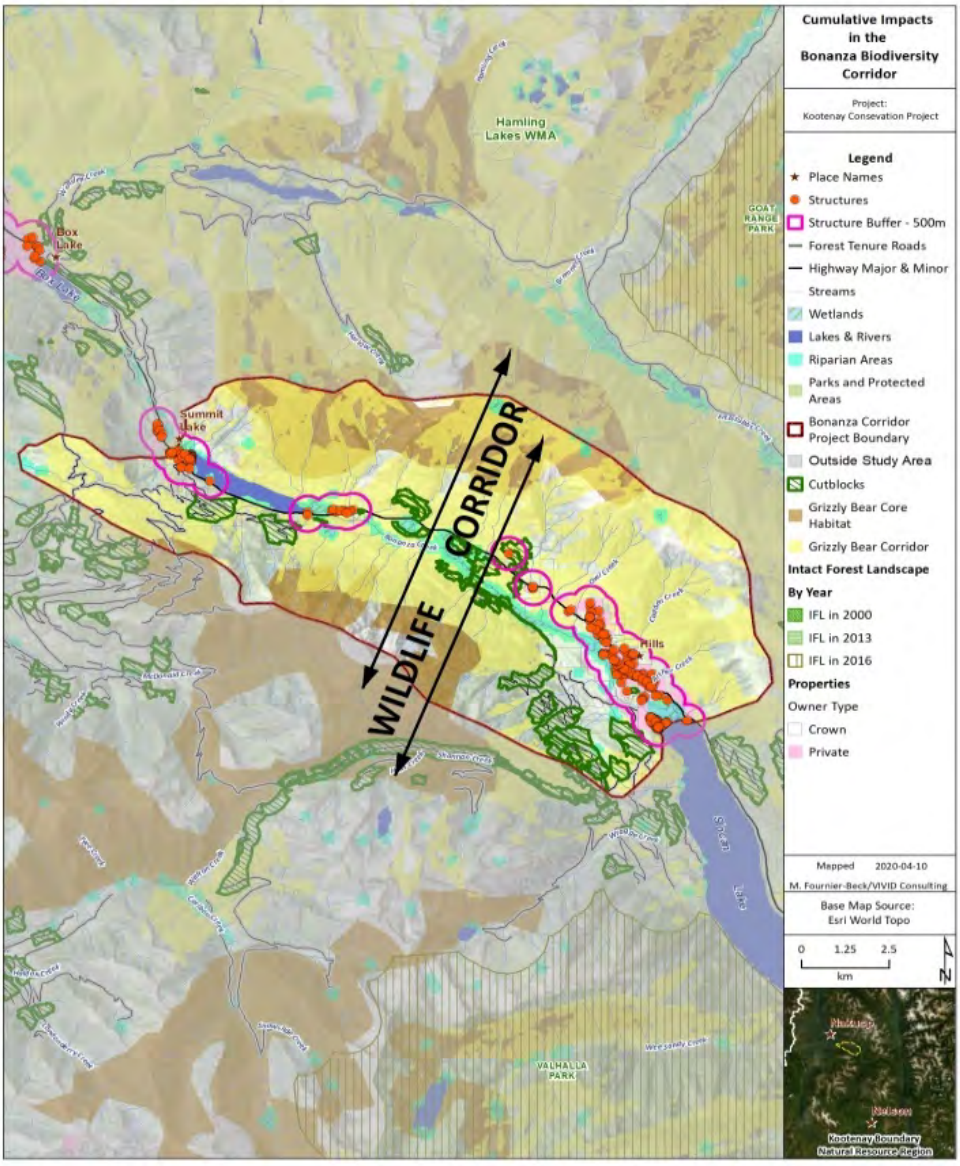


Figure 26. The Bonanza Biodiversity Corridor with grizzly bear core (tan) and linkage (yellow) habitats as identified by the Trans-border Grizzly Bear Project (Proctor et al., 2015), overlaid with cumulative impacts relative to a preliminary upland wildlife corridor. (Source: Kootenay Connect).

Participants at the Forum also identified *conservation targets* including species at risk (Table A-1); habitat types (Table A-2); habitat features (Table A-3); ecological process (Table A-4); and

ecological threats (Table A-1) in Appendix B. We briefly report on the results here. For more details, refer to *Slocan Lake Watershed Conservation Actions Summary Report*[23].

The second workshop, held in 2020 in Silverton and hosted by Kootenay Connect and SLSS, built on the 2017 conservation planning efforts by adding new ecological threats, conservation opportunities, and collaborative strategies (Appendix B). This workshop identified the need for mapping cumulative effects (Figure 26) and highlighted the importance of projects such as the Bonanza Wetland Enhancement Project (a Kootenay Connect CNPP project), which has enhanced and restored three valley-bottom wetlands (Figure 27). In addition, SLSS and its team have assessed beaver habitat, and mapped and ground-truthed species at risk, habitat types, and remaining old growth forest to enhance habitat connectivity along elevation gradients (see below for more details).

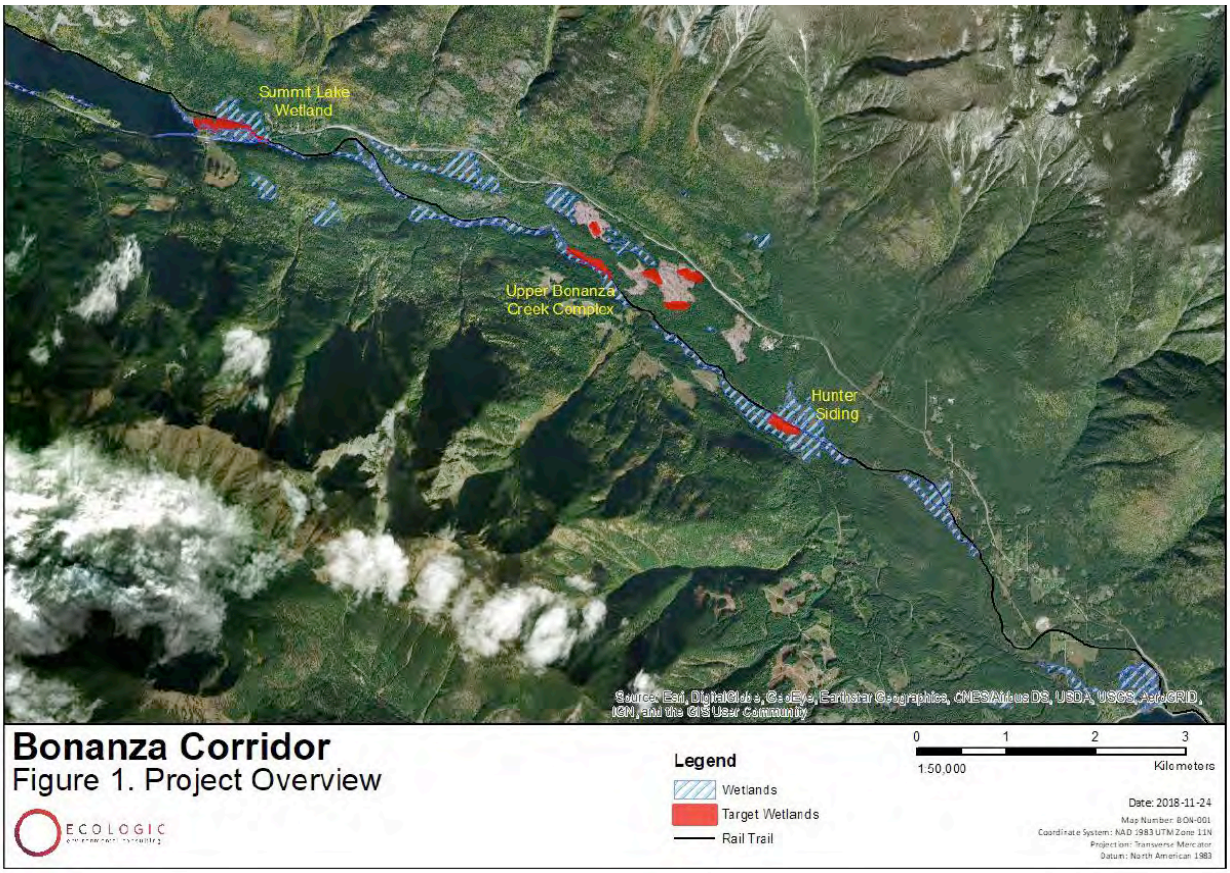


Figure 27. Wetland restoration work in three wetland sites at Summit Lake, Upper Bonanza Creek, and Hunter Siding supported by Kootenay Connect Community-Nominated Priority Places for the Slocan Lake Stewardship Society in the Bonanza Biodiversity Corridor. (Source: EcoLogic Consultants).

[23] https://kootenayconservation.ca/wp-content/uploads/Slocan-Lake-Watershed-Forum-14Mar2017.pdf

3.2.4 PRIORITY CONSERVATION ACTIONS FOR THE BONANZA BIODIVERSITY CORRIDOR

Priority conservation actions identified at the second BBC workshop in March 2020 included:

- Take a landscape-level approach to wildfire preparedness to help prevent catastrophic fires by encouraging Fire Smart forestry practices around private land in the corridor with a combination of thinning and low intensity fires in the wildland-urban interfaces.
- Protect areas around important old-growth patches that lived through past fires.
- Explore Old Growth Management Area (OGMA) protection system in the corridor and ground-truth for accuracy.
- Initiate hydrologic baseline data collection for water monitoring of the Bonanza Creek Watershed.
- Increase public awareness of the ecological significance of the BBC through use of signage and other activities – use this as an opportunity to encourage public participation.
- Notify KCP of potential private conservation properties in the area.
- Explore options and work with the RDCK for how to designate EDPAs in Environmentally Sensitive Areas on private lands.
- Establish a citizen science road watch (mobile App) to monitor roadkill and identify mortality hotspots for potential management.

3.2.5 KOOTENAY CONNECT COMMUNITY-NOMINATED PRIORITY PLACES PROJECT

From 2019-2023, SLSS used Kootenay Connect CNPP funding along with matching funds from other sources to carry out six primary projects. These projects were a direct result of priority actions previously identified in the Slocan Lake Watershed Forum and Kootenay Connect workshops described above.

1. Re-establish hydrologic connectivity between the wetland and riparian zones by enhancing/restoring three wetland sites along Bonanza Creek and Summit Lake.
2. Map all habitat types and remaining old growth using Lidar remote sensing and Terrestrial Ecosystem Mapping (TEM) to protect existing stands of old growth and propose new OGMAs.
3. Conduct a complete species and species at risk inventory.
4. Identify sensitive aquatic habitats for fish.

5. Assess beaver habitat and estimate current beaver population.
6. Prepare a Conservation Plan for the BBC.

3.2.5.1 BONANZA WETLAND ENHANCEMENT PROJECT

Between 2019-2023, restoration activities focusing on hydrologic connectivity and ecological processes to foster species at risk recovery, biodiversity, and climate resilience within three wetland complexes were undertaken and completed. In 2022, monitoring was initiated to assess the efficacy of their hydrologic and ecosystem functions (Peyton et al., 2022). Over time, these restored wetlands will provide long-term ecological benefits through improved water flow and enhanced aquatic and terrestrial (wildlife) habitats which will create a healthier wetland-riparian system and wildlife corridor.

Hunter Siding Wetland

In 2014, SWAMP identified a 2.3-ha area, locally known as Hunter Siding, as a candidate for restoration (Figure 28). Hunter Siding occupies the lowest elevation of a large wetland complex that extends from the edge of Highway 6 west to Bonanza Creek. The complex includes large areas of shrub and forest swamps, beaver ponds, multiple permanent and intermittent watercourses as well as small fens and marshes.

The restoration objective at Hunter Siding was to re-create wetland communities known to occur in the area: Cedar – skunk cabbage swamps and Alder – lady fern swamps. Excavation was performed with a light touch to encourage the reclaiming of natural processes. Historically, disturbances to this site included logging, ditching for drainage, and the construction of a century-old railway through the wetland.

Restoration at the Hunter Siding Wetland was completed in 2021; in 2022, effectiveness monitoring showed the sedge and willow-dominated wetlands appeared to be responding positively to additional water during the summer season. Monitoring included plant diversity as well as survivability of all vegetative plantings (which was 82%) and invasive plants. Western toads were present in new pools which were able to hold enough water through August-September for the development of toadlets. In addition, moose, deer, and beaver were captured on remote cameras in the restored area. More details can be found in Peyton and Durand (2023) along with recommendations for future stewardship work[24].

[24] https://kootenayconservation.ca/wp-content/uploads/2023/04/Bonanza-Wetlands-Restoration-Monitoring-and-Maintenance-Report.pdf

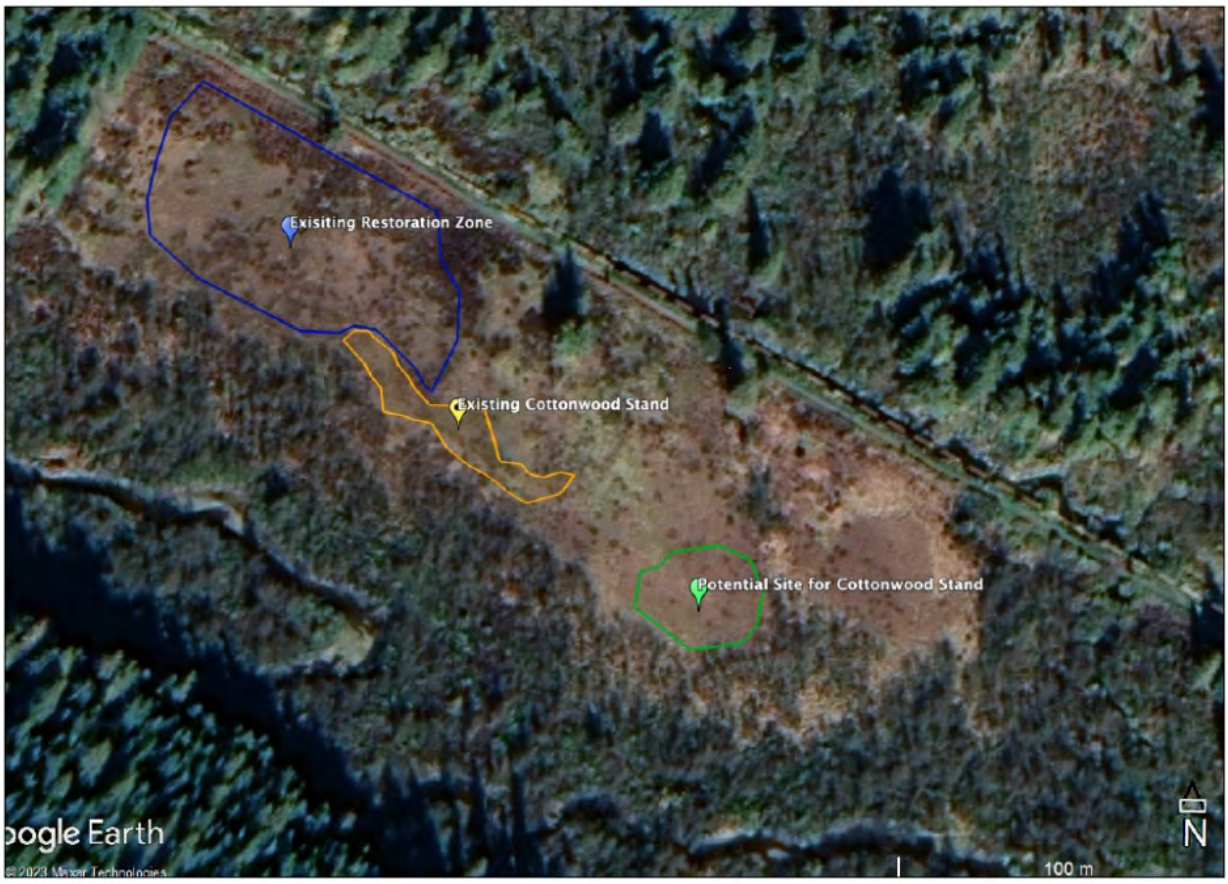


Figure 28. View of the Hunter Siding Wetland restoration sites. (Source: SLSS).

Upper Bonanza Floodplain

The Upper Bonanza restoration occurred in a 12.9-ha wetland and riparian area along Bonanza Creek. Roughly 1.5 km of old rail bed passes through this area, with large portions bisecting active floodplains. The floodplain area is predominately mid-bench alder, willow, and red-osier dogwood along the length of the creek's shoreline. Conifer and mixed floodplain forests are not common in the active floodplain, limiting future recruitment of large woody debris into the creek. Bisecting the active floodplain by the old rail bed has further limited the opportunity for recruitment of woody debris, with few large logs observed within the creek during field assessments in the spring of 2019.

A fish habitat assessment for kokanee and rainbow trout was conducted by Okanagan Nation Alliance in preparation for restoration of Upper Bonanza Creek and Summit Lake Wetland sites in 2021 (Figure 29). Restoration activities included improving hydrologic connectivity across the old rail bed that was isolating portions of the wetland, increasing hydraulic diversity by

deflecting straight sections (Figure 30), and enhancing instream trout rearing habitat by adding woody debris.

Upper Bonanza restoration work was completed in 2021 and monitoring in 2022 found the improvements in good shape and functioning as intended. A future modification could be to lower the height of the swales to allow water to move across the rail bed for connectivity in normal flow years. Remote cameras have recorded an abundance of wildlife using the wetland from great blue heron to black bear.

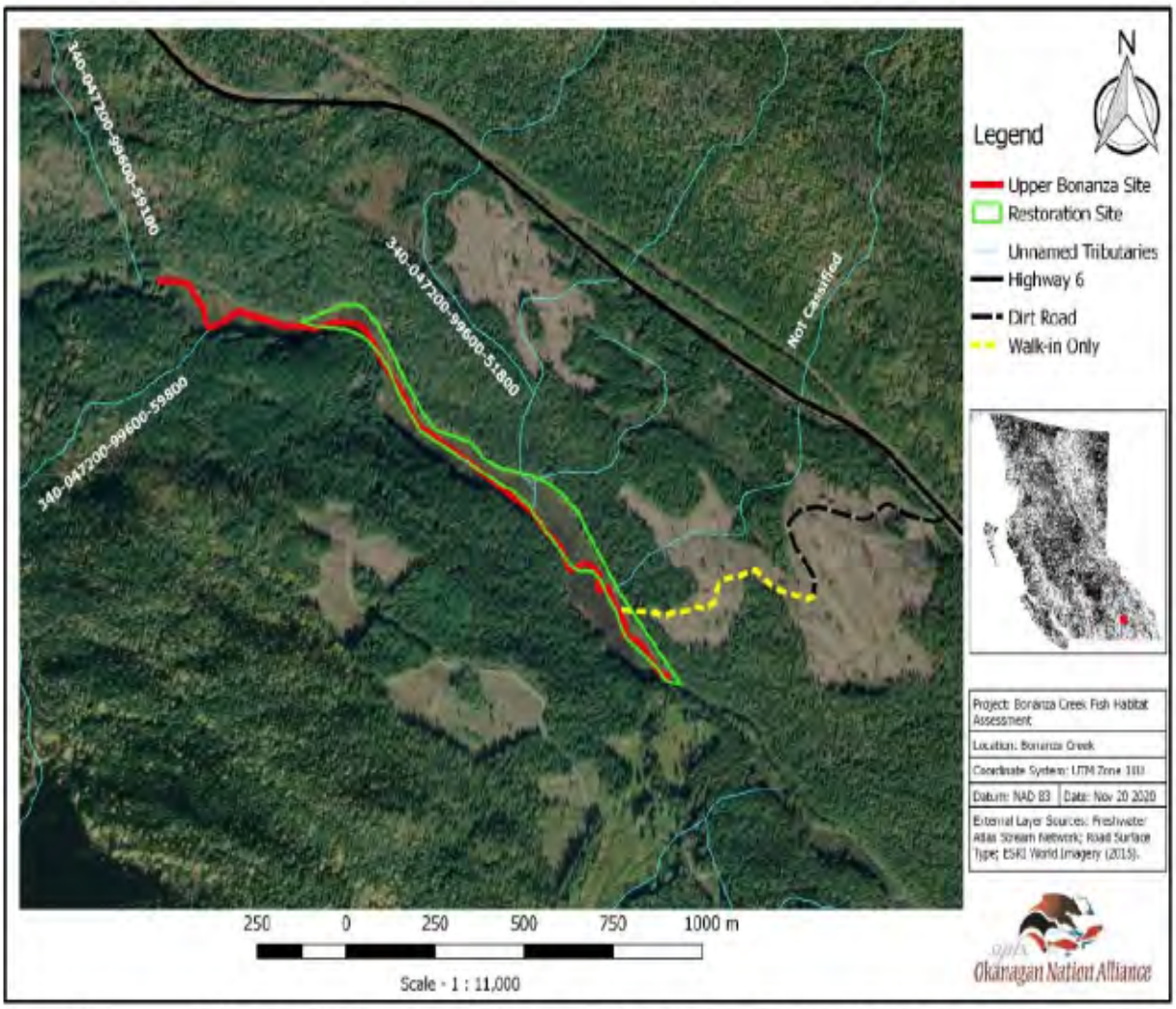


Figure 29. Wetland restoration planning for the Upper Bonanza Creek site includes monitoring area (red), proposed restoration (green), tributaries (blue), and site access (black and yellow). (Source: ONA, 2020).

Figure 30. Pre- and post-site construction to improve hydrologic diversity and connectivity along Upper Bonanza Creek. (Photos: Mountain Station Consultants).

Summit Lake Wetland

Approximately 700 m of the historic railway passes through a large wetland complex at the southeast end of Summit Lake. Large portions of this section of the rail trail flood and erode each spring, predominantly due to beaver activity and changes to hydraulic flow patterns. This section of trail is an integral part of the annual western toad (federally listed as Special Concern) migration from Summit Lake eastward to the Nakusp Range, as many thousands of toadlets migrating with difficulty along and across the trail. The old railway forms a long, linear obstruction through the wetland complex, essentially acting like a long dam, with multiple natural watercourses bisected by the old rail bed.

The restoration objectives at Summit Lake were to reduce flooding and erosion of the rail trail, manage hydrologic connectivity between upstream and downstream portions of the trail, keep recreational trail users out of the wetlands, reduce sediment entering aquatic habitats, and improve habitat for western toad migrations and beaver (Figure 31). In 2021, Summit Lake wetland restoration work improved hydrological connectivity at five sites where the trail bed was rebuilt using swales with similar material as the original substrate; and pedestrian walkways were installed at each water crossing site (Figure 32). Monitoring in 2022 revealed all objectives were being met (Peyton and Durand, 2023). This wetland complex straddling the rail trail supports a wide range of critical aquatic and terrestrial habitats and contributes significantly to

the hydrologic functioning of the Slocan Lake Watershed. The wetlands are especially important to breeding and migrating western toads.

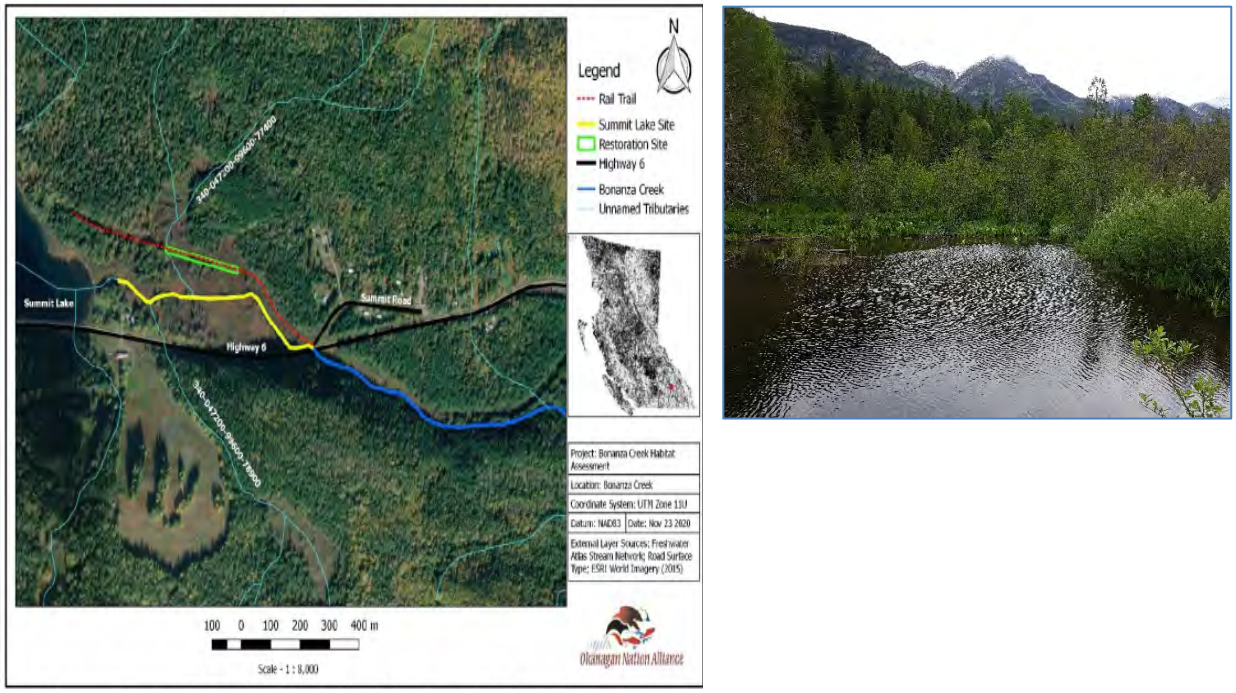


Figure 31. Map for the Summit Lake Site includes the proposed restoration (green), the monitoring area (yellow), site access (red and black), and outflow to Bonanza Creek (blue). (Source: ONA, 2020).

Figure 32. Restoration works on the north side of Summit Lake included installation of five pedestrian walkways that retained the recreational use of the Rail Trail while allowing water to flow through the old railway berm and provide secure cover for migrating toadlets. (Photo: SLSS).

3.2.5.2 BEAVER HABITAT ASSESSMENT

Beavers inhabit portions of the riparian and wetland areas in the BBC; however, the actual distribution of this species is unknown. These 'ecosystem engineers' have the power to drastically alter floodplain habitats by building dams, creating open water, cutting down trees and shrubs, digging canals, and building beaver lodges. On the positive side, these activities increase stream complexity, improve water storage, moderate stream temperatures, reduce stream velocities, create habitat, and reduce flooding (Kinas et al., 2017). On the negative side, however, beavers' activities can create chaos in human-dominated landscapes by causing property damage and flooding, as well as jeopardizing infrastructure.

In the somewhat rural and undeveloped landscape of the BBC, beavers are positively shaping riparian ecosystems through transforming running water into ponds and wetlands. Beaver impoundments seem to be playing a critical role in maintaining ecological diversity and successional changes within streams. Around the world, beavers are being recognized for their role in watershed health and their ability to act as a tool for climate change adaptation and species-at-risk recovery efforts (Kinas et al., 2017).

In 2020, field surveys undertaken in the BBC documented current (active), potential, and historic beaver habitat (Figure 33). Evidence of habitat use included vegetation cuttings, scent mounds, dams, soil excavations, lodges, larders, and trails and runs. Habitat mapping was completed in conjunction with TEM.

All ecosystems that contained features conducive to beaver use (larger creeks, ponds, wetlands, floodplains, and shrub-dominated areas close to water) were considered potential beaver habitats. Areas with significant beaver activity, providing natural channeling and hydrologic flows throughout the corridor, were identified. These habitat categories were mapped as: Active Use, Potential Use, Historic Use, Not Suitable (Figure 34). The habitat assessment suggested that active beaver populations occupy 47.2% (65.3 ha) of the suitable habitat in the BBC.

In 2021, researchers carried out another field survey to assess all potential beaver habitat[25]. Wildlife cameras were installed throughout the BBC at beaver lodges and dams to determine if the structures were being used. Overall, 67 dams were mapped, of which 35 were active. Of the 144 ha of habitat that was assessed: 67 ha was found to be 'Active Use', 58 ha of 'Potential Use', 13 ha of 'Historic Use, and 6 ha 'Unsuitable Habitat'. The conclusion was that 41% of available habitat was currently being used by beavers (Peyton, 2022).

[25] https://kootenayconservation.ca/wp-content/uploads/2022/06/BBC_Beavers_Mar2022.pdf

a

Plate 3.1-1. Lodge near Summit Lake that was active in 2019, then inactive in 2020 due to trapping.

b

Plate 3.1-4. Large active dam on Bonanza Creek in Upper Bonanza.

c

Plate 3.1-2. Apparently inactive lodge near Hunter Siding.

d

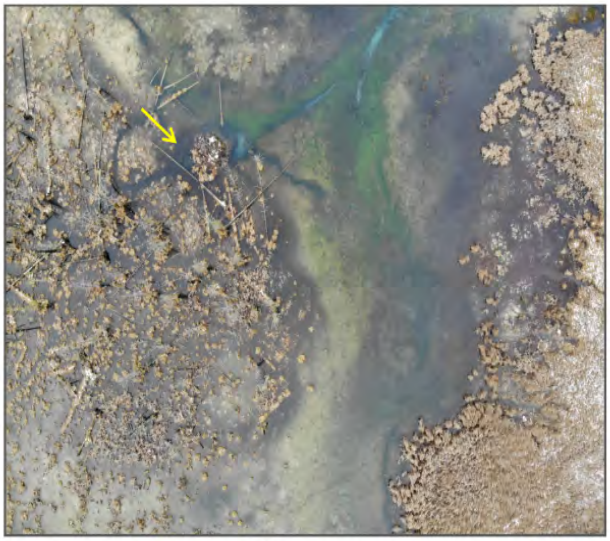


Plate 3.1-3. Active beaver lodge identified via drone surveys in Bonanza Marsh.

Figure 33. Photos of a) beaver lodge near Summit Lake that was active in 2019 and then inactive in 2020 due to trapping; b) large active functioning dam on Bonanza Creek at the Upper Bonanza restoration site; c) Inactive beaver lodge near Hunter Siding; and d) active beaver lodge in Bonanza Marsh. (Photos: Ecologic Consultants).

The population was estimated to be 35 to 45 beavers based on the number of lodges and expected colonies. The overall potential could be as high as 90 beavers in 18 colonies if all potential habitat was being utilized. Over the course of this three-year project, beaver activity

was found to increase mainly along the middle and upper reaches of Bonanza Creek and to decrease somewhat south of Summit Lake due to trapping.

a b

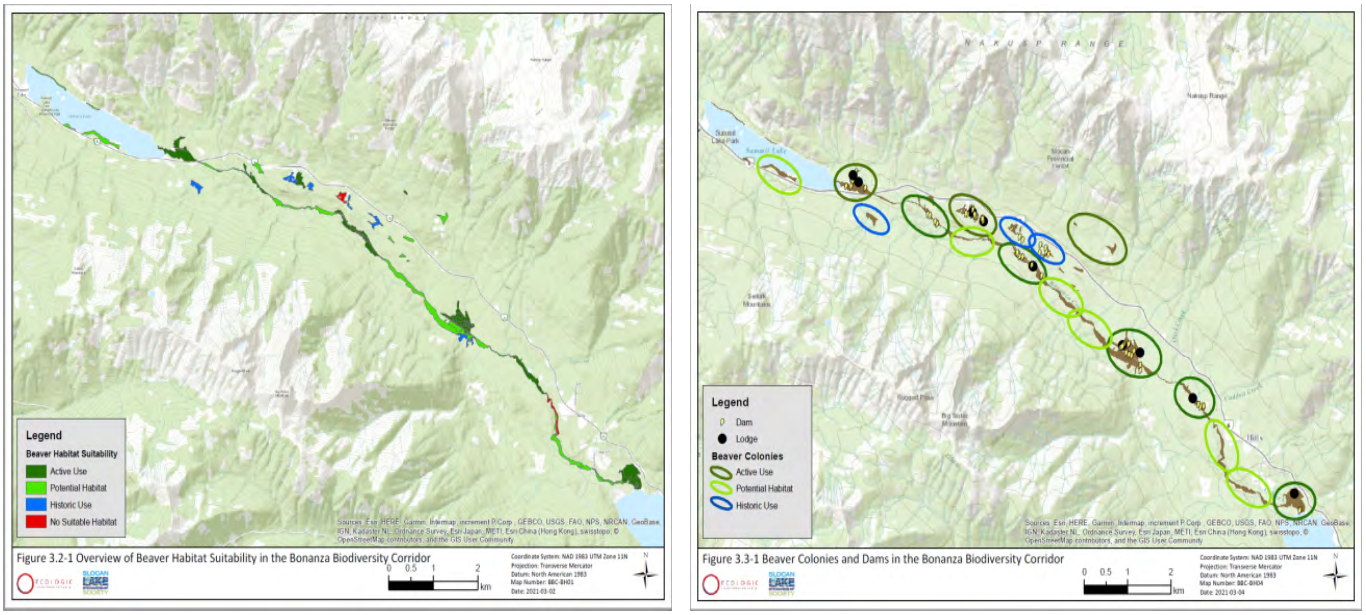


Figure 34. a) Beaver habitat suitability, active, potential, and historic; and b) beaver colony status. (Source: Durand and Peyton, 2021).

3.2.5.3 BIODIVERSITY AND SPECIES AT RISK ASSESSMENT

In 2020-2021, an extensive field and desk-top inventory of biodiversity and species at risk by Durand and Ehlers (2021) documented 1,425 unique species (Table 1) and affirmed the aptly named Bonanza “Biodiversity” Corridor (Figure 35). Species that have provincial and/or federal conservation ranks were identified in the BBC including:

- 4 Endangered, 7 Threatened, and 15 Special Concern species from the federal Species at Risk Act (SARA, 2020);
- 5 Endangered, 8 Threatened, and 21 Special Concern species from the federal Committee on the Status of Endangered Wildlife in Canada (COSEWIC); and
- 5 Red, 55 Blue, and 11 Yellow species tracked by the British Columbia Conservation Data Centre.

This species data will guide future field surveys to focus on under-studied taxonomic groups (e.g., lichens, slime molds), specific habitat types that have a high potential to support SAR that

are known to occur as well as those habitat types that may potentially occur in the BBC, and additional species that have not been observed in the BBC to date.

Table 1. Biodiversity within the Bonanza Biodiversity Corridor (Durand and Ehlers, 2022).

Lifeform	No. of Taxa
Amphibian	4
Annelid	1
Benthic Invertebrate	102
Bird	160
Fish	16
Fungus	258
Lichen	81
Mammal	45
Mollusc	22
Myxomycete	64
Plant	567
Reptile	4
Terrestrial Arthropod	100
Total	**1,425**

Figure 35. The blue-listed Pale Jumping Slug (*Hemphillia camelus*), a new species for the BBC, was found in two locations in 2020. (Photo: Ryan Durand).

Another project in the BBC was the mapping of old-growth forest to assist in conservation planning and justifying further protection of this important low-elevation Interior Cedar-Hemlock Forest type and habitat for old-growth dependent species. Future work includes field ground-truthing the draft old-growth map (Figure 36) and comparing it to existing provincial OGMAs.

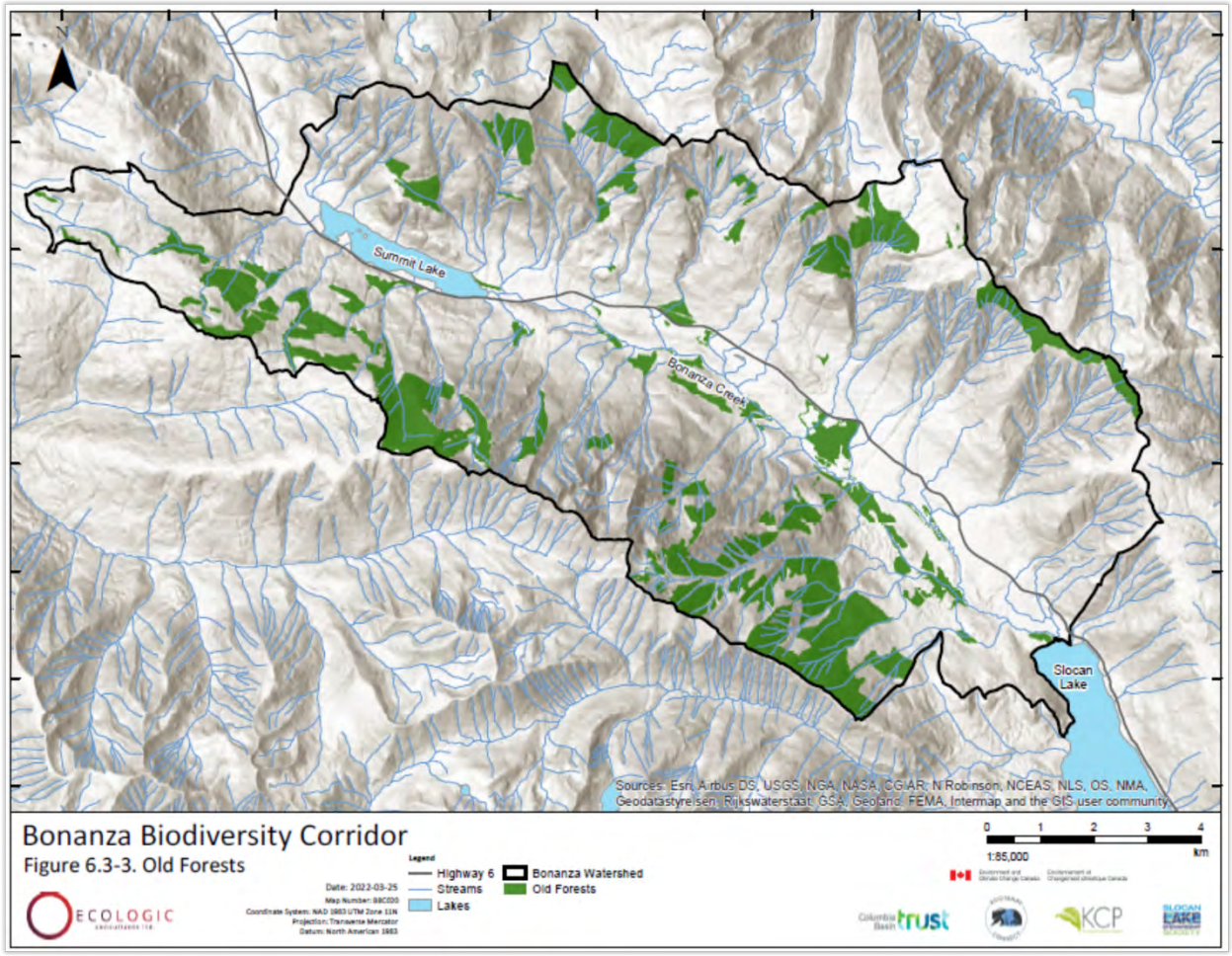


Figure 36. A map of old-growth forests that contributed to the Conservation Values Assessment of the Bonanza Biodiversity Corridor. (Source: EcoLogic Consultants, 2022).

3.2.5.4 CONSERVATION MANAGEMENT PLAN

In an effort to roll up the results of four years of Kootenay Connect projects in the BBC, the SLSS developed two documents to guide their way forward. The *Bonanza Biodiversity Corridor Conservation Values Assessment* (SLSS, 2022) with ecosystem mapping, habitat assessments, and an in-depth inventory of the full range of biodiversity that occurs in the watershed (Figure 37) and the *Bonanza Biodiversity Corridor Conservation Plan* (SLSS, 2023) that provides a strategic roadmap for local and First Nations communities, provincial government, and vested stakeholders to move forward with a progressive and adaptive approach for engaging and protecting the BBC. The plan provides an initial framework to structure and guide recommendations for land and water management, partnerships, and public and stakeholder engagement needed to implement specific strategies.

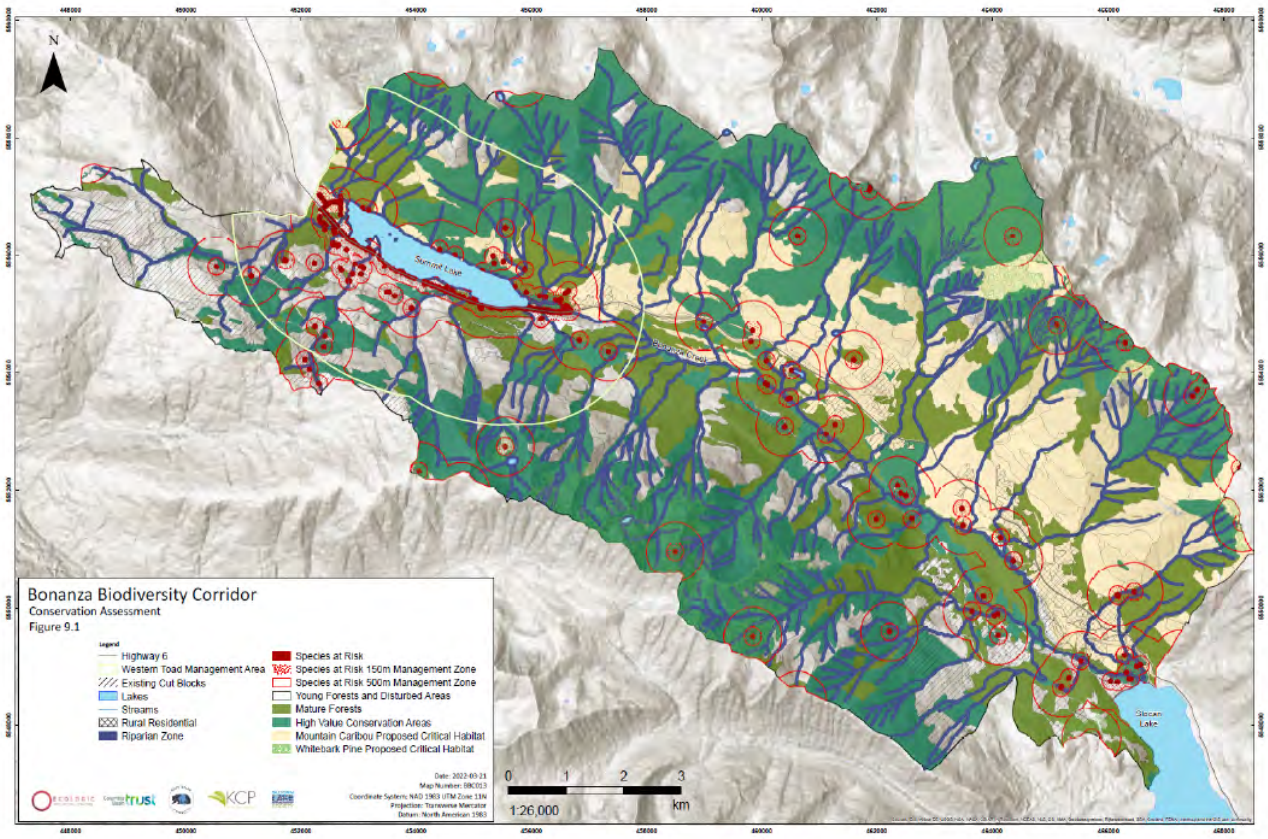


Figure 37. Map of high value conservation areas and recommended management zones from the draft Conservation Plan for the Bonanza Biodiversity Corridor. (Source: EcoLogic Consultants).

3.2.5.5 NEW CONSERVATION LAND

As mentioned above, in 2022 a 5-ha private property that includes the southern portion of Bonanza Marsh and straddles the mouth of Bonanza Creek as it enters Slocan Lake was donated to the Nature Conservancy Canada (Figure 38). This lakeshore property, although small in size, goes a long way in protecting this important wetland complex for its rich biodiversity values and ecological processes, and landscape connectivity. For example, the marsh is a key migratory stop-over for birds, and in fall of 2022, a remote camera detected a grizzly bear meandering along the lakeshore very near this property heading towards Bonanza Creek.

Figure 38. The Bonanza Marsh Conservation Area was donated to the Nature Conservancy of Canada in 2022 to secure the southern anchor of the Bonanza Biodiversity Corridor and the confluence of Bonanza Creek with Slocan Lake. (Source: NCC).

3.2.6 CLIMATE ADAPTATION RECOMMENDATIONS FOR THE BONANZA BIODIVERSITY CORRIDOR

At the 2020 Kootenay Connect workshop in Silverton, Greg Utzig, a climate change modeler and landscape ecologist, proposed piloting a process for meaningfully incorporating climate change impacts into assessments of habitat connectivity. Employing a climate change lens to the Bonanza Biodiversity Corridor enabled us to explore new connectivity needs for climate-induced shifts in species' ranges in the area and the key role of water distribution in determining existing and future cool, wet climate refugia (Utzig and Holt, 2015b).

Following this workshop, Utzig further outlined a potential approach to incorporating changes associated with climate disruption into threat assessments and management planning for the

BBC[26]. Important components of climate disruption adaptation will be: a) a trend to warmer and drier conditions at the lower elevations – shifts from climates associated with closed forests to those of open savannah forests or even grasslands; b) almost complete disappearance of climate envelopes associated with Engelmann spruce-subalpine fir (ESSF) forests; c) increased incidence of extreme events in the form of high intensity precipitation, heat waves/drought, windstorms, freeze/thaw events, floods and landslides will result in further types of disturbance; d) increased occurrence of winter precipitation as rain rather than snow, especially at lower elevations; and e) significance of potential cool refugia and/ or wildfire refugia.

A proposed regional climate change corridor runs from Valhalla Provincial Park along the west side of Slocan Lake through the BBC and then extends along Box Lake to Upper Arrow Lake (Figure 39).

Recommendations include:

- Identify cool, wet, old-growth refugia and protect them using a buffer around important old-growth patches that lived through past fires.
- Identify wetlands that are fed by drainages on the east side of Highway 6 that provide cold water through hot, dry summer conditions.
- Restore intra-wetland and floodplain connectivity to hold water longer.
- Build in wetland redundancy by protecting multiple areas of similar wetland and riparian habitat types.
- Don't focus restoration objectives based on current or past conditions – consider future climate change impacts, i.e., restoration activities must help bridge between different climate conditions.

[26] https://kootenayconservation.ca/wp-content/uploads/2020/05/Bonanza-Creston-Climate-Adaptation-Strategies-Report.pdf

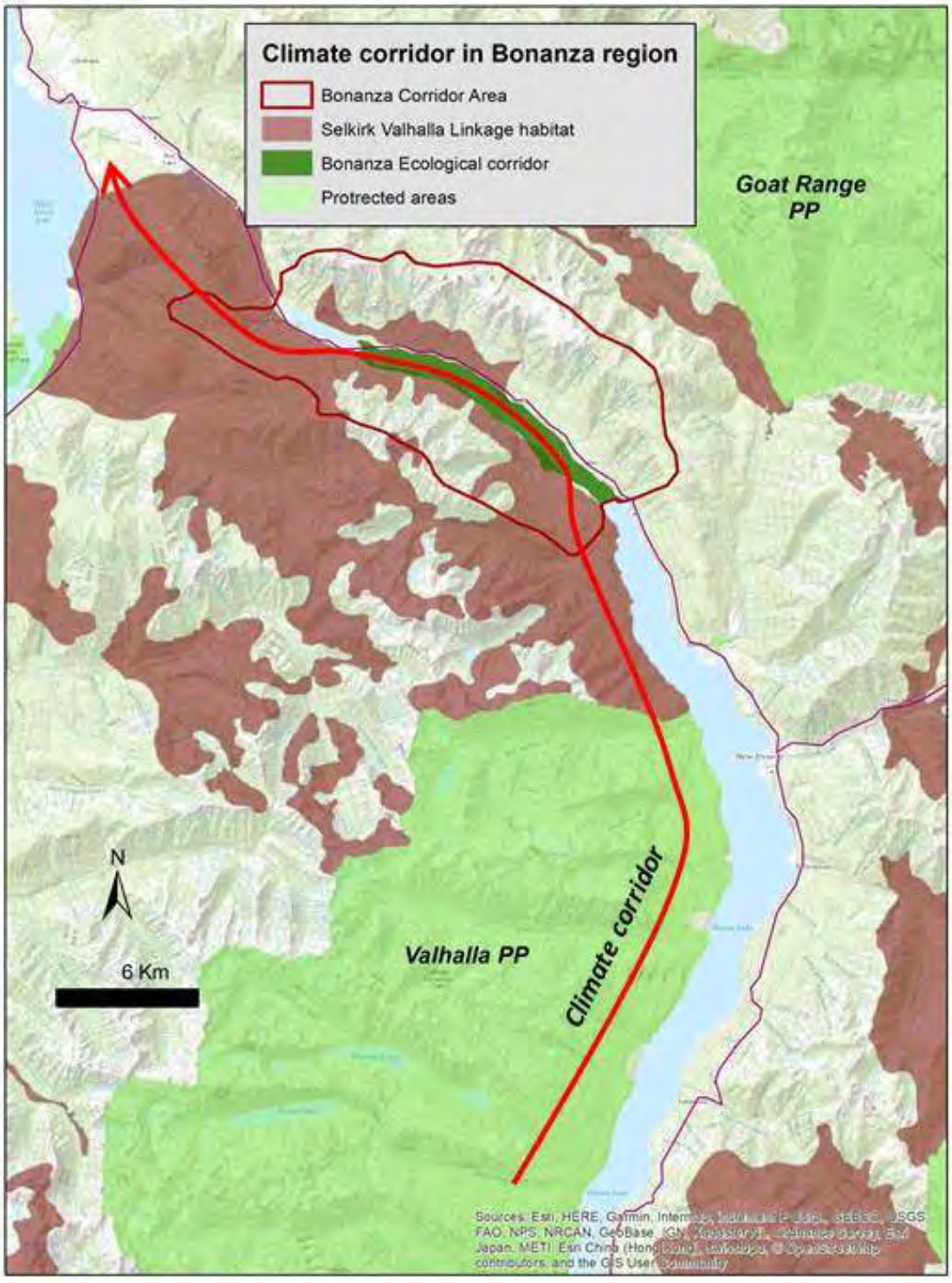


Figure 39. The Bonanza Biodiversity Corridor is an important component of a regional climate change corridor running from the Valhalla Provincial Park to Upper Arrow Lake (Utzig, 2020).

3.3 COLUMBIA WETLANDS

3.3.1 GEOGRAPHIC DESCRIPTION

The Columbia Wetlands are part of Kootenay Connect Community-Nominated Priority Places. The 180-km long Columbia Wetlands within the Rocky Mountain Trench extend from Canal Flats in the south to Donald at the north end (Figure 40, 41). It is one of the largest intact wetland complexes in Canada, and an international Ramsar Site recognized by the United Nations. The Columbia Wetlands contain the headwaters of the Columbia River and its only undammed portion. Much of this wetland complex occurs within the provincial Columbia Wetlands Wildlife Management Area (CWWMA) with a mix of private and federal lands managed as National Wildlife Areas (NWA).

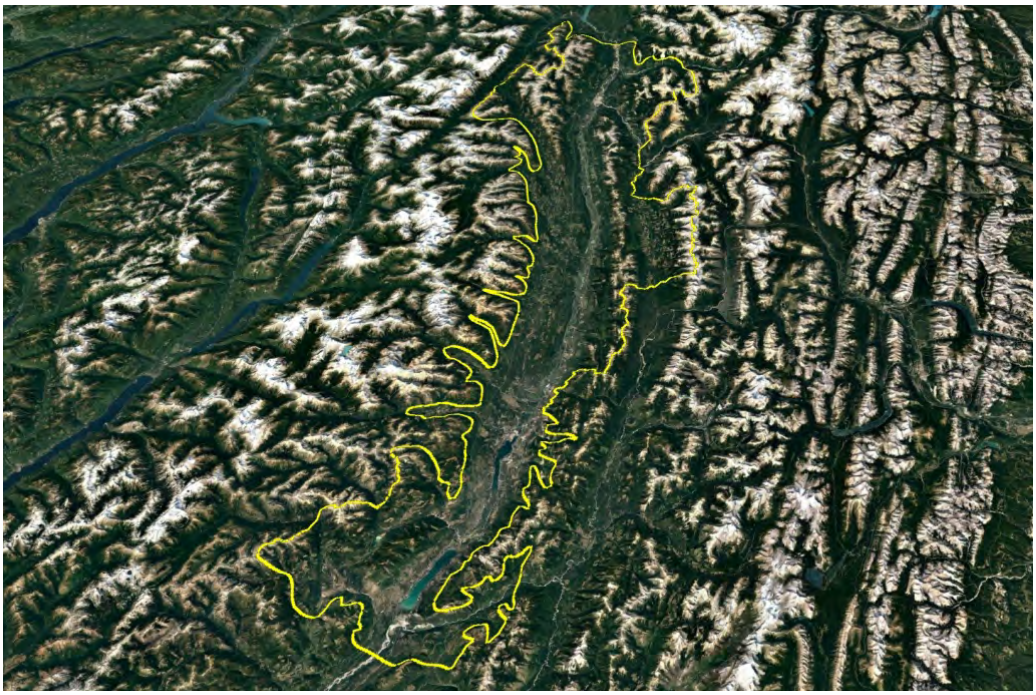


Figure 40. Google Earth image of Columbia Wetlands north-south along the Rocky Mountain Trench (yellow). (Source: Kootenay Connect).

This extensive complex of wetlands along the Columbia River separates the Canadian Rocky and Purcell Mountains across much of the northern portion of the Columbia Valley. It also separates several large, protected areas including Kootenay and Glacier National Parks and the Provincial Purcell Wilderness Conservancy (Figure 42). This physical setting situates the Columbia Wetlands as both an important north-south and east-west corridor for a broad spectrum of biodiversity.

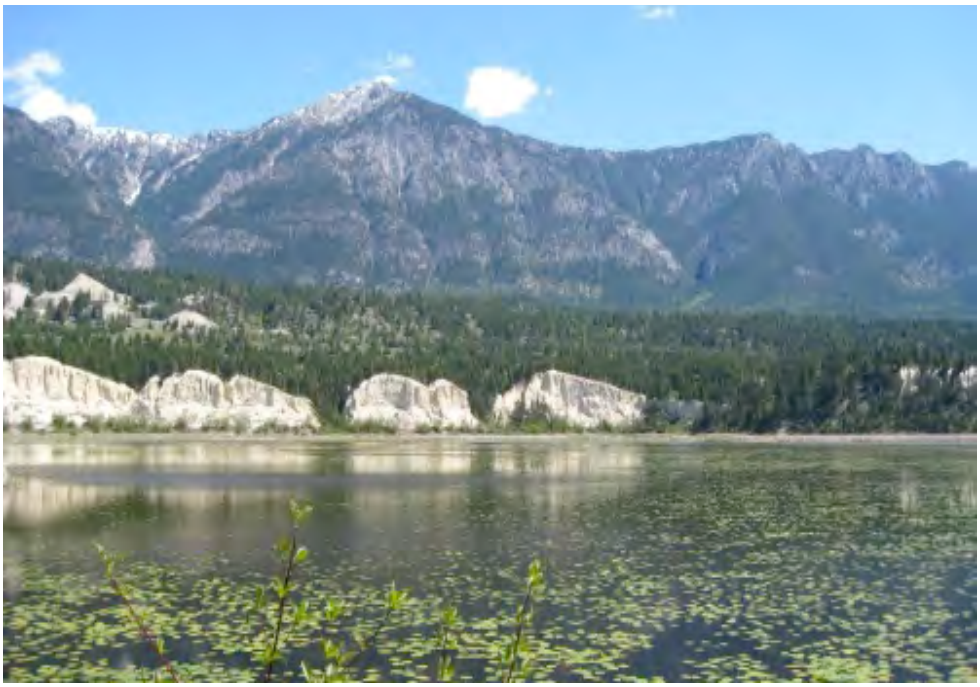


Figure 41. Shallow open water wetland surrounded by clay banks in the Columbia Wetlands near Edgewater, BC. (Photo: M. Mahr).

3.3.2 LEADING CONNECTIVITY CONSERVATION GROUPS & ALLIES

Most groups that engage in conserving and managing biodiversity and habitats in the Columbia Wetlands are partners of the Columbia Wetlands Stewardship Partners (CWSP). This non-profit partnership includes over 30 organizations dedicated to working with all levels of government, community groups, and the public to implement a shared stewardship model for the management of the upper Columbia River and adjacent wetlands. The partnership includes a variety of environmental, agricultural, hunting and fishing organizations, various levels of federal and provincial government, local communities, First Nations, and business representatives from tourism and forestry sectors.

3.3.3 COLUMBIA VALLEY CONSERVATION ACTION FORUM AND KOOTENAY CONNECT WORKSHOP

In December 2017, KCP and CWSP co-hosted a Conservation Action Forum (Mahr, 2018a). We briefly report on the results here. For more details, refer to *Columbia Valley Priority Conservation Actions Summary Report*[27]. Scientific recommendations led to identifying conservation targets and ecological threats for the area.

[27] https://kootenayconservation.ca/wp-content/uploads/Columbia-Valley-Conservation-Action-Forum-Summary-Report-FINAL_20Dec2017.pdf

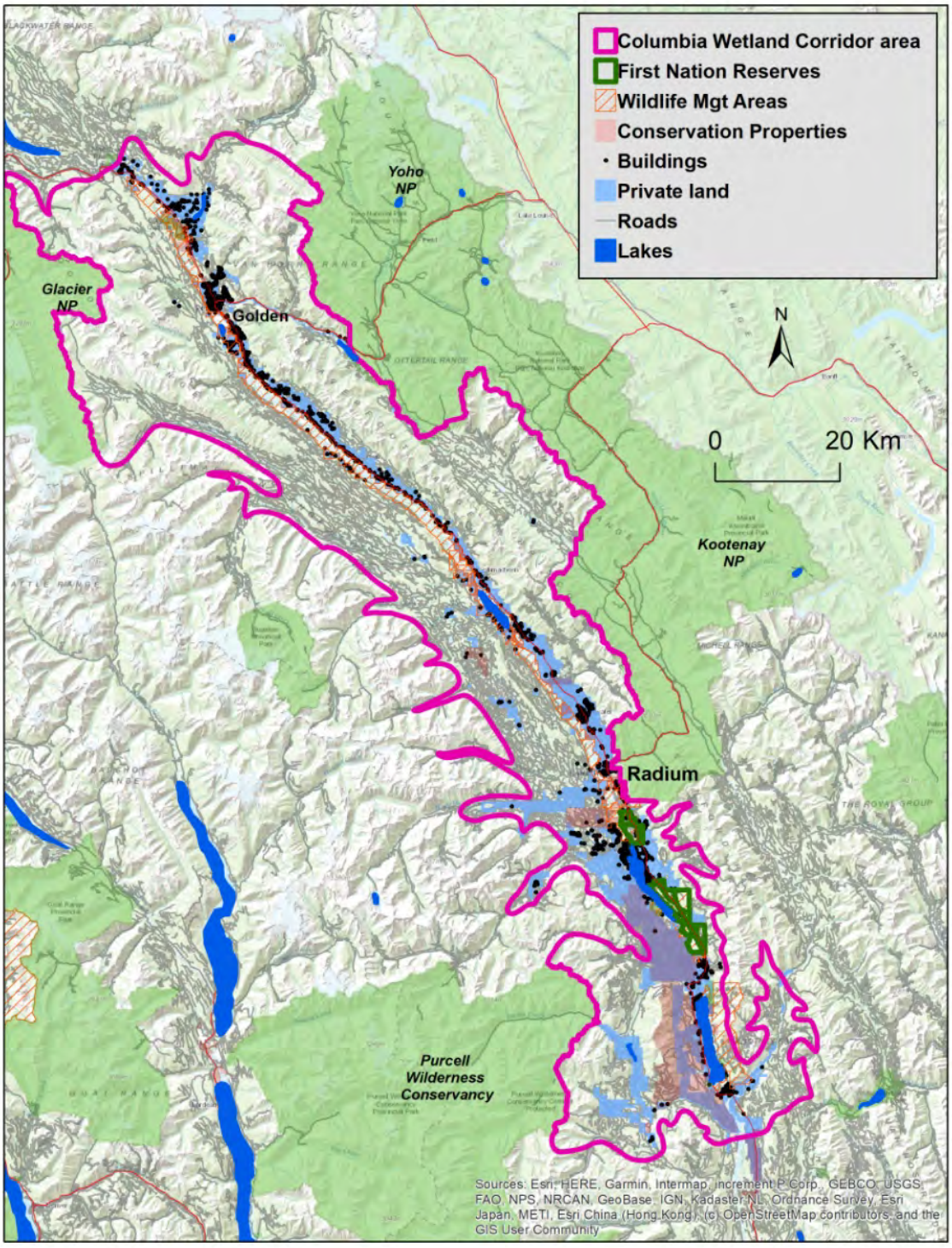


Figure 42. The human footprint of settlements and roads within the Columbia Wetlands Corridor. (Source: Kootenay Connect).

Two years later in November 2019, Kootenay Connect held a Columbia Wetlands Corridor workshop to discuss wildlife corridors and ecological connectivity with participants who shared their diverse expertise and interests to conserving the Columbia Wetlands. This group updated the lists of conservation targets and threats generated at the 2017 Conservation Action Forum, including species at risk (Table A-1); habitat types (Table A-2); habitat features (Table A-3); ecological process (Table A-4); and *ecological threats* (Table A-5) in Appendix B.

This corridor workshop focused on how past habitat suitability models developed for ungulates and carnivores could be updated to inform cross-valley upland corridors; the need for hydrologic monitoring and assessments to identify wetland vulnerable to climate change and inform mitigation management; the need for more species at risk surveys; the benefits of creating a "conservation opportunities map" for private lands along the boundary of the CWWMA to be used by the Nature Conservancy of Canada and The Nature Trust of BC; and how Kootenay Connect can provide scientific rationale for corridor identification and designation of ESAs/EDPAs within corridors for Official Community Plans (OCPs).

3.3.4 PRIORITY CONSERVATION ACTIONS FOR THE COLUMBIA WETLANDS CORRIDOR

Many of the following actions identified in 2019 are being addressed through Kootenay Connect CNPP and the Kootenay Connectivity Working Group.

- Protect hydrological inflow in the Columbia River and Wetlands by expanding monitoring and implementing adaptive measures to reduce impacts from climate change on hydrologic processes and functions that could impact the area's fish, wildlife, and overall biodiversity.
- Implement a regional conservation plan to facilitate species (including SAR) and habitat shifts necessary for resilient ecosystems to adapt to climate change, including connectivity for species and ecosystems in both the north-south and east-west dimensions:
    - Identify and protect old-growth hotspots as potential climate refugia.
    - Identify biodiversity hotspots for potential climate refugia.
- Floodplain management:
    - Identify floodplain hazard zones – to be zoned as no development.
    - Introduce management that slows water flow through the Columbia Wetlands and increases complexity and interconnected waterways.
    - Identify drainages with more permanent and colder sources of water.
- Use Kootenay Connect's wildlife science and maps to guide recreation access management planning initiated by the provincial government in the Columbia Valley.

- Support the RDEK planning office and elected officials willing to integrate science-based information into private land development permitting for sensitive areas. RDEK planners indicated the following as potential avenues of cooperation with Kootenay Connect:
    - Use of Development Permit Areas relative to ESAs – Kootenay Connect can help define ESAs (high, medium, low) that would be managed through their existing permitting process.
    - Kootenay Connect can provide a scientific rationale for designating corridors and incorporating them into land use planning.
    - Scientific rationale for ESAs should include sensitive habitats for species at risk, wetlands, riparian, wildlife corridors, etc. as well as important wetland-upland (cross-valley) connectivity.
    - As OCPs are being updated, Kootenay Connect can provide details for corridor identification.
    - Identify for protection private and public lands adjacent to wetlands outside the CWWMA and NWAs.
    - Identify and map important floodplain areas, alluvial fans, and hazard areas for management planning.
- Identify potential WHAs under BC's Forest and Range Practices Act (FRPA) for important habitats for American badger, Lewis's woodpecker, and great blue heron – these species may be less controversial since protections may not impact forestry as much as other species at risk.
- Gather existing scientific information to identify cross-valley upland-wetland corridors for as wide a spectrum of nature as possible.

3.3.5 KOOTENAY CONNECT COMMUNITY-NOMINATED PRIORITY PLACES PROJECT

From 2019-2023, CWSP used Kootenay Connect CNPP funding along with matching funds from other sources to carry out projects in six primary arenas that would inventory and protect species at risk, enhance wetlands vulnerable to drought with climate change, protect mature cottonwoods, facilitate wildlife connectivity throughout the Columbia Valley, and prioritize Crown and private land for conservation.

- **Wetland Classification** using LiDAR remote sensing and TEM to map specific habitat types within the extensive wetlands complex to guide future conservation planning. Ecosystem mapping was completed for 14,144 ha of the Columbia Wetlands during the winter of 2019-2020. The mapping was completed at a scale of 1:1,250 using a variety of provincial and private data sources.

- **Hydrologic Assessments** were initiated in 2021 to identify wetlands vulnerable to changes in hydrology due to climate change (e.g., melting glaciers, shifts in precipitation, increased temperature). Remote sensing and modeling illustrating changes in open water wetlands over time were combined with systematic monitoring of water levels, and how presence/absence of beavers influenced the water in vulnerable wetlands.
- **Cottonwood Conservation** protects high-value cottonwood stands and wildlife trees in the Columbia Wetlands by protecting mature cottonwood trees from beaver herbivory and harvesting. Wetland mapping and surveys in Year 1 identified critical stands of mature cottonwoods and informed sites to install wire protectors around selected cottonwood trees. In total, 124 large trees, often near active beaver colonies, were protected from 2021-2022.
- **Inventory of Key Species at Risk** that rely upon Columbia Wetland habitats. Extensive literature and database searches resulted in the identification of 65 species at risk and 21 ecological communities at risk found to occur in the Columbia Wetlands (Darvill, 2020). GIS maps and recommendations for filling data gaps and conservation actions were integrated within Kootenay Connect during 2020. Field inventories from 2020-2023 focused on Lewis's woodpecker, osprey, western painted turtle, American badger, and the rare ecological community of alkali saltgrass—foxtail-barley.
- **Multi-species Upland Corridors** were proposed for four important cross-valley connectivity areas in the Columbia Valley of Golden/Donald, Brisco/Spillimacheen, Radium/Steamboat and Columbia Lake based on habitat modeling of six target species of large carnivores and ungulates, including grizzly bear, American badger, wolverine, elk, bighorn sheep, and mountain goat.
- **Biodiversity Conservation Opportunities (BCOs)** mapping project occurring in Years 2-4 (2020-2023) focused on increasing opportunities for conservation and protection of private and Crown land adjacent to the Columbia Wetlands and CWWMA. BCOs were identified using Kootenay Connect's multi-species habitat modeling and SAR data to determine the conservation values of the selected parcels that were then ranked and prioritized for conservation and stewardship actions to benefit habitats and species within the four cross-valley Columbia Valley Corridors.

3.3.5.1 WETLAND CLASSIFICATION

In 2019-2020, ecologist Ryan Durand of EcoLogic Consultants produced a first of its kind classification and mapping of wetland community types across the entire length of the Columbia Wetland (Durand, 2020) (Figure 43). This vegetation base layer has been essential to

understanding the relationship between Kootenay Connect's target species and the diversity of habitats in the greater landscape. It's also helped inform CWSP's hydrologic assessment of wetland types vulnerable to climate change.

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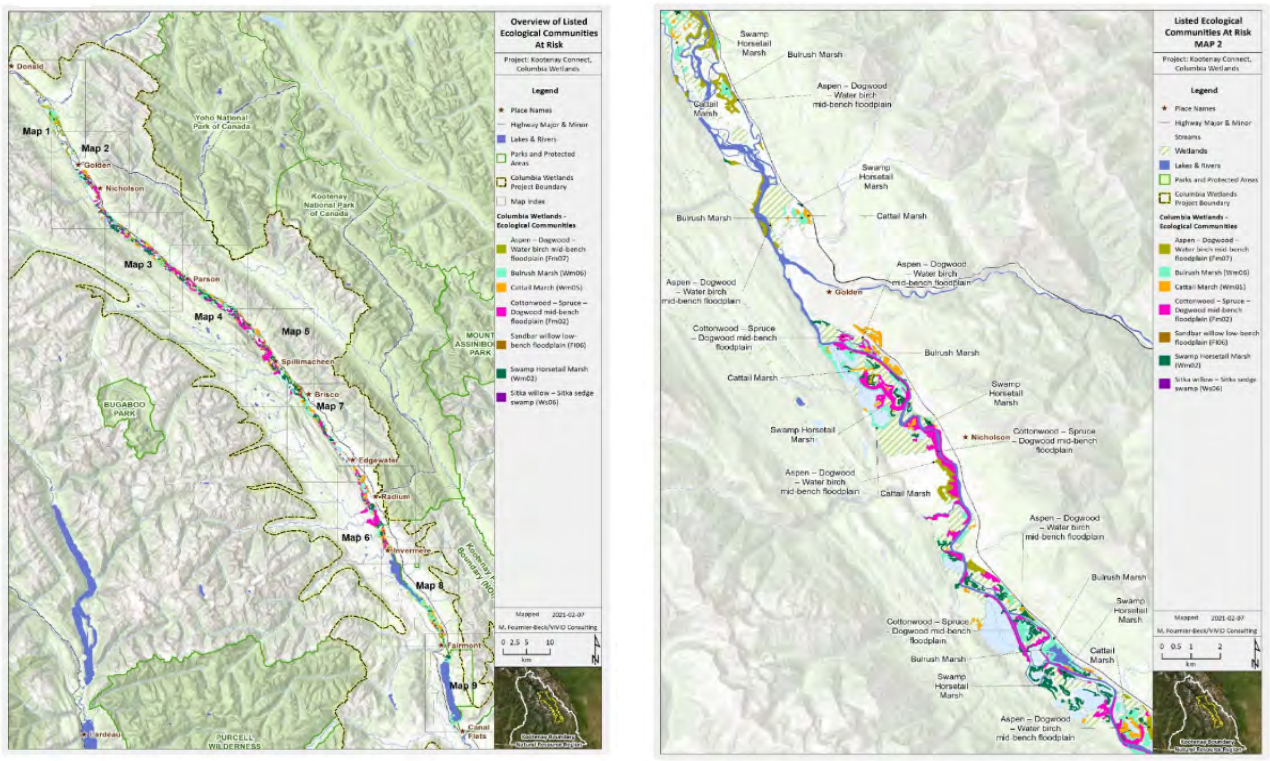

Figure 43. a) Ecological communities at risk identified in the Columbia Wetlands along the Upper Columbia River captured in nine mapping units (Durand, 2020; Darvill, 2021); and b) closeup map of at-risk communities in the Columbia Wetlands between Nicholson and Golden, BC.

3.3.5.2 HYDROLOGICAL ASSESSMENT OF THE COLUMBIA WETLANDS

The region's hydrology underpins the rich wetland ecosystems and their inhabitants. Climate change, increasing temperatures and depleting snowpack, is expected to play an important role in the future maintenance and functionality of these wetlands that host many ecological processes and ecological services (e.g., wildlife habitat, biodiversity, nutrient cycling, water purification, flood control, irrigation potential, recreation, etc.). Hopkinson et al. (2020) combined groundwater, river, and wetland basin hydrologic monitoring with remote sensing within a portion of the Columbia Wetlands across three-and-a-half decades (1984–2019) to identify floodplain wetlands that have lost water over this period and are vulnerable to the impacts of climate change (Figure 44).

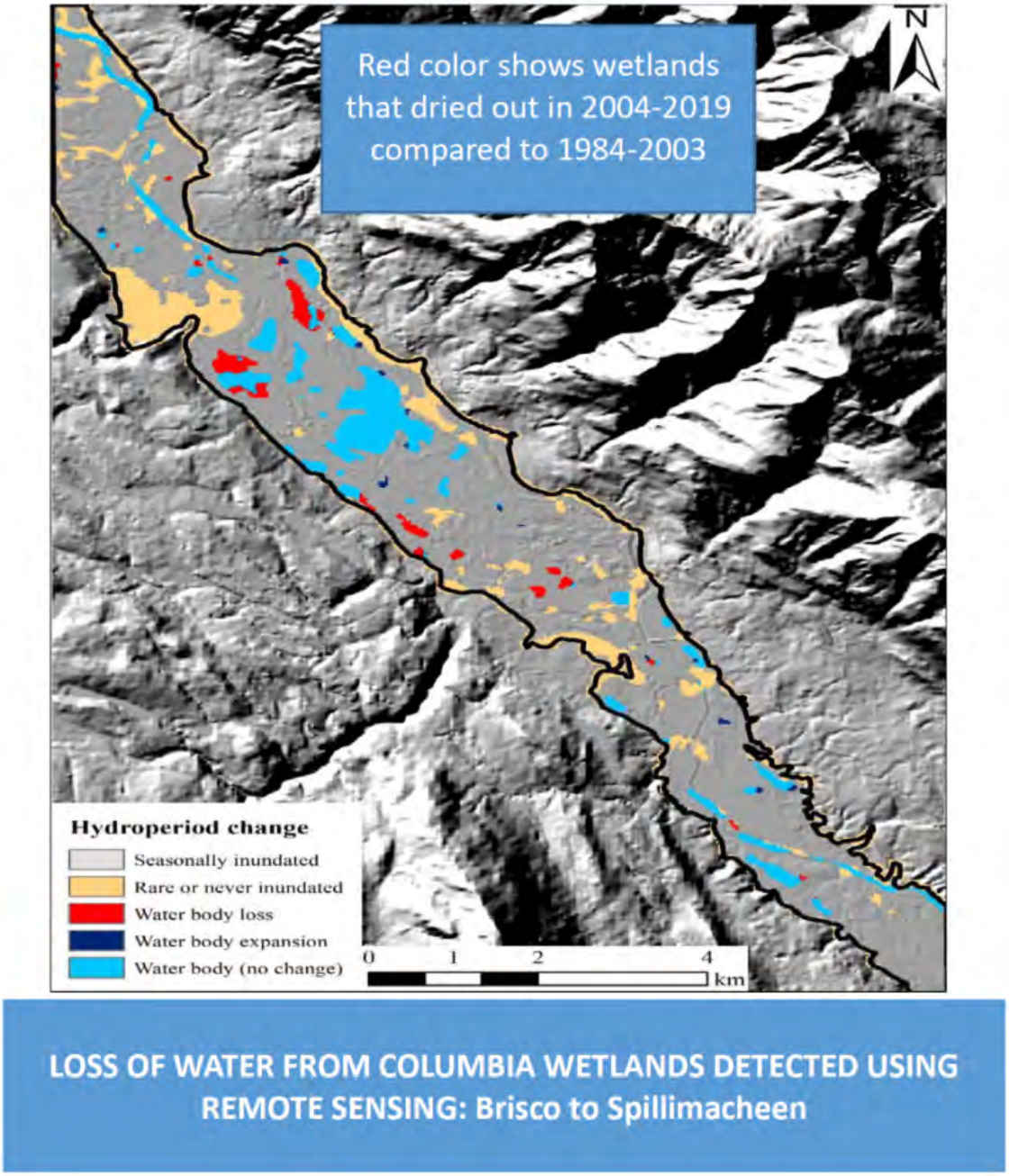

Figure 44. Wetlands that have lost water across three-and-a-half decades between 1984 and 2019 as detected through remote sensing (Hopkinson et al., 2020).

CWSP used these results to investigate 37 wetlands and categorized them into 5 main classes encompassing 22 ecosystem types (Leven et al., 2022). One wetland type receives flood water annually, two are periodically connected to floodwaters in select years, and one only receives inflow through groundwater (Goodbrand and MacDonald, 2022). These categories are useful to

determine which wetlands may need management to help mitigate the impacts of climate change.

In examining climate change scenarios in which temperatures are predicted to increase and precipitation increases only slightly, the timing of water delivery to wetlands can change dramatically. For example, reductions in snowpack will impact late season stream flows, whereas increases in rain will bring early snow melt and higher spring peak flows which will alter the dynamic between the main river channel and the adjacent wetlands. Wetlands that are isolated from the Columbia River are predicted to dry out during low moisture years and therefore retain less water overwinter that is critical for spring migrating birds. Intermittently connected wetlands were also predicted to be vulnerable to climate change by retaining less water. These wetlands may benefit from proactive management such as increasing hydrologic connectivity with the main river channel. Options for future management include re-opening gaps in the natural levees lining the main Columbia River channel to enable connectivity with these isolated, vulnerable wetlands, particularly in areas where isolation has been exacerbated through human development such as railway beds.

CWSP's assessment of the hydrologic status of the entire 20,000 ha wetlands (Figure 45) estimated that about 75% of these wetlands are fully connected with the main Columbia River and fully flood in June. Wetlands only partially connected to the river comprise 13% of the wetland complex while isolated wetlands make up 12%. In total, this means that only a quarter of the Columbia Wetlands retain water over the winter and into the early spring which is essential habitat for migrating spring waterbirds and species at risk.

After examining 79 natural levee openings and 359 beaver dams, CWSP determined that beaver activity is critical for hydrological function of the Columbia Wetlands and has the potential to mitigate the impacts from climate change, particularly on hydrologic connectivity (Leven et al., 2022). Criteria for candidate artificial beaver dams (aka beaver dam analogues) were itemized and in 2021-2022 sites were scouted. In 2022, two beaver dams were constructed restoring 54 ha of wetland near a farmer's property that was facing water loss for his livestock operation (Figure 46). In monitoring this site, CWSP found that the water level was raised ~35 cm, enough to cover the mud flats that were previously present. In 2023, CWSP will compare water bird numbers and species richness before and after restoration work. An increase in both is expected. These results will be compared to similar sites nearby with and without the benefits of beaver dams.

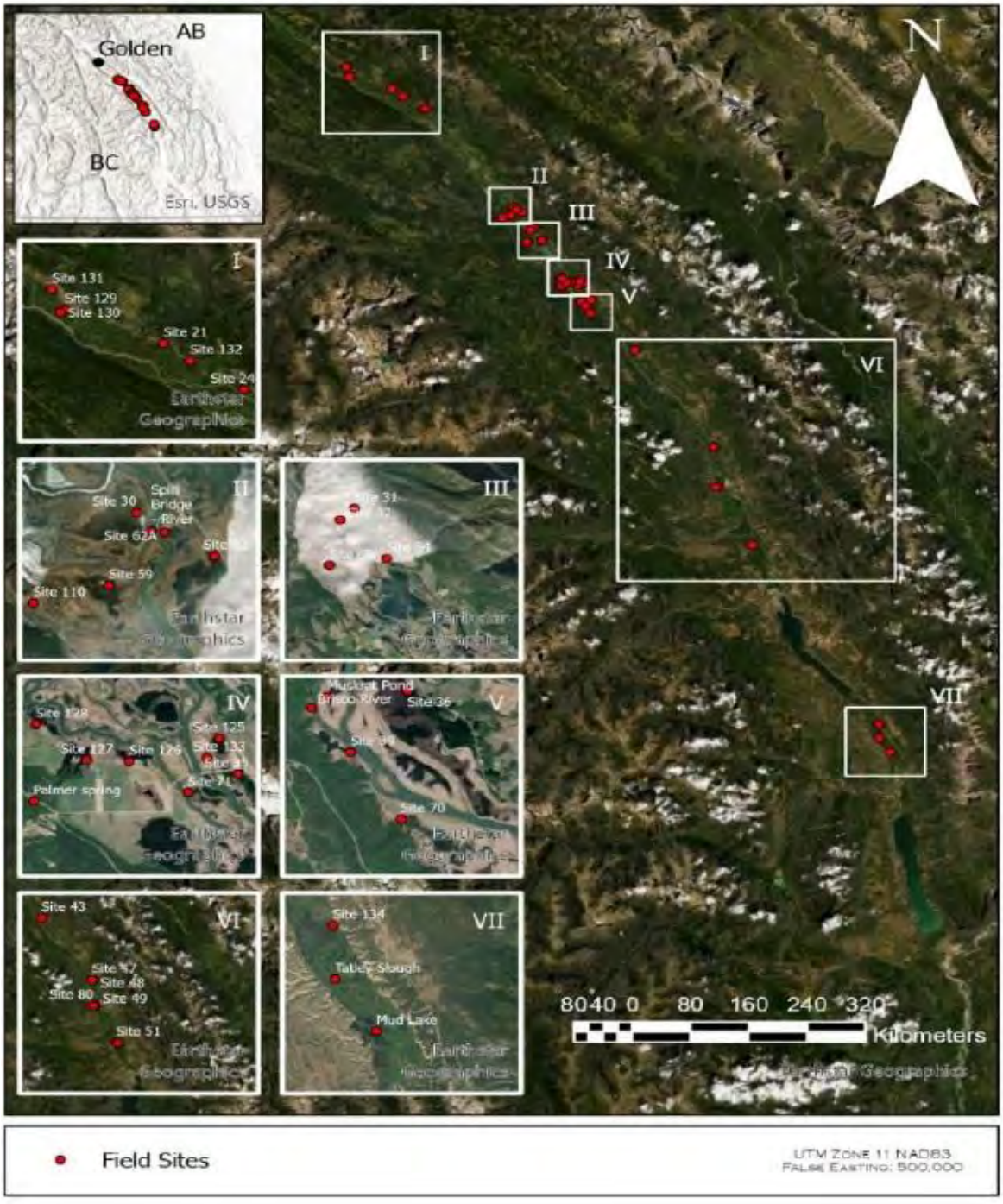

Figure 45. Water level monitoring stations within the Columbia Wetlands along the Upper Columbia River. (Source: MacHydro).

Figure 46. Artificial beaver dam being constructed to retain water in a wetland important for spring migratory bird stopover near Brisco, BC. This wetland is isolated from the main Columbia River channel and vulnerable to drought. (Photo: CWSP).

3.3.5.3 COTTONWOOD CONSERVATION

The cottonwood conservation project protects high-value cottonwood stands and wildlife trees in the Columbia Wetlands by protecting mature cottonwood trees from beaver herbivory and harvesting. Retaining cottonwood trees is important for biodiversity because they provide habitat diversity, perching opportunities, and valuable nesting sites for birds such as large raptors, great blue herons, and woodpeckers and roosting sites for bats within riparian areas. Cottonwoods provide habitat as well as important forage and building materials for beavers. These important wildlife trees are limited and valuable in the Columbia Wetlands.

Using results from cottonwood and species at risk mapping produced in Year 1 (2019-2020) (Figure 47), CWSP identified important mature cottonwoods and prioritized those that had existing nest structures as well as stands with multiple mature trees and younger recruitment trees (Prince et al., 2022). CWSP invited cottonwood expert, Dr. Stewart Rood, to assess the state of cottonwood regeneration across various wetland areas in the Columbia Wetlands. Dr. Rood observed substantial regeneration of cottonwood on the alluvial fans, but little regeneration of cottonwoods along the levees in the main river channel. In total, 124 of the

larger cottonwood trees located near areas of high beaver activity were protected with wire fences in 2021 and 2022 (Gustafson and Higgins, 2023) (Figure 48).

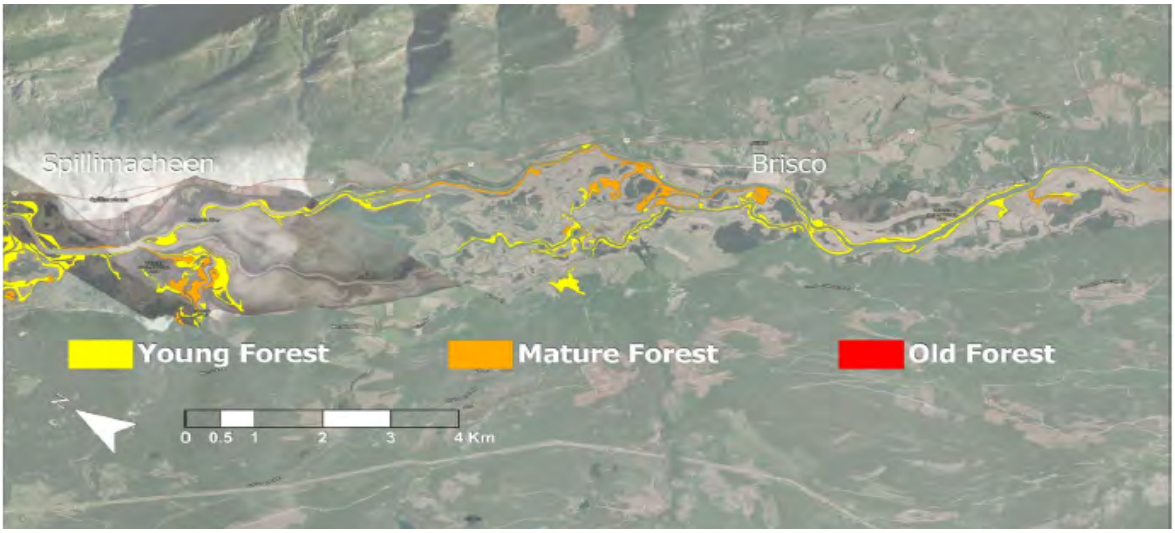

Figure 47. Cottonwood stands mapped along the upper Columbia River near Brisco, BC. (Source: EcoLogic Consultants).

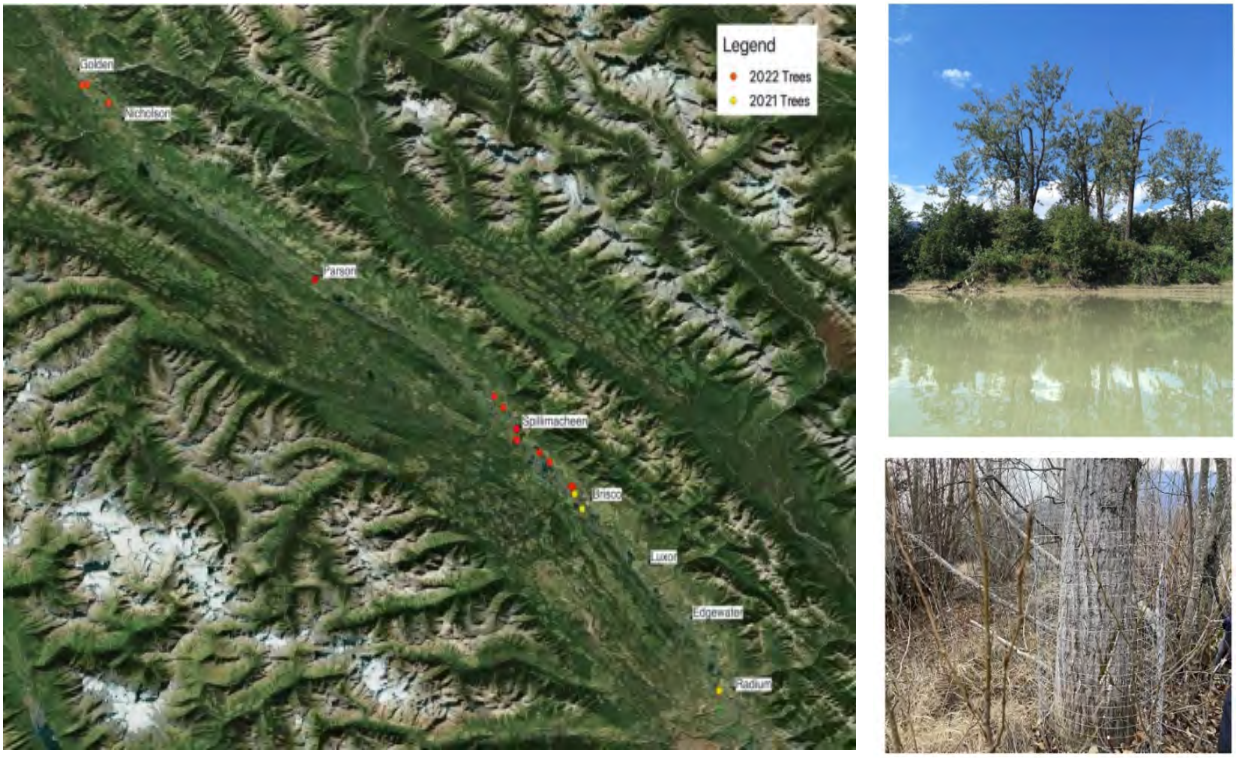

Figure 48. a) Map of cottonwood trees fenced from beaver in 2021-2022; b) rare mature cottonwood stands are important wildlife habitat being protected from beavers; and c) large cottonwood tree fenced from beaver activity (Gustafson and Higgins, 2023).

3.3.5.4 SPECIES AT RISK

CWSP's approach to identifying where and how to enhance protections for a variety of provincially and federally recognized species at risk in the Columbia Valley began by consolidating in one place all the SAR information that was dispersed across various provincial and federal wildlife agencies, independent biologists, consulting firms, and wildlife reports supported by regional funders. Achieving the first step of a comprehensive literature review (Darvill, 2020) helped CWSP to identify research and inventory survey gaps to fill (Figure 49).

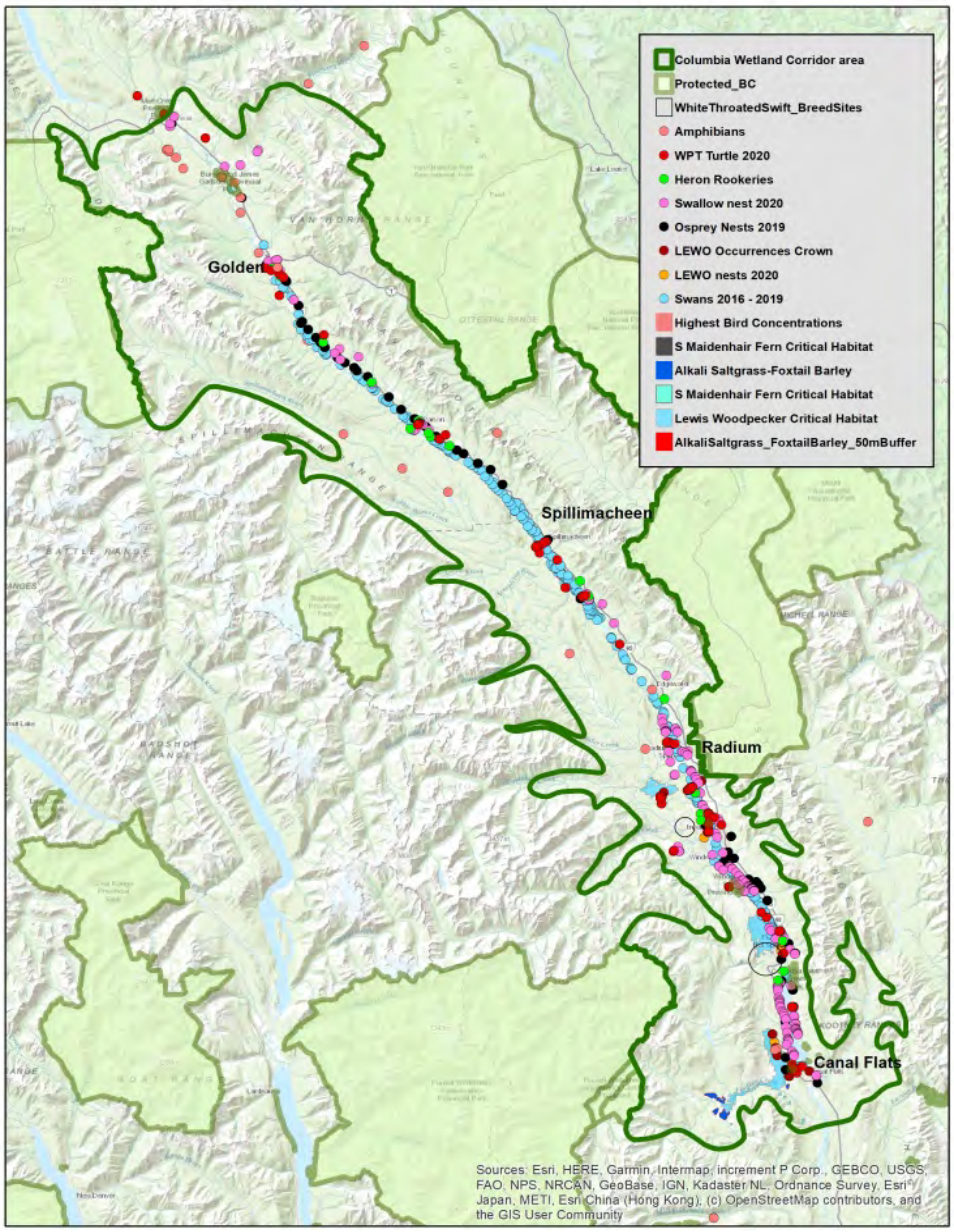

Figure 49. Results from two years of species at risk surveys and desktop research (Darvill, 2020, 2021).

From 2021-2023, field inventorying, monitoring, and mapping work has documented important new information on several species of concern and rare ecological communities. This data has led to a suite of stewardship recommendations and habitat enhancement activities that are discussed below. Field surveys of key species and sensitive ecological communities have included waterbirds (Figure 50), alkali saltgrass-foxtail barley (Figure 51), Lewis's woodpecker (Figure 52), osprey, western painted turtle (Figure 53, 54), American badger (Figure 55, 56), and mountain goat mineral licks.

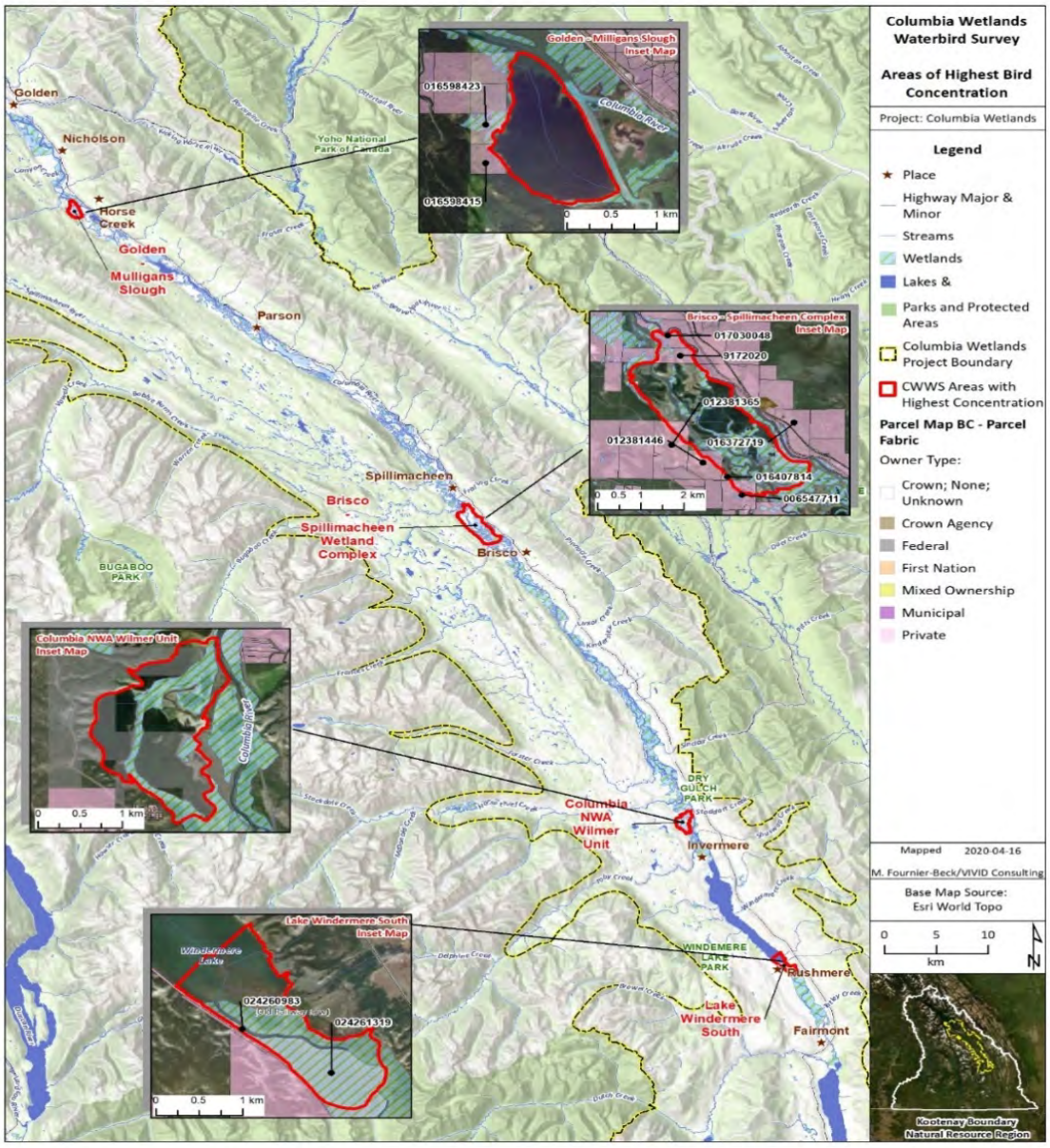

Figure 50. Areas of highest bird concentrations in the Columbia Wetlands that represent conservation opportunities (Darvill, 2020, 2021).

Conservation actions emanating from this effort included, but were not limited to, recommendations and efforts to establish Wildlife Habitat Areas (WHAs), designate Wildlife Habitat Features (WHFs), and extend existing Wildlife Management Areas (WMAs) on adjacent Crown land.

Alkali Saltgrass–Foxtail Barley Ecological Community

Inventories of the rare alkali saltgrass–foxtail barley ecological community confirmed its occurrence in previously identified locations. Three areas totalling over 60 ha (Figure 51) have been identified and proposed to become provincial WHAs.

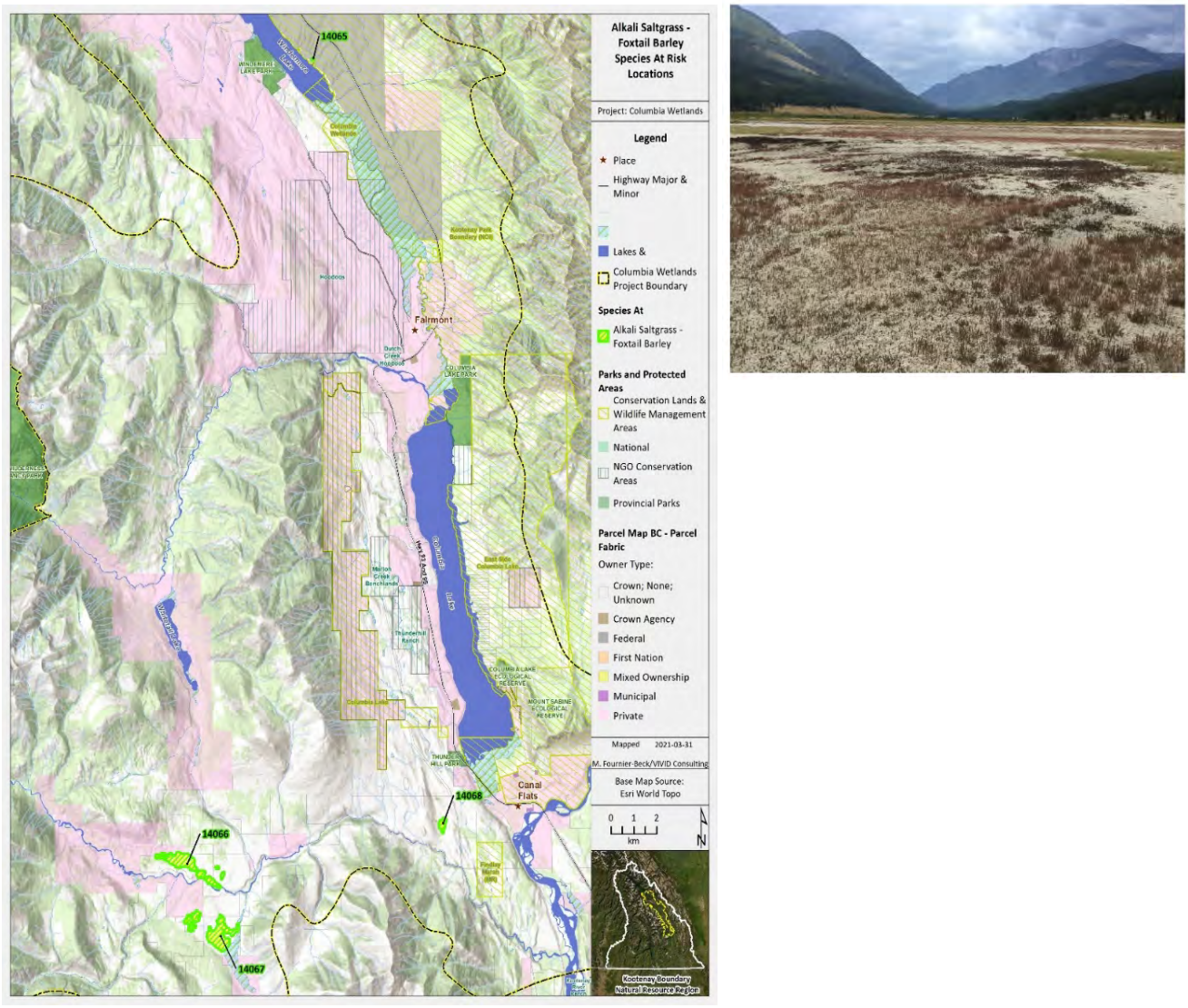

Figure 51. Proposed Alkali Saltgrass–Foxtail Barley Wildlife Habitat Areas within the larger Columbia Wetlands ecosystem (Darvill, 2021).

Lewis's Woodpecker

Inventories of Lewis's woodpecker sites, including active nests, revealed that they were all on private land thus new WHA designations were not eligible (Figure 52). However, Darvill (2021) recommended the expansion of federally designated critical habitat to include several active nests outside of the current boundary, as well as proposed options for private land conservation of Lewis's woodpecker nest sites.

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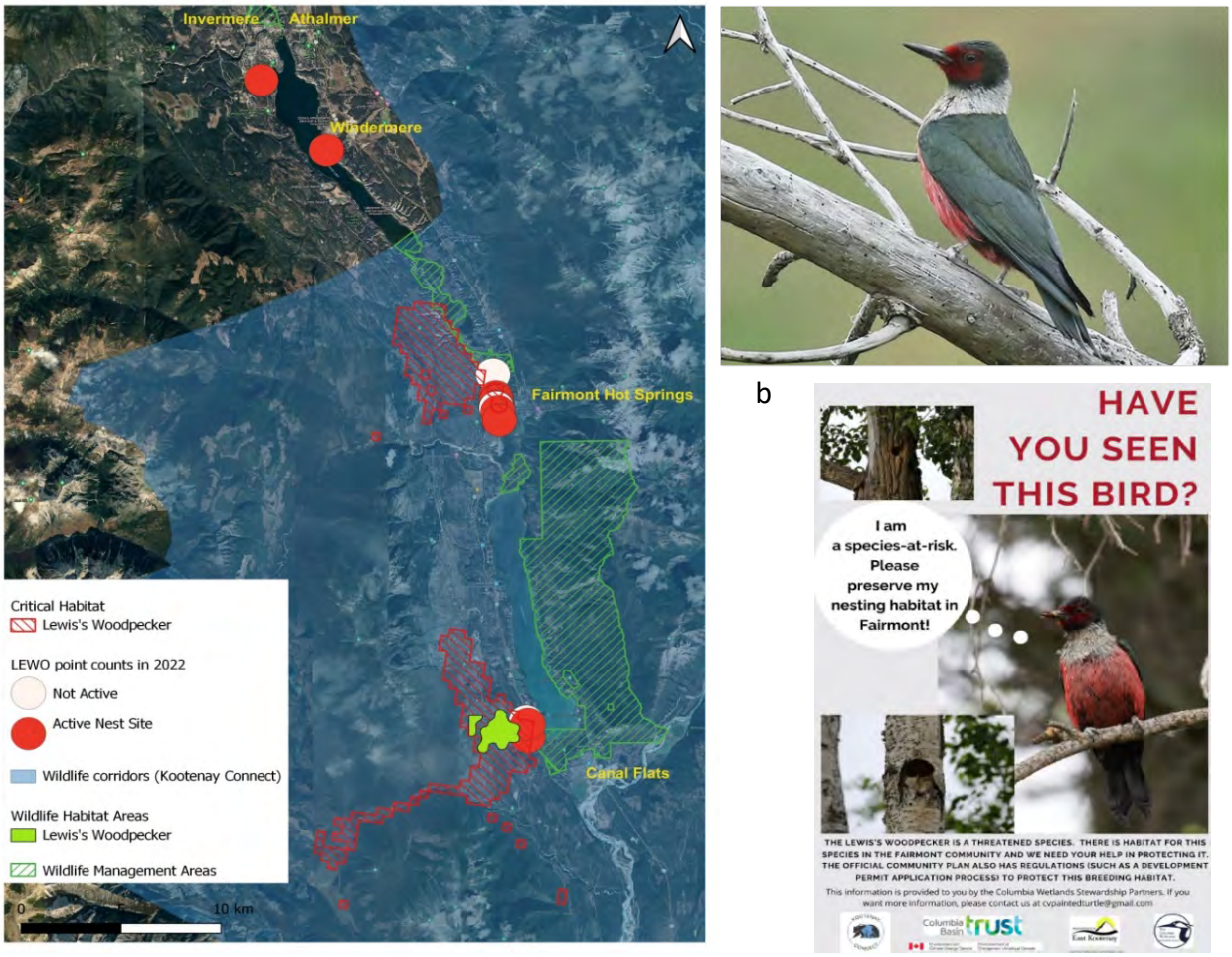


Figure 52. a) Lewis's woodpecker nest sites located in the Columbia Wetlands along the upper Columbia River and b) Lewis's woodpecker poster to encourage the reporting of public sightings (Darvill, 2021).

Osprey

Osprey are a highly visible and much-admired species in the Columbia Valley. They are also a bio-indicator of ecosystem health because they are sensitive to anthropogenic and climatic

influences and can be affected by land and water management practices as well as predation and displacement by other species. During 2020-2021, surveys of osprey nests were completed to help determine the population trend (if possible), and reasons for osprey mortality. The survey resulted in monitoring 65 osprey nests, 19 of which produced offspring, a decrease in nest success from the previous year. In 2022, 71 osprey nests were monitored, 27 of which produced chicks and were deemed successful (Darvill, 2023). Comparison of nest numbers and nest success over four years of monitoring was done to determine how many nests were active each year and to determine annual nest success (Table 2). Most nests were on power poles that do not qualify for WHF designation as the structures are not "natural"; however, several identified tree nests are already afforded some level of protection as they are on First Nation, Nature Conservancy of Canada, or NWA lands.

Table 2. Comparison of osprey nest success from 2019-2022 (Darvill, 2023).

Year	# of osprey nests recorded	# of nests active during beginning of season	# of nests either presumed or known to have produced fledglings
2019	59	43	27
2020	65	43	19
2021	72	39	27
2022	71	39	27

Recommendations for future projects include:

- Continue monitoring osprey as a bio-indicator of ecosystem health given its sensitivity to human disturbance, degraded water quality, and discarded plastics/twine causing nest entanglement as well as predation and displacement by other species.
- Specifically monitor occupancy of nesting platforms and propose the addition of poles and platforms to be installed, if deemed appropriate.
- Continue to provide results from 2-3 separate monitoring inventories conducted throughout spring-summer to determine how many nests are occupied, active, and successful with fledglings.

Western Painted Turtle

Knowledge of western painted turtles' nesting and basking sites increased measurably with field surveys in 2020-2022 (Figure 53). The BC Conservation Data Centre noted three turtle nesting sites in the Columbia Wetlands prior to 2015, and in 2020 Kootenay Connect's project identified 18 sites (Darvill, 2021). Nest predation was noted at several of the nest sites. Between 2021-2023, two large turtle nesting beds were fenced from predators on private land. During this same period, 24 basking logs were installed at several locations such as Armstrong Bay on Columbia Lake, Dorothy Lake near Invermere, the Radium Mill Pond and various

wetlands in Brisco and Spillimacheen (Figure 53, 54). Working with the Ministry of Transportation and Infrastructure, CWSP installed western painted turtles crossing signage at areas known to have high road mortality. In 2023, an alternative nesting site was constructed at an important site in Spillimacheen to mitigate high turtle mortality due to predation and proximity to the Westside Road (Darvill, 2023).

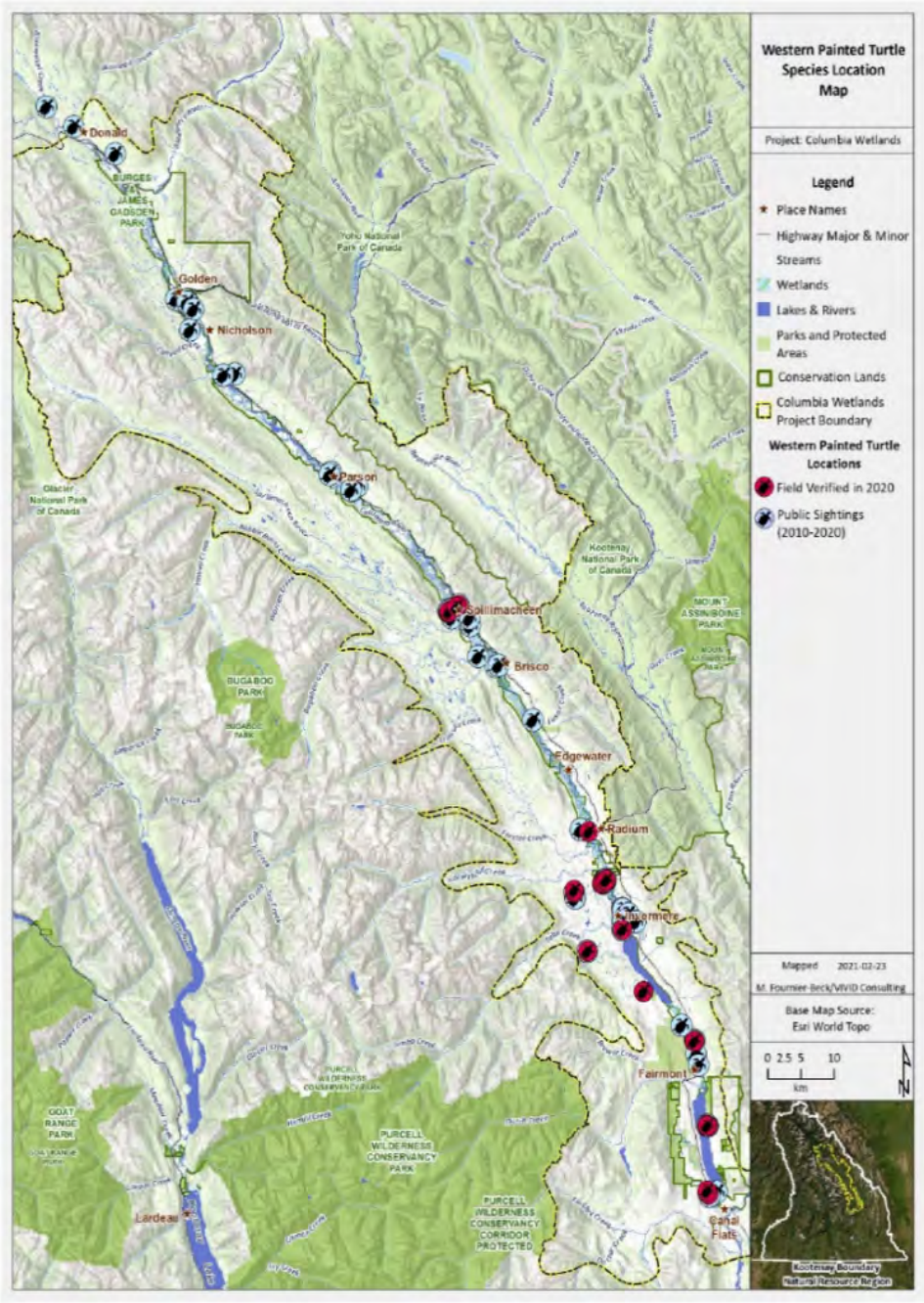


Figure 53. Western painted turtle sites identified by field surveys within the Columbia Wetlands (Darvill, 2021).

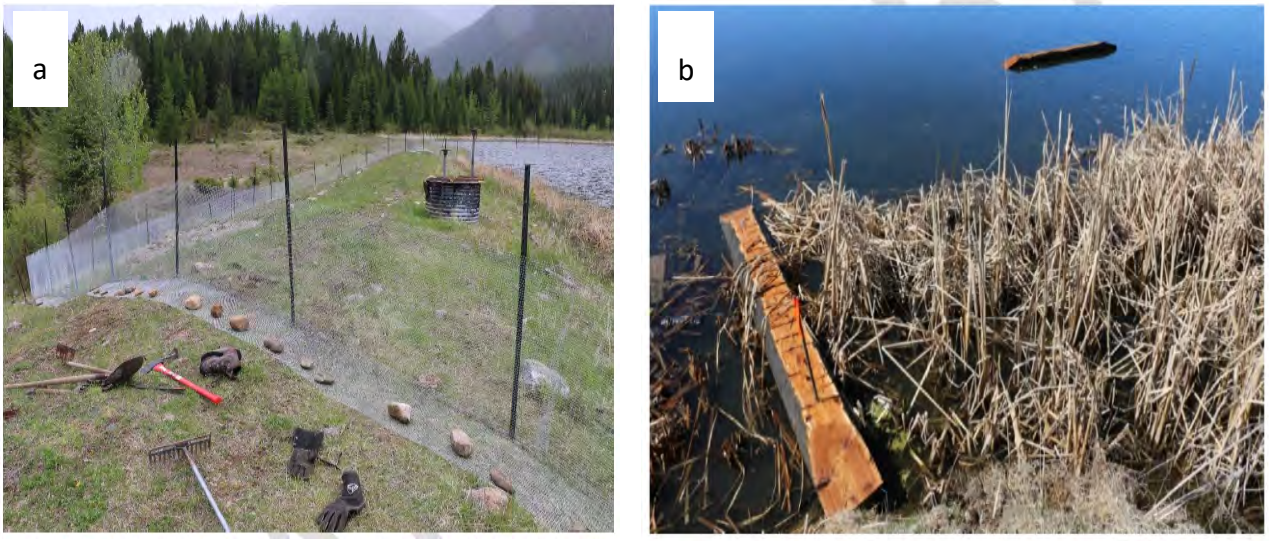


Figure 54. a) Fenced nesting site for western painted turtles; and b) installed basking logs. (Photos: R. Darvill).

Mountain Goat

Field inventories in 2020-2021 identified three important mountain goat mineral licks in Canyon Creek in Nicholson and Toby Creek near Invermere. Applications to designate them as WHAs were successful; thus, these lick sites are now protected under FRPA.

American Badger

In 2021-2022, an American badger project was initiated to assess the status of the approximately 100-160 individuals living in the Columbia Valley. This project provided public education, described areas of critical badger habitat, and collected observations of badger burrows that provided rationale and evidence to submit applications for designation as Badger WHAs and WHFs under FRPA. Badger WHAs protect concentrations of burrows, abundant prey sources, maternal denning areas, and friable soils. WHAs provide more protection than WHFs through land management practices at a broader scale. The two designations are not mutually exclusive – features can be listed as WHFs as an initial step in the process, then designated as WHAs where warranted. According to Adams and Kinley (2004), WHF designation may be sufficient in some situations to protect and maintain badger burrows, especially maternal dens, provided that a 20-m radius (or one tree length, whichever is less) around the burrow is kept free of machinery impacts and soil disturbance.

Seventy-nine public submissions of American badger observations provided a starting place for field ground-truthing as well as high habitat suitability according to the American badger resource selection function (RSF) model developed by Kinley et al. (2013) (Figure 55).

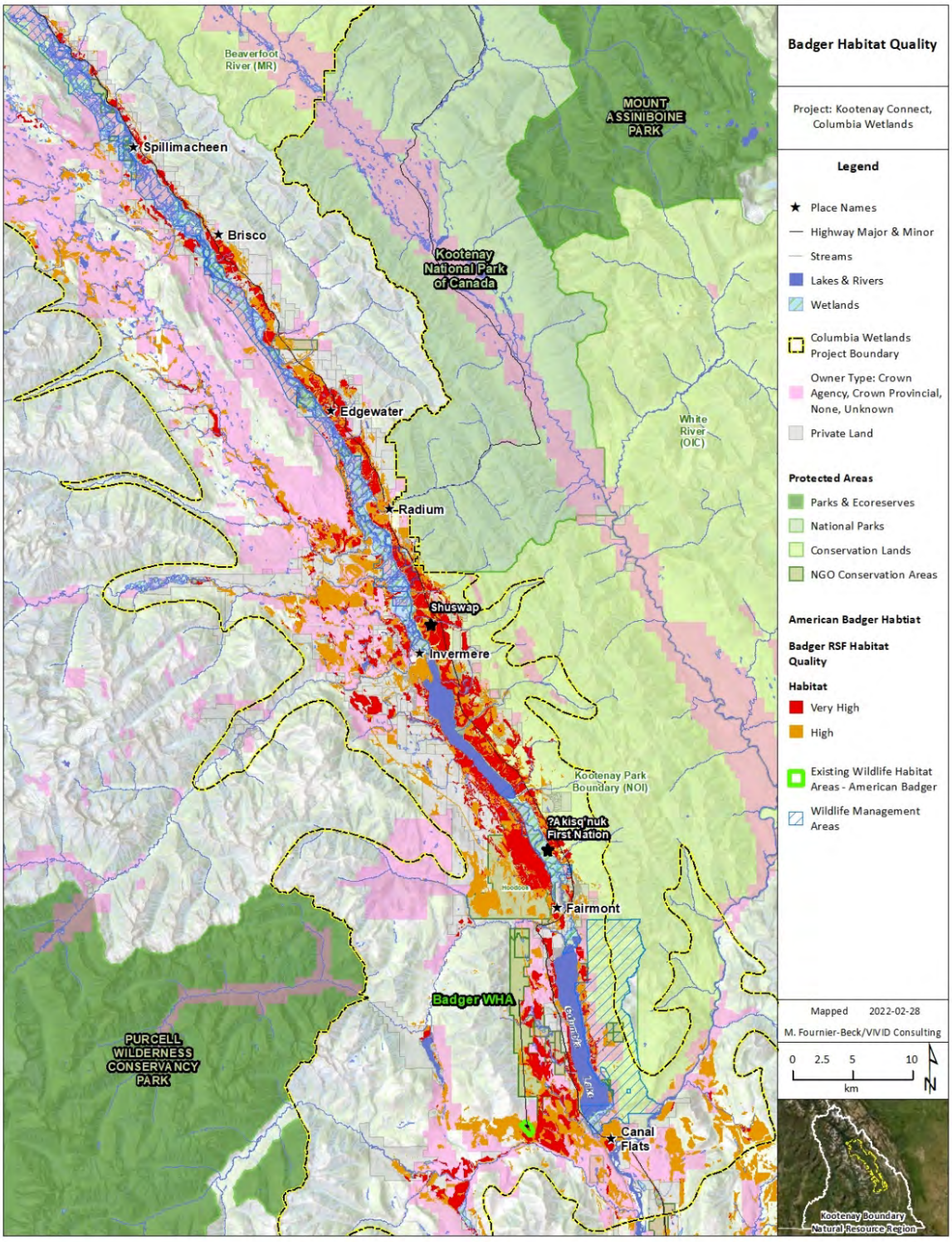


Figure 55. Map of habitat quality for American badger (Kinley et al., 2013) in the Columbia Valley that includes existing WHAs. This habitat layer contributed to predicting multi-species Kootenay Connect corridors. (Source: Kootenay Connect).

Most observations made in 2022 occurred on private land with only four observations occurring on provincial Crown land and one was within the Columbia National Wildlife Area Figure 56). A total of 983 burrow entrances were observed on public lands, 80% (790) of which were in functional condition and have been proposed for WHFs and WHAs with the provincial government (Table 3; Darvill, 2023).

Table 3. Results from inventories on American badger habitat on provincial Crown land (Darvill, 2023).

Area	# of burrows in functioning condition	# of new burrows (used in 2022)	# of old burrows (used previous to 2022)	Unknown year of burrow use (2022 or previous)	Total # burrows	Inventory completed in area in 2022
Old Coach	367	0	0	367	367	No
Rushmere	96	8	149	42	199	Yes
Steamboat	322	137	239	34	410	Yes
Thunderhill	5	2	1	4	7	No
Total	**790**	**147**	**389**	**447**	**983**	

a

b

Figure 56. High level of unauthorized recreational impacts on a) Crown land and b) Columbia Wetlands Wildlife Management Area with high badger activity and within core critical habitat as proposed in the federal American Badger Recovery Strategy. (Photos: R. Darvill).

3.3.5.5 MULTI-SPECIES CROSS-VALLEY UPLAND CORRIDORS

To help identify conservation opportunities related to cross-valley connectivity, in 2020-21 Kootenay Connect gathered available data for modelling habitat selection for several large mammal species to estimate wetland-upland corridors along the 180-km length of the Columbia Wetlands. All of Kootenay Connect's mapping results of focal species and ecological communities at risk were combined with analyses that identified cross-valley multi-species upland corridors for large mammals (Proctor, 2021) discussed below.

To assess the relationship between human settlement, private land, and forestry roads, Kootenay Connect brought these layers together in GIS (Figure 57). Grizzly bear data was obtained from the Trans-border Grizzly Bear Project, which used GPS radio-collar data to derive habitat selection (RSF) models from a nearby study area in the Purcell Mountains, just to the south of the upper Columbia Valley (Proctor et al., 2015). Proctor et al. (2015) used the RSF models to predict grizzly bear corridors regionally and did extensive evaluation of these predictions across the Kootenay region.

Widespread DNA survey data of wolverines was used to develop the wolverine habitat selection (Mowat et al., 2020). This DNA study did not predict corridors; that analysis is expected over the next few years. In the interim, Kootenay Connect consulted with the wolverine biologists who collected the data to estimate preliminary wolverine corridors that are driven in part by a wolverine food layer, i.e., marmot habitat (an important food source for wolverines) (Kortello et al., 2019). Briefly, Kootenay Connect's wolverine corridors were estimated to connect areas of higher wolverine density, which maximized movement through high-quality marmot habitat, habitats with lower road densities, and riparian drainages for larger landscape-level movements (D. Hausleitner Pers. Comm.).

The Elk RSF was generated from telemetry data collected in the southern portion of the nearby Elk Valley and extrapolated through the upper Columbia River drainage up through Donald at the north end of the Columbia Valley (Mulligan, 2020a, 2020b). Elk corridors were estimated to follow areas of high-quality elk habitat as determined through RSF habitat selection models.

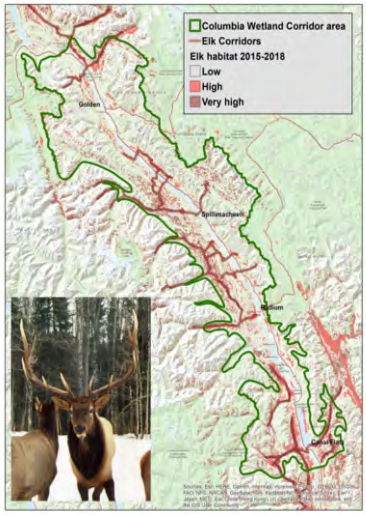
The mountain goat RSF was developed by the provincial government (Ross and Vander Vennen, 2021) from telemetry data collected and reported within Poole et al. (2009). The badger RSF was developed by Kinley et al. (2013) after years of local badger radio-collar work in the upper Columbia Valley. All estimated species corridors were brought together in one map (Figure 58a) to look for spatial patterns to predict several multi-species corridors (Figure 58b).

a) Grizzly Bear

b) Wolverine

c) American Badger

d) Rocky Mountain Elk



e) Mountain Goat

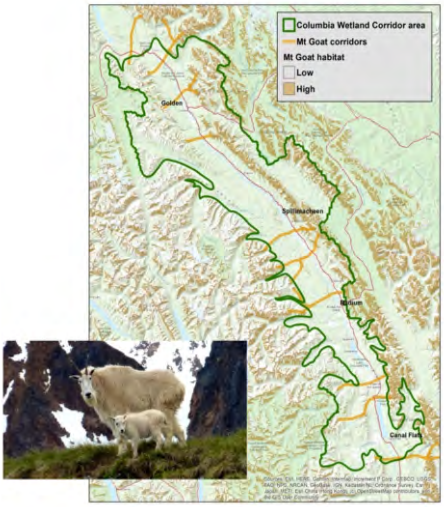


Figure 57. Grizzly bear habitat (Proctor et al., 2015); b) wolverine density (Mowat et al., 2020); c) American badger habitat (Kinley et al., 2013); d) elk habitat (Mulligan, 2020a, b); and e) mountain goat habitat (Ross and Vander Vennen, 2021) across the Columbia Valley.

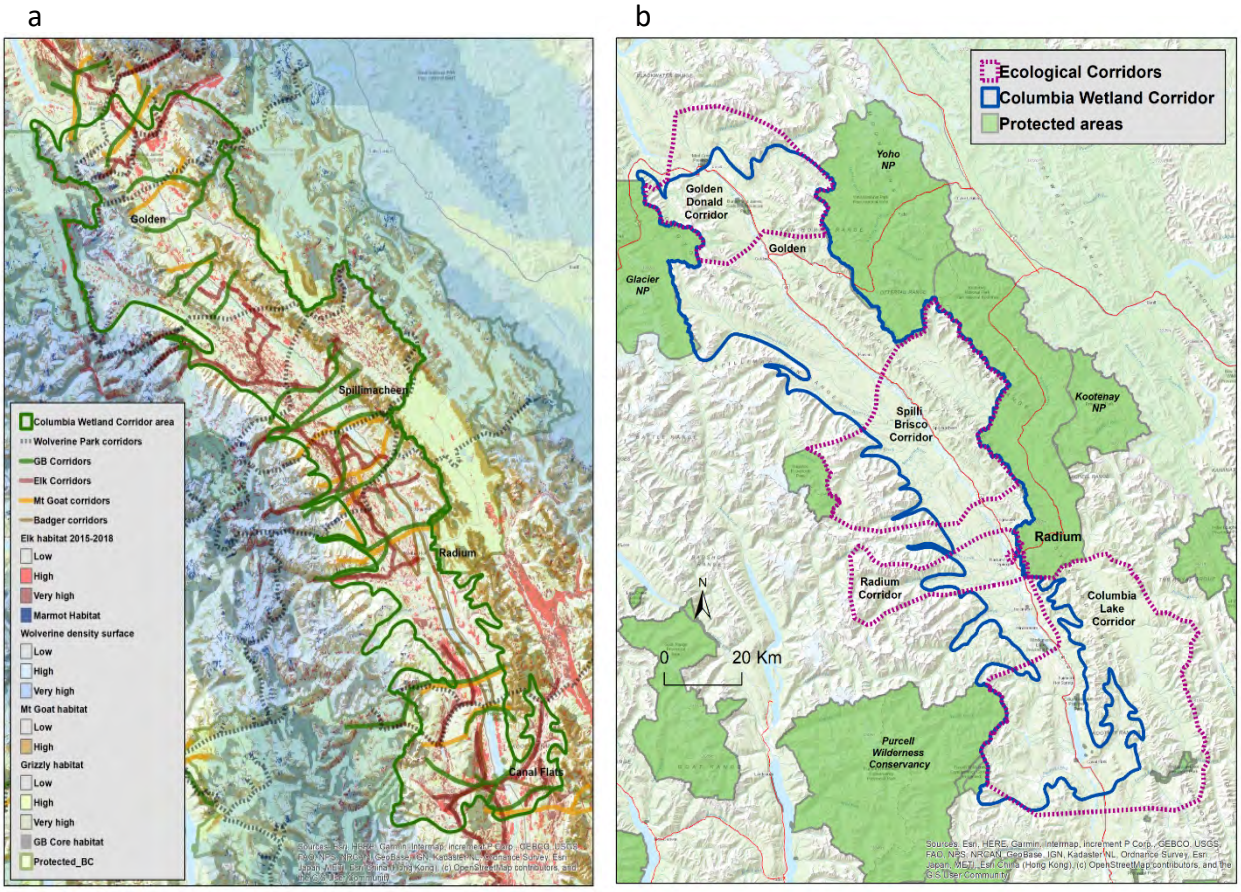


Figure 58. a) Estimated corridors for grizzly bear, elk, mountain goat, badger, and wolverine; and b) predicted multi-species wetland-upland corridors across the 180-km length of the Columbia Wetlands between the Purcell and Rocky Mountains (Proctor, 2021).

3.3.5.6 IDENTIFYING BIODIVERSITY CONSERVATION OPPORTUNITIES

Much of the Columbia Wetlands and portions of the adjacent benchlands are protected in one form or another (e.g., provincial WMAs or federal NWAs, provincial parks, private conservation properties, and administered Crown lands). However, there is a significant conservation gap in the valley bottom surrounding the wetlands where much of the land is privately owned or provincial land that is not protected. One of the goals of Kootenay Connect CNPP in the Columbia Valley is to identify and integrate species and ecosystems at risk (Darvill, 2020, 2021) and multi-species upland corridors (Proctor, 2021) to assess future "biodiversity conservation opportunities" (BCOs) for land conservation to enhance north-south and cross-valley connectivity.

To figure out how and where to prioritize further protection of the wetlands complex, CWSP developed a process to identify conservation values on non-administered public and private land adjacent to and upland from the CWWMA. Information used for identifying conservation values came from publicly available spatial data as well as new research and inventory information generated by Kootenay Connect-supported projects (see above). This analysis resulted in a list of 131 BCOs that were assessed by CWSP for high conservation value, feasibility of acquisition, stewardship potential, or possible conservation land designation. CWSP created an evaluation matrix that began with the ranking system developed by KCP for the evaluation of candidate private properties for acquisition in the Kootenays, which includes attributes such as priority biogeoclimatic zones, species at risk, habitat features, old growth, and ungulate winter range.

CWSP then developed a spatial model to assess and value properties using a multi-layered approach to prioritize public parcels for conservation land designation, private land purchase, and private land stewardship. Numerical scores were assigned to each attribute to contribute to the scoring and ranking of all the properties. (Maps of BCOs are explicitly not shown to protect the privacy of landowners.)

Ninety-one private and 40 public properties comprise a total of 131 BCOs (Table 4). Of these properties, 91 are located within Kootenay Connect's identified multi-species corridors. Eighty-two properties contained threatened wetland ecosystem types, 85 properties are known to have species at risk occurrences, and 109 properties have mapped critical habitats or important habitats like ungulate winter range.

Table 4. Potential Biodiversity Conservation Opportunities for properties of interest based on Species at Risk, Sensitive Ecological Communities, and Wetland-Upland Kootenay Connect Corridors within the Columbia Wetlands and surrounding area. (Source: Gustafson et al., 2023).

Category	# Properties*
Total BCO Properties Assessed	131
Private – Potential for Land Trust Acquisition	57
Private – Potential for Farmland Advantage/Stewardship Agreements	34
Crown – Potential for Stewardship Agreements	2
Crown – Potential Land Conservation	32
Crown – Potential Corridor Conservation Designation	7

** Note: The categories do not sum to the total because of overlapping membership in several possible categories.*

3.3.6 CLIMATE ADAPTATION RECOMMENDATIONS FOR THE COLUMBIA WETLANDS

An analysis on the influence of climate change on the Columbia Valley (Utzig, 2021) incorporated the inputs from watersheds, mountain faces, creeks and rivers associated with Purcell Mountains on the west side and the Rocky Mountains on the east side of the valley (Figure 59). Findings include that changing precipitation regimes to more rain (less from snow) will place increasing pressure on late summer and fall water levels in the valley bottom wetlands. In portions of watersheds that exist in the high country, glacial melt can mitigate this trend in the short-term; however, as glaciers continue to decline due to climate change, they will cease to contribute surface water at these critical times of year.

Utzig (2022) also points to another important aspect of climate change in the Columbia Valley in areas where ecosystems anticipated to convert to grassland/steppe may challenge forest-dependent plant and wildlife species and influence their distribution and necessitate they find refugia. Forested riparian habitat will therefore increase in importance perhaps providing cooler, moister refugia for both north-south and east-west migrations. Utzig integrated climate and local data to model potential climate corridors in the Columbia Valley (Figure 60).

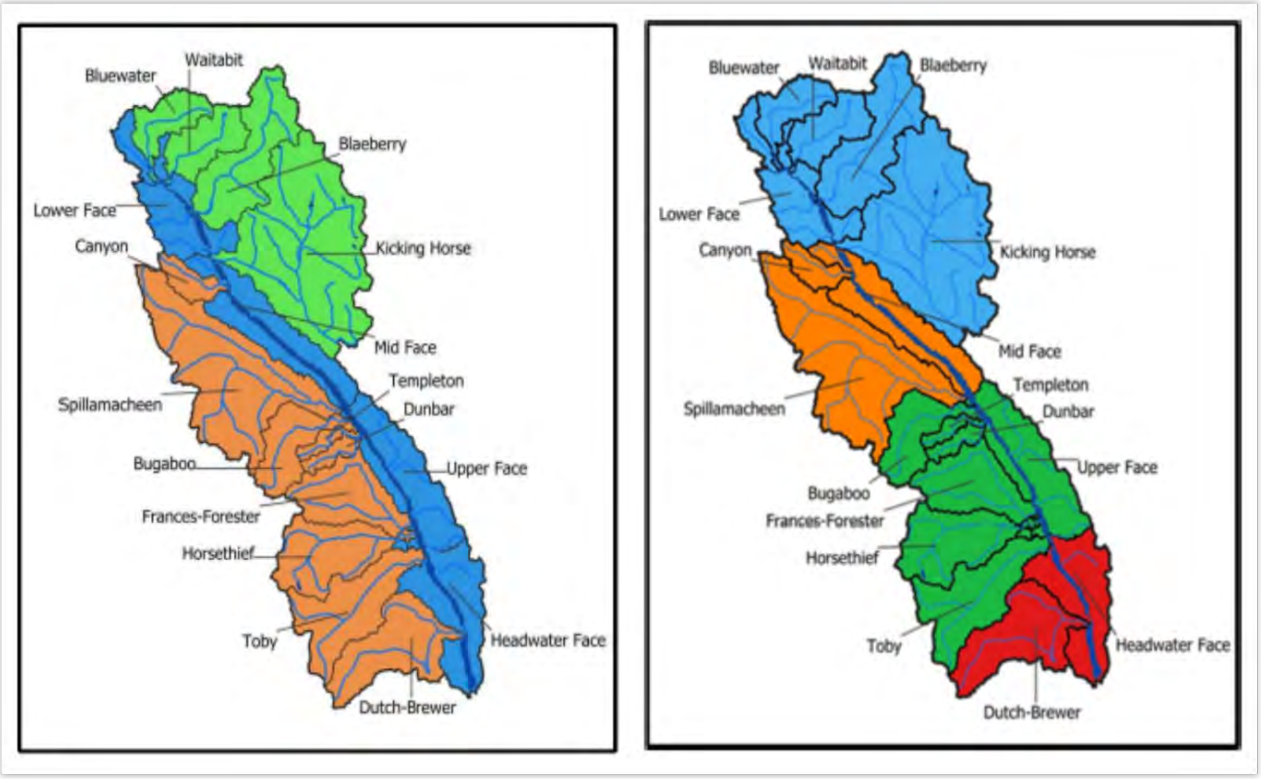


Figure 59. Columbia Wetlands a) watershed face units (blue), Purcell tributaries (brown), and Rocky Mountain tributaries (green); and b) watershed segments: headwaters (red), upper (green), Mid (orange), and lower (blue) (Source: Utzig, 2022).

To maximize connectivity both north-south, east-west and upslope from the wetlands, the protection of riparian forests along the wetlands and tributary streams from forest harvesting and development will be of increasing importance. In addition, as ecosystems shift to more open forests and grasslands at lower elevations, they will also experience more frequent disturbance such as fire, flood, drought, insect outbreaks, heavy debris flows, landslides, etc. that will also impact species distribution and survivability.

As discussed above in the section focused on wetland hydrology, several strategies are recommended to increase water retention in the Columbia Wetlands through various means, including opening gaps in levees between the main river channel and adjacent wetlands that have been closed from human activities such as the railroad or road construction; and adding/encouraging more beaver dams to store water in strategic locations.

Protection of east-west riparian corridors along tributaries such as Dutch and Brewer Creeks near Fairmont Hot Springs will help mitigate rising temperatures and prevent erosion during flooding events. In upland forests, proactive thinning to reduce wildfire risk and fuel loads, safe-guarding moist refugia areas (i.e., those areas less likely to burn), and planting drought resistant species may all be helpful actions to take. Additional recommendations include:

- Maintain and potentially expand monitoring of streamflow, glacial retreat, seasonal wetland water levels, and groundwater contributions.
- Utilize historical data, current modeling outputs and Global Climate Model projections to develop models that better quantify changes to seasonal flows of water inputs and water levels in the wetlands themselves as a basis for developing strategies to minimize future risks.
- Expand the area and rate of forest ecosystem restoration activities, consistent with creating fire resilient communities throughout the lower elevation areas of the Columbia Valley frequented by drought and frequent wildfire regimes, including:
    - Remove forest in-growth and ladder fuels.
    - Reduce stand densities to reduce risk of crown fires and build resilience to drought and forest pests.
    - Protect large fire-resistant trees such as, ponderosa pine, Douglas-fir, and western larch.
    - Re-introduce low intensity fire and make controlled burning a primary ecosystem management tool.
    - Reduce fire risk to riparian areas by protecting and enhancing areas along streams and rivers, as well as wetlands and lakes.

- Minimize disturbance to riparian areas, restore native vegetation, and minimize upstream disturbances that may affect peak flows.
- Monitor and manage outbreaks of forest pests where possible utilizing environmentally acceptable methods.
- Protect and enhance deciduous trees and stands such as trembling aspen, cottonwood, and paper birch.

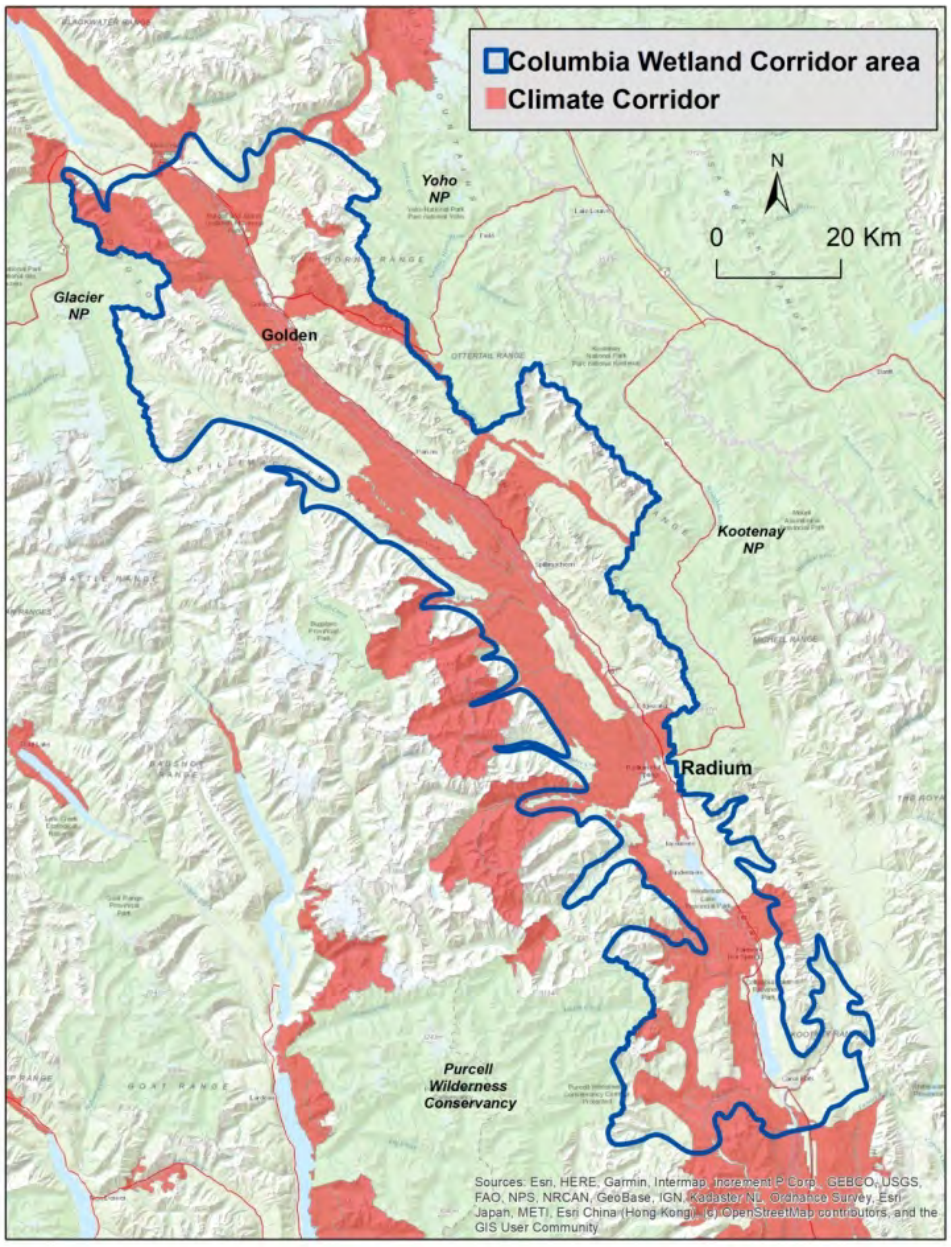


Figure 60. Climate corridors in the Columbia Valley based on integrated climate and local data modeling. (Source: Utzig, 2022).

3.4 WYCLIFFE WILDLIFE CORRIDOR

3.4.1 GEOGRAPHIC DESCRIPTION

The Wycliffe Wildlife Corridor is part of Kootenay Connect Community-Nominated Priority Places. This grassland and dry open forest corridor with scattered wetlands and riparian areas is located within the southern Rocky Mountain Trench between Kimberley and Cranbrook, BC (Figure 61, 62). The Wycliffe Corridor is part of the dry Interior Douglas-fir biogeoclimatic zone, which supports a mosaic of plant communities with biological richness and rarity, as well as significant populations of rare and endangered species. This ecosystem requires periodic low-intensity fires to maintain its structure and fire suppression in the recent past has necessitated extensive forest thinning and the reintroduction of fire through prescribed burns and cultural burning (MacKillop et al., 2018). The mosaic of native grassland and open and closed forest provides a variety of habitat types with some different habitat associations than the other riparian-wetland corridors within the Kootenay Connect focal corridors. Small wetlands and riparian areas on smaller creeks as well as the St. Mary River provide mesic conditions that support songbirds, reptiles, and amphibians. Wycliffe is well-known for its important winter range for deer and elk, mature open forest habitat for Lewis's woodpecker and Williamson's sapsucker, and true native grasslands supporting several federally and provincially listed plant species, such as hairstem groundsmoke and scarlet gaura.

Figure 61. Wycliffe Wildlife Corridor. (Photo: R. Klafki).

Figure 62. Google Earth image of the Wycliffe grasslands-riparian corridor between Cranbrook and Kimberley, BC separating the Rocky and Purcell Mountains. (Source: Kootenay Connect).

3.4.2 LEADING CONNECTIVITY CONSERVATION GROUPS & ALLIES

Within this corridor is the Wycliffe Conservation Complex, located just south of Kimberley, BC, which is managed in a partnership between the Nature Conservancy of Canada, The Nature Trust of BC (NTBC), and the Ministry of Water, Land and Resource Stewardship (MWLRS) (Figure 63). The complex includes important areas such as the Luke Creek Wildlife Corridor and Pine Butte Ranch Conservation Area and is comprised of twenty-three parcels totaling more than 1,109 ha (2,740 acres). As described above, this area is ecologically significant with a diversity of habitats that support several species at risk while also functioning as an important regional wildlife corridor.

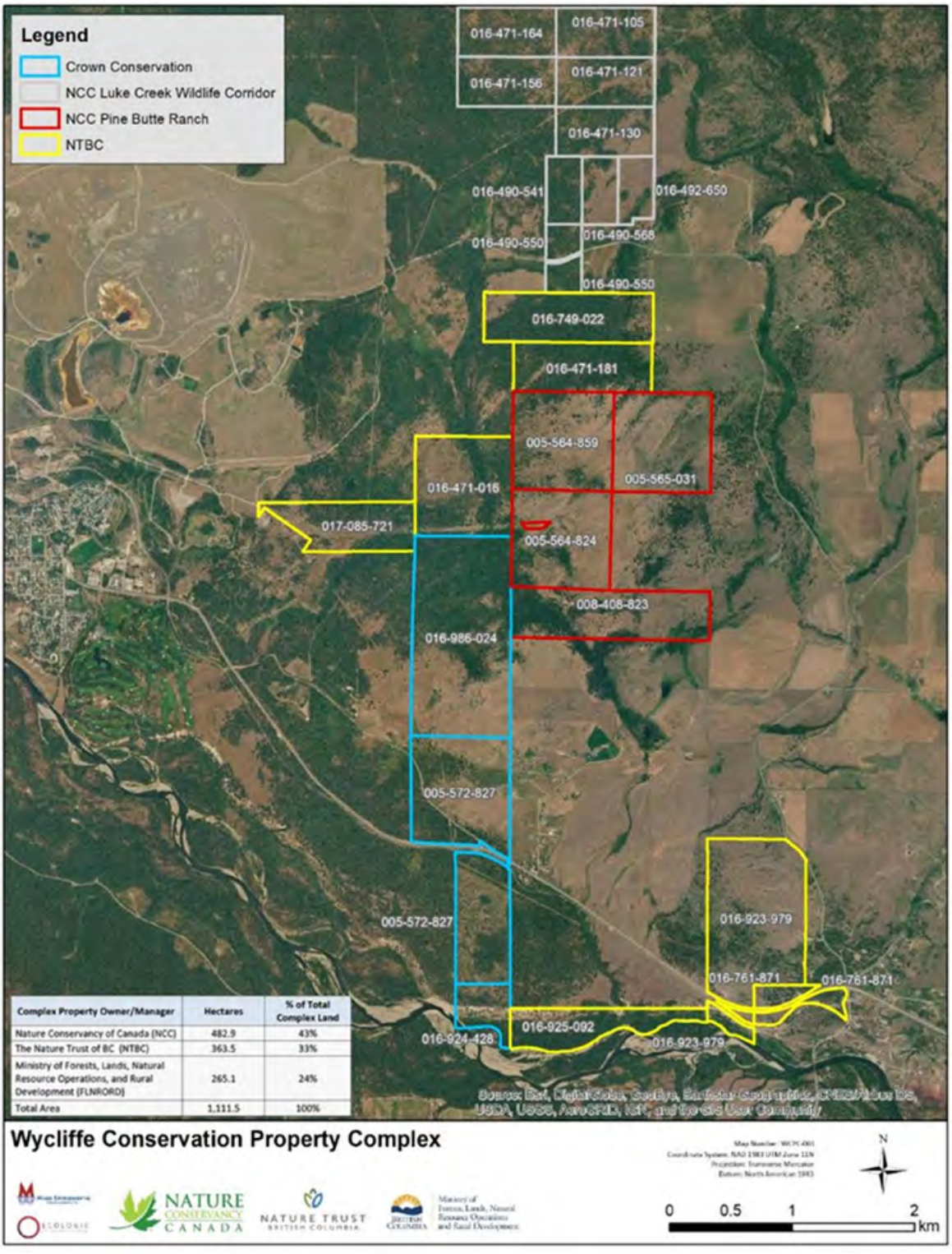


Figure 63. Wycliffe Conservation Complex ownership including the Nature Conservancy of Canada, The Nature Trust of BC, and Province of BC. (Source: NTBC).

3.4.3 KOOTENAY CONNECT WORKSHOP

KCP has not yet hosted a Conservation Action Forum in this region, thus the workshop organized by Kootenay Connect in September 2019 initiated a discussion of conservation priorities. Participants included independent and government biologists, conservation land trusts (NCC, NTBC), Regional District of East Kootenay (RDEK) regional planners, ʔaq̓am Community, and conservation organizations (e.g., Rocky Mountain Trench Natural Resources Society, Kootenay Community Bat Project). Workshop participants decided on a Wycliffe Wildlife Corridor boundary by considering cumulative human impacts (Figure 64), distribution of American badger, grassland habitat types, and ungulate migration linking the St. Mary River drainage to the open grassland complex. They also identified species at risk (Table A-1); habitat types (Table A-2); habitat features (Table A-3); ecological process (Table A-4); and *ecological threats* (Table A-5) for Wycliffe in Appendix B.

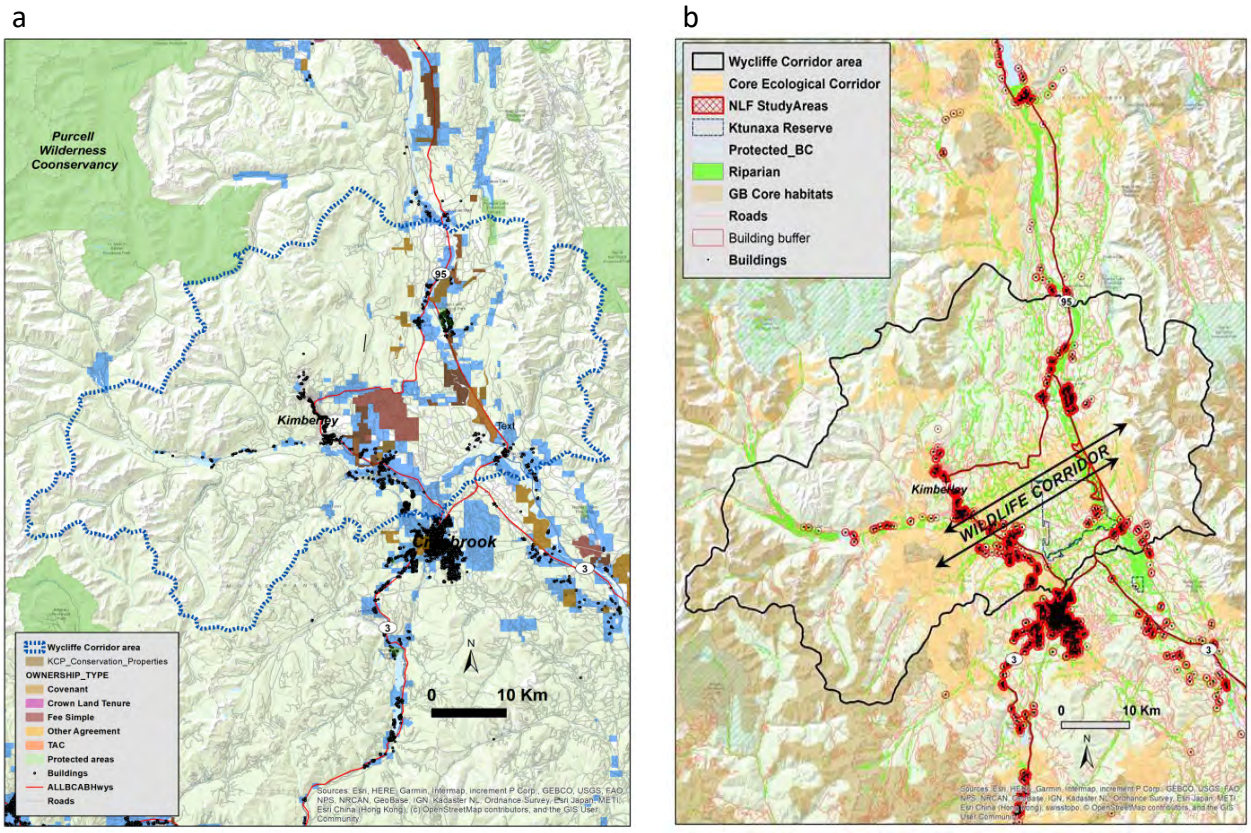


Figure 64. a) Human footprint in the Wycliffe Corridor between Cranbrook and Kimberley, BC separating the Rocky and Purcell Mountains; and b) the same area with grizzly bear core (tan), linkage (beige), riparian (green) habitats as identified by the Trans-border Grizzly Bear Project (Proctor et al., 2015), overlaid with cumulative impacts relative to preliminary upland wildlife corridors. (Source: Kootenay Connect).

The Wycliffe Corridor has a large proportion of private lands, which greatly influences the challenges and opportunities for conservation planning. A key result of this workshop was the group's interest in increasing private land conservation and stewardship through various options including direct purchase and conservation easements in cooperation with NCC and NTBC to build upon previous successes in the Wycliffe Corridor, as well as land use planning and regulatory processes through the RDEK that could provide additional protections.

This workshop helped align Kootenay Connect's objectives with existing planning processes within the RDEK. The RDEK planners were interested in exploring how they could integrate Kootenay Connect's scientific data about natural values into their process of revising Official Community Plans (OCPs) in which ESAs could be designated and managed using Development Permit Areas. This as an important arena within which Kootenay Connect can assist the RDEK in identifying critical habitats and connectivity corridors and providing advice on acceptable and prohibited land uses and activities on private land that would potentially enhance or degrade wildlife and habitat values.

Lastly, the Wycliffe Corridor presents an important opportunity to encourage voluntary stewardship practices to improve habitat and reduce human-wildlife conflict on private land. Local agricultural groups, such as Farmland Advantage, and stewardship groups involved in KCP's Stewardship Solutions Toolkit[28] offer expertise and financial support.

3.4.4 PRIORITY CONSERVATION ACTIONS FOR THE WYCLIFFE WILDLIFE CORRIDOR

Priority conservation actions identified at the Kootenay Connect workshop include:

- Provide science-based information to provincial access management planning in the area, particularly grizzly bear habitat use and huckleberry patch models from the Trans-border Grizzly Bear Project.
- Assess the overlapping habitat needs of American badger, elk, and grizzly bears to help define wildlife corridors (Figure 65).
- Incorporate livestock exclusion with wildlife-friendly fencing for sensitive wetlands.
- Assess the impact of and possible solutions for existing ungulate exclusionary fencing that may be inhibiting wildlife movements.
- Provide data and maps to NCC and NTBC to support new opportunities for private land securement.

[28] https://kootenayconservation.ca/stewardship-solutions/

- Identify areas for the provincial government to designate WMAs or WHAs (e.g., for Lewis's woodpecker, Williamson's sapsucker, or flammulated owl).
- Increase private land conservation and stewardship opportunities, including working with the RDEK on mechanisms to implement private land conservation e.g., discouraging the cutting of wildlife trees, thereby reducing the impact on Lewis's woodpecker.
- Reach out to absentee landowners, including CP Rail, to engage them in conservation activities on their unused lands in the corridor.
- Cooperation between NCC, NTBC, provincial government and Ktunaxa Nation Council on conservation priorities that span land ownership.
- Fire management to reduce potential for catastrophic fires also relies upon cooperation between NCC, NTBC, provincial government and Ktunaxa Nation Council.
- Integrate science-based criteria for ESAs and identify them for incorporation in RDEK's private lands DPA program and for potential inclusion within OCPs to address private land within regional connectivity areas. This would include exploring compensatory tools for conservation zoning for willing landowners.

a) Grizzly Bear b) American Badger c) Rocky Mountain Elk

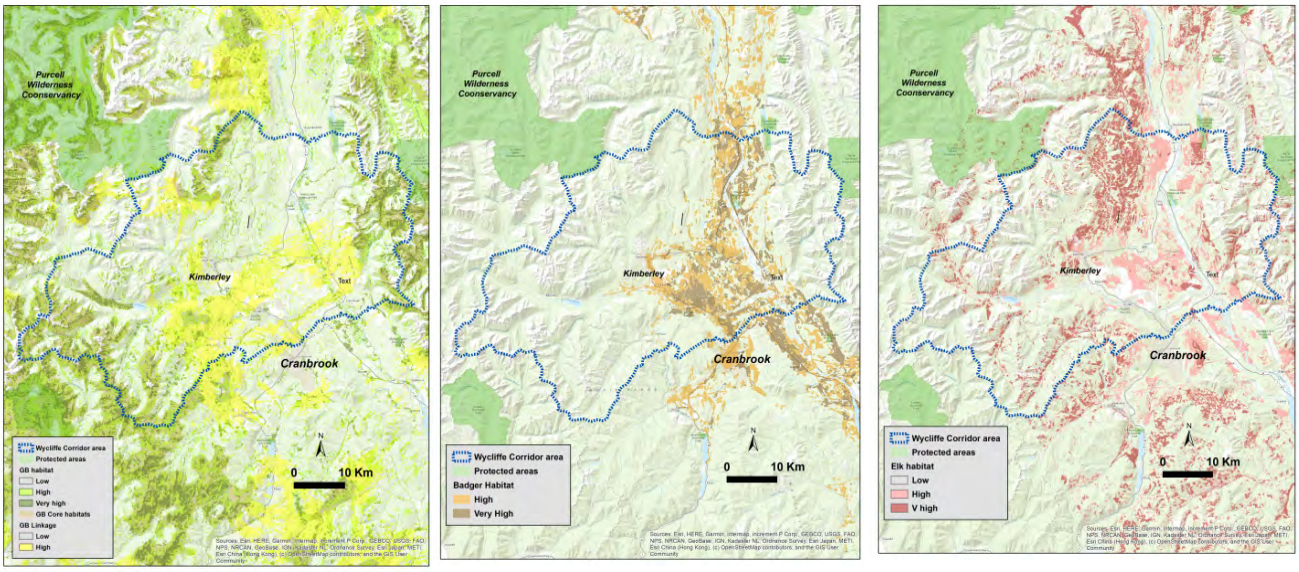


Figure 65. a) Grizzly bear habitat (Proctor et al., 2015); b) American badger habitat (Kinley et al., 2013); and c) elk habitat (Mulligan, 2020a, b) in the Wycliffe Corridor.

3.4.5 KOOTENAY CONNECT COMMUNITY-NOMINATED PRIORITY PLACES PROJECT

From 2019-2023, NTBC and NCC used Kootenay Connect CNPP funding along with matching funds from other sources to carry out conservation activities.

3.4.5.1 SPECIES AT RISK HABITAT ENHANCEMENT

Species at risk in the Wycliffe Corridor targeted for conservation include the American badger (federally listed as Endangered and provincially red-listed), Williamson's sapsucker (federally listed as Endangered provincially blue-listed), and Lewis's woodpecker (federally listed as Threatened and provincially blue-listed). Habitat restoration and enhancement activities pursued by the land trusts and the provincial government are intended to benefit these species at risk as well as other species of concern.

There are fewer than 100 breeding adult American badgers in the East Kootenay region where they are vulnerable to increasing threats from road mortality. The loss of open grassland areas to forest encroachment and urban development is resulting in ongoing habitat decline (COSEWIC, 2012; Environment and Climate Change Canada, 2021).

The Williamson's sapsucker is a migratory woodpecker that depends on old-growth coniferous and mixed forests in southeastern BC, with fewer than 1,000 individuals breeding in two Canadian subpopulations. Its distribution is limited by the availability of large, old nest-trees such as western larch. The main threat to this cavity-nesting species is logging and forest harvesting, including removal of dangerous trees for worker safety, forest fires and fire suppression (COSEWIC, 2017).

In Canada, the Lewis's woodpecker breeds only in British Columbia. Its population is small, with fewer than 1,000 individuals, and there is evidence of ongoing declines in parts of its Canadian range where it has been monitored over time. Threats to this cavity nester include habitat loss and degradation from increasing urban and agriculture development, and fire suppression (Environment and Climate Change Canada, 2017).

Projects at the Wycliffe Conservation Complex were designed to address changes to the natural fire regime caused by decades of wildfire suppression efforts that have reduced habitat quality. Over time, grassland and open range conditions have been gradually transitioning into conifer forests through in-growth and encroachment processes. With this change, the conservation partners observed that many habitat attributes necessary to sustain populations of American badger, Lewis's woodpecker, and Williamson's sapsucker are being impaired. In Wycliffe, it has become clear that one of the most effective ways to improve habitat for these species is to reduce young forest densities and transition to mature open forest stands.

Activities consisted of field surveys (Figure 66) to assess habitat and to develop management prescriptions for these three SAR. Forest thinning prescriptions for American badger and Lewis's woodpecker included habitat enhancements that reduce conifer stem density (Figure 67, 68), and for Williamson's sapsucker prescriptions included the creation of suitable colonial ant nest habitat by increasing downed woody debris levels.

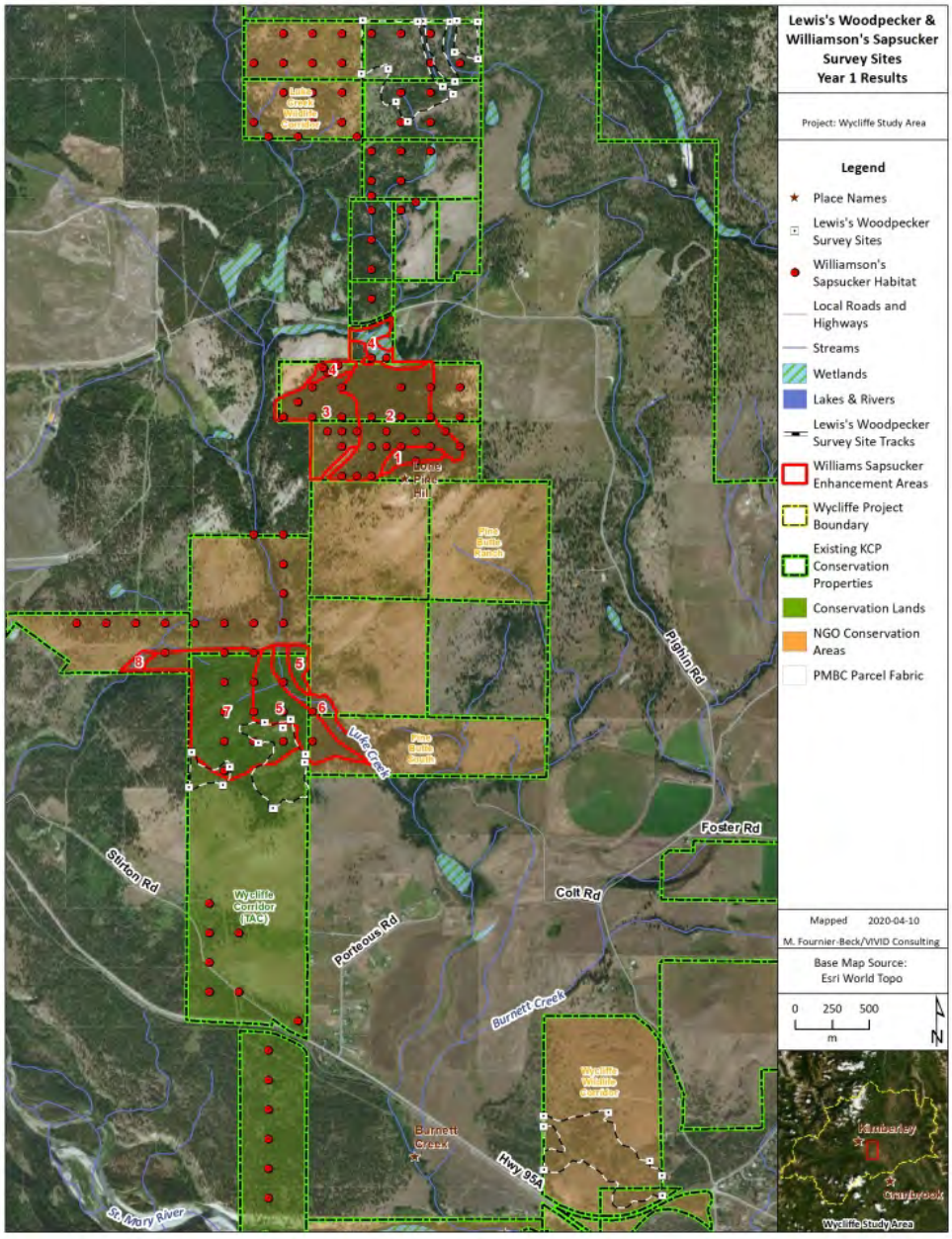


Figure 66. Williamson's sapsucker and Lewis's woodpecker survey work carried out with Kootenay Connect's ECCC funds by the Nature Conservancy of Canada and The Nature Trust of BC in Wycliffe in 2019–2020. (Source: NCC).

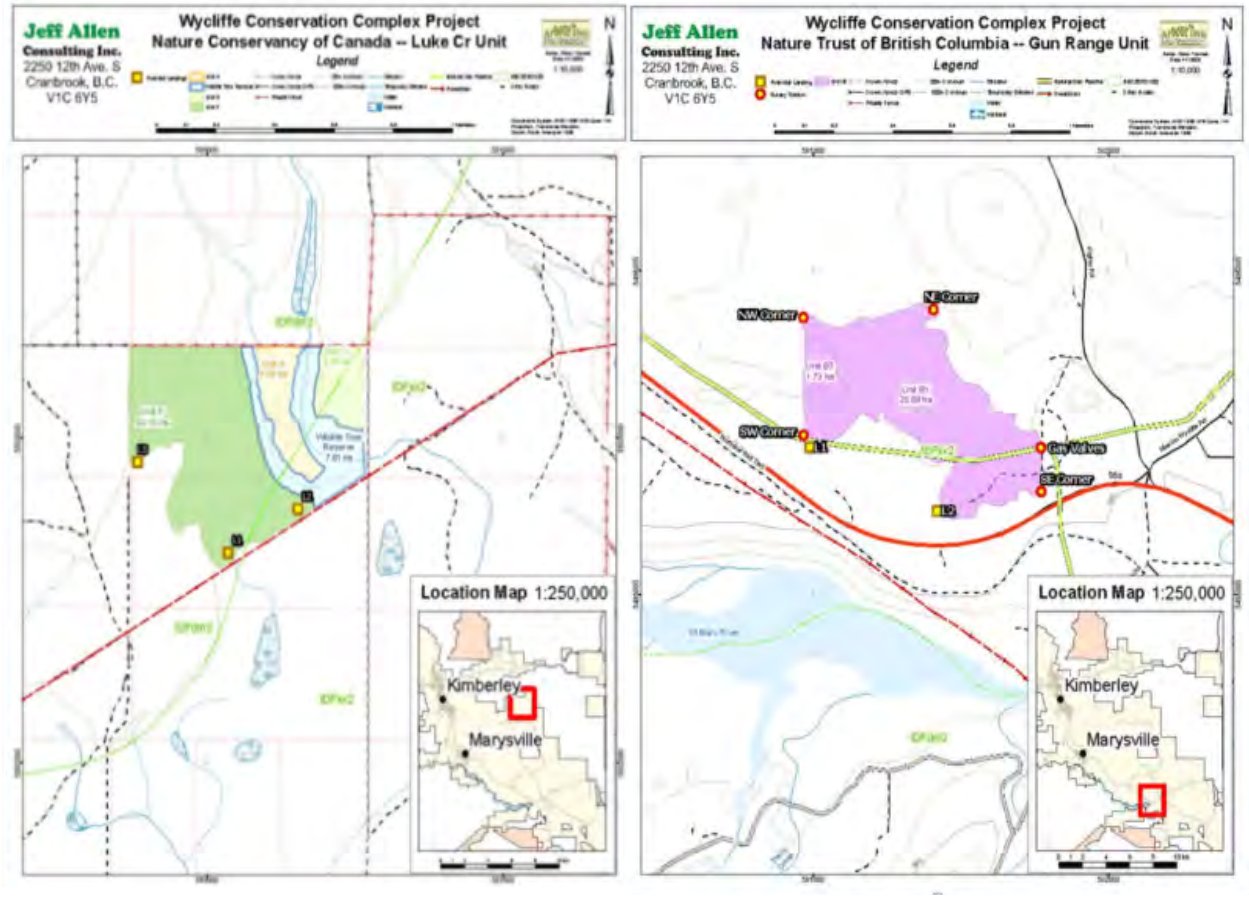


Figure 67. The Nature Trust of BC and Nature Conservancy of Canada Luke Creek and Gun Range units where forest thinning occurred to enhance habitat for species at risk. (Source: Jeff Allen Consulting).

Figure 68. An example of tree thinning to enhance open forest habitat in the Wycliffe Corridor. (Photos: NCC).

The best area for habitat enhancement for Williamson's sapsucker were identified with four distinct stand types totalling 69.7 ha to be prioritized for forest restoration and/or enhancement. Specific habitat enhancements for Williamson's sapsucker included encouraging mature, large-diameter trees – in particular, retaining veteran western larch trees – as well as thinning treatments to increase success of larch of different age classes and retaining large woody debris and other features that attract ants. Also, 215 ha were assessed for habitat enhancement opportunities to benefit Lewis's woodpecker (Figure 69) and American badger. Three sites were prioritized for improvement such as tree thinning on a total of 87 ha to increase habitat quality and population viability of Lewis's woodpecker and American badger.

NCC hired contractors to reduce tree density of forest cover by removing smaller trees including ponderosa pine and Douglas fir to increase fire resiliency and open canopies and favor large old trees for nesting sites. Western larch and aspen were mostly left undisturbed to retain historic species diversity, Woody debris piles were created throughout to promote biodiversity and provide forage (insects and colonial ants). Pre- and post-treatment plots were established to monitor habitat improvements.

a) b)

Figure 69. a) Lewis's woodpecker-worthy snag; and b) a Lewis's woodpecker perched on a snag located on conservation lands in the Wycliffe Corridor. (Photos: NCC).

3.4.5.2 INVASIVE PLANT CONTROL

Management activities from 2021-2023 in Wycliffe also focused on improving grassland health (Figure 70) and invasive species management (Figure 71). NTBC focussed on reducing invasive plants by teaming up with the East Kootenay Invasive Species Council (EKISC) to inventory grasslands and recommend prescriptions for treatment. Overall, 58 ha were chemically treated to remove blueweed, Dalmatian toadflax, common burdock, Canada thistle, common tansy, spotted knapweed, sulfur cinquefoil, and yellow hawkweed. All the work was guided by a management plan for conservation lands owned by either NCC (22 ha), NTBC (9 ha), or the province (4 ha). Post-treatment monitoring on selected sites was reported annually to determine effectiveness.

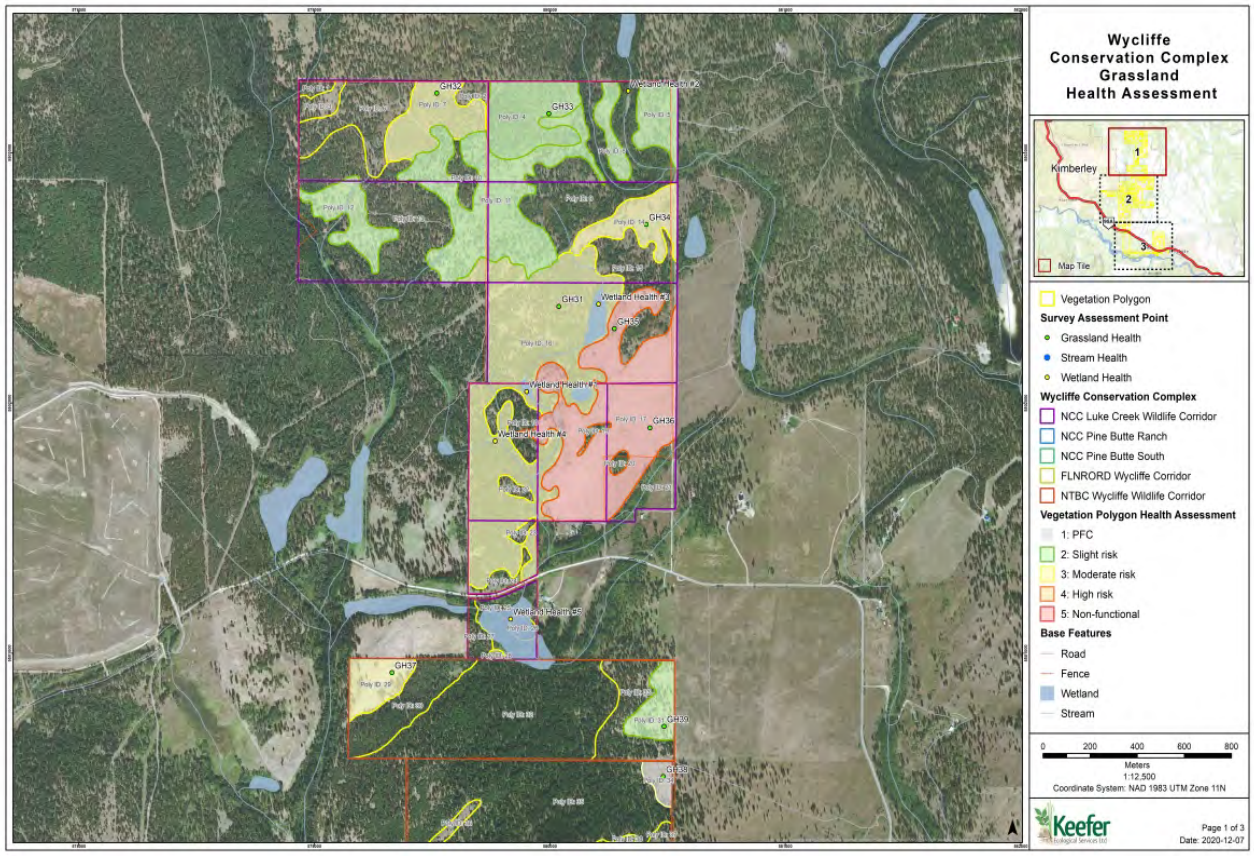
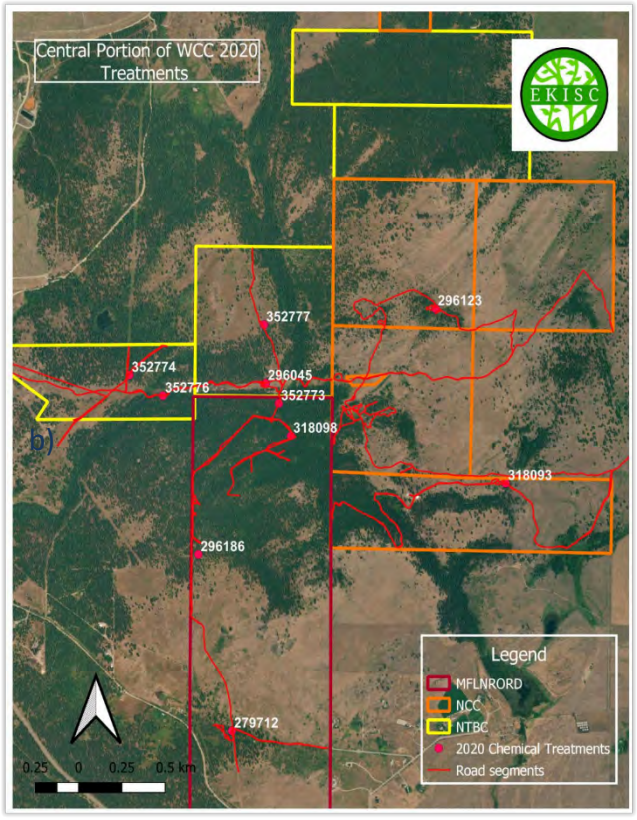


Figure 70. Map showing grassland health of the north section of the Wycliffe Conservation Complex. (Source: Keefer Ecological Services).

a



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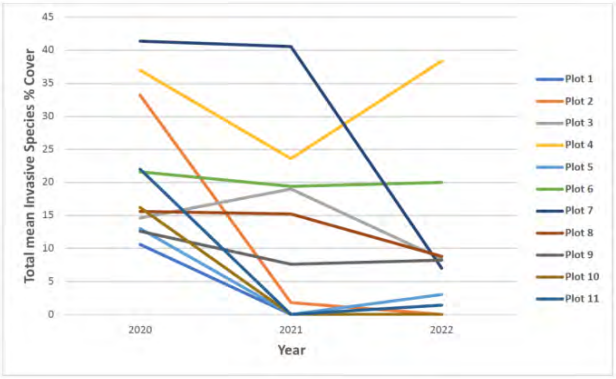

Figure 71. a) Invasive plant management in the Wycliffe Conservation Complex from 2021-2023; and b) monitoring results showing a decrease in invasive plants after treatments across several plots. (Source: East Kootenay Invasive Species Council).

3.4.5.3 WILDLIFE-FRIENDLY FENCING

Fencing was prioritized in 2021-2023 to reduce cattle trespass and recreational access in sensitive areas on the Wycliffe Conservation Complex. Fencing work included the removal of unneeded fences and old barbed wire, repairs and/or replacement of fences in poor or non-functioning condition as well as, installation of new fence in previously unfenced locations where conservation land demarcation for public access controls and cattle exclusion was important. Following a Property Complex Fencing Plan developed in the summer of 2021, work included 6 fencing projects across the conservation properties (Figure 72). All erected or restored fences were a “wildlife friendly” design in which barbed wire fences were fitted with a smooth high tensile bottom and top wire to allow wildlife to pass without injury or entanglement. In total 12,129 m of fence work was implemented. These included approximately 144 m of fence repairs, 5,637 m of fence removal, 1,413 m of new fence construction, and 4,935 m of removal and new fence replacement combined (Figure 73, 74).

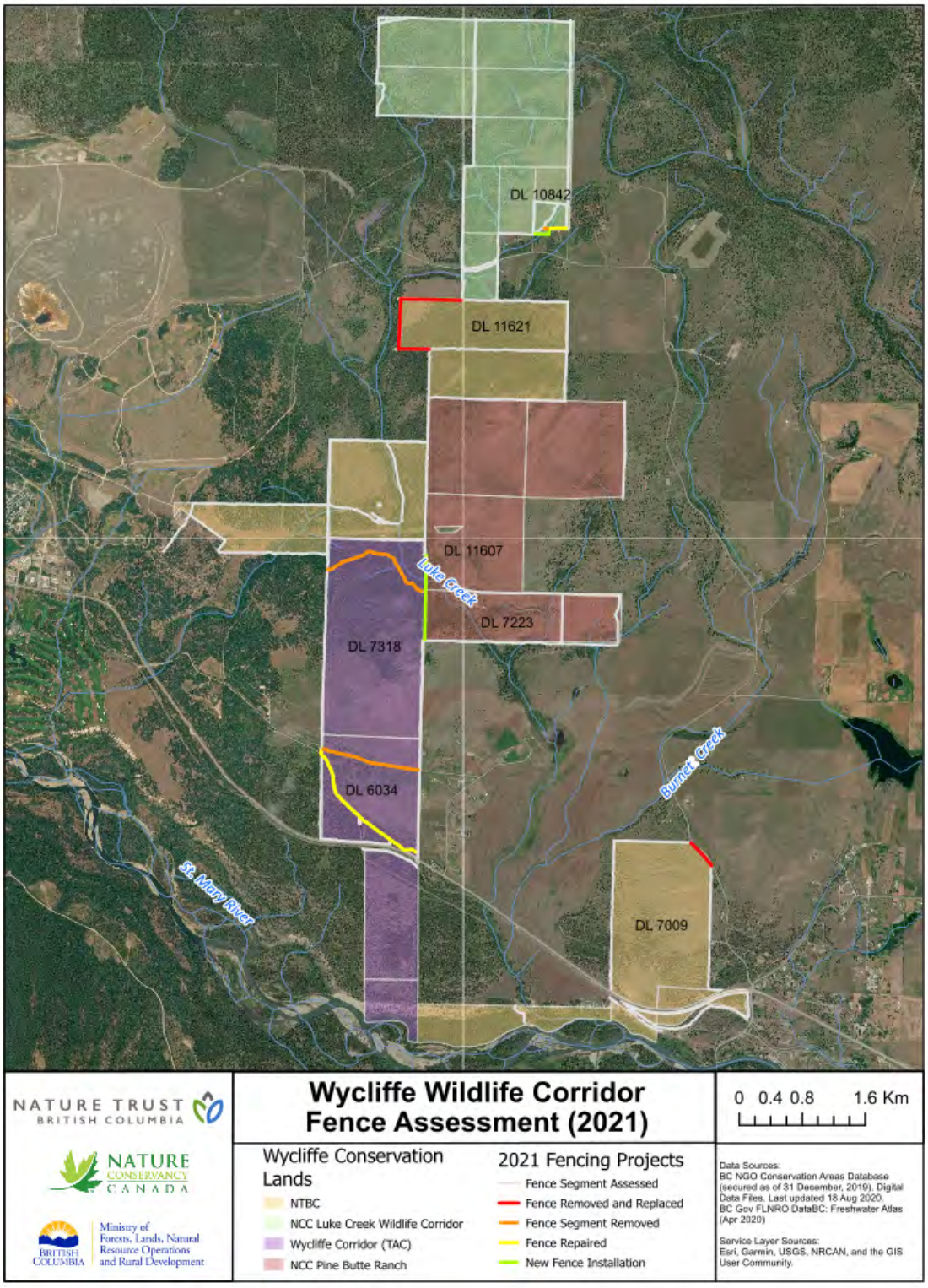

Figure 72. Wycliffe Corridor Fence Assessment that guided wildlife-friendly repair, replacement, and removal projects. (Source: NTBC).

Figure 73. a) Staple locks were built into new or repaired fences where they intersected with game trails. This modification allows the top and bottom strands to be moved to aid in passage; and b) Elk crossing a new wildlife friendly fence in the Wycliffe Conservation Complex. (Photos: NTBC).

Figure 74. a) Fence installed in 2021 identifies grassland grazed by cattle vs conserved for wildlife one year later with The Nature Trust of BC land to the right; and b) Motorized traffic threatens sensitive ecological values on many conservation properties in the region. (Photos: NTBC).

3.4.5.4 PRIVATE LAND MAPPING TO ASSIST LAND TRUSTS

To increase our collective understanding of where priority private lands for conservation occur in the Wycliffe Corridor, Kootenay Connect mapped all private lands within 500 m of riparian-wetland habitats and then selected properties that either: a) overlapped with riparian and wetland habitats, b) were located within our proposed upland wildlife corridors, or c) had both attributes. Our analysis was a first cut in identifying private lands for possible purchase through land trusts (NCC and NTBC). In the process, we created an extensive GIS database of natural values of species and habitats and mapped cumulative impacts (Figure 75).

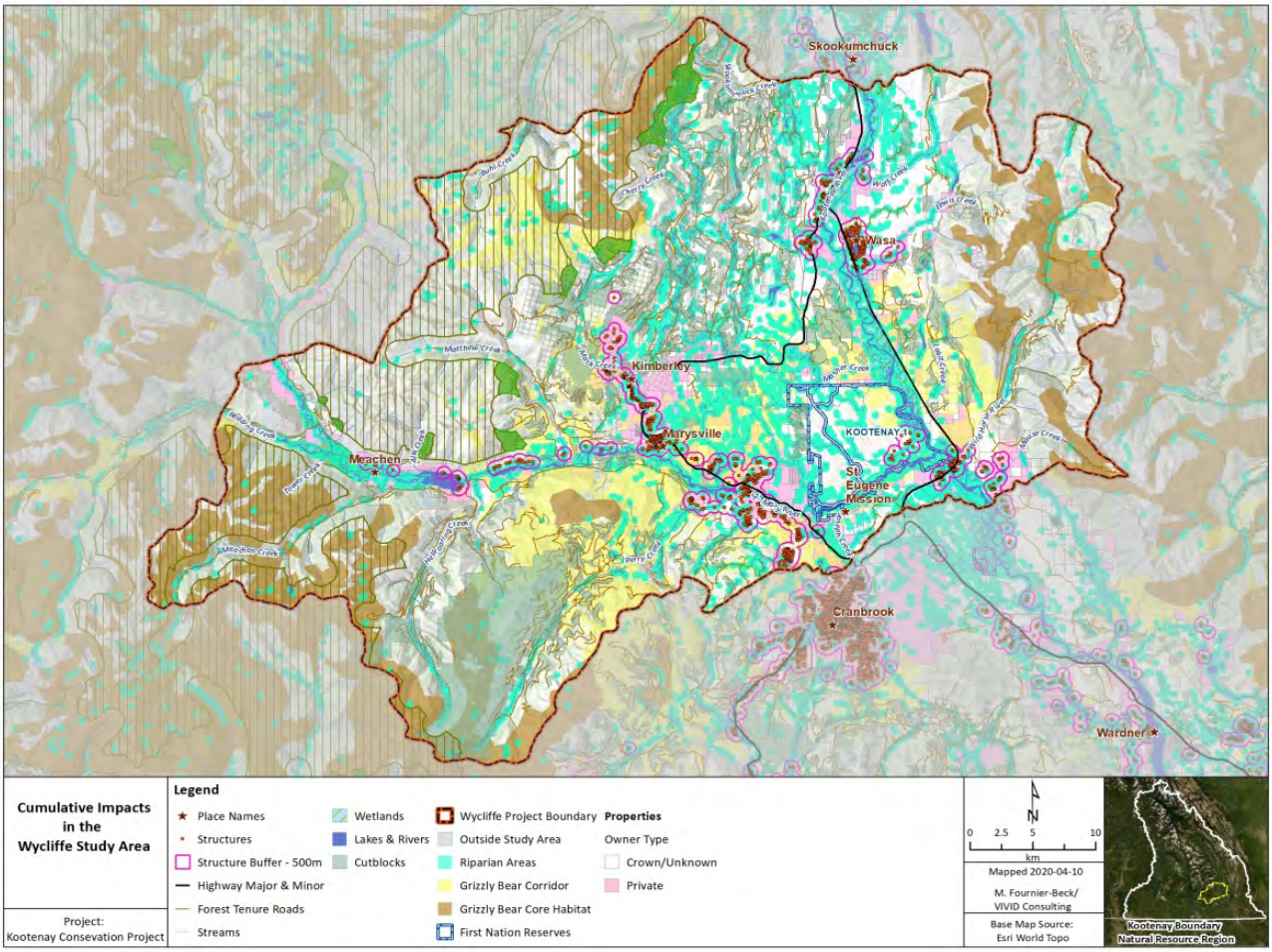

Figure 75. Cumulative impacts in the Wycliffe Corridor. (Source: Kootenay Connect).

3.4.6 CLIMATE ADAPTATION RECOMMENDATIONS FOR WYCLIFFE WILDLIFE CORRIDOR

In 2021, Kutenai Nature Investigations[29] provided a climate change lens for conservation planning for the Wycliffe Corridor (Utzig, 2022). From a regional connectivity perspective, the Wycliffe Corridor plays an important role for connecting across the Rocky Mountain Trench, linking the Southern Purcell Mountains and the Kootenay Ranges of the Rocky Mountains. This corridor is also an integral section of the low elevation north-south continental rift valley of the Rocky Mountain Trench which extends over 1,600 km from Montana to the Yukon (Figure 76).

[29] https://kootenayconservation.ca/wp-content/uploads/2022/06/Utzig_Climate_Wycliffe-Corridor-and-Climate_-Final_Report_Mar2022.pdf

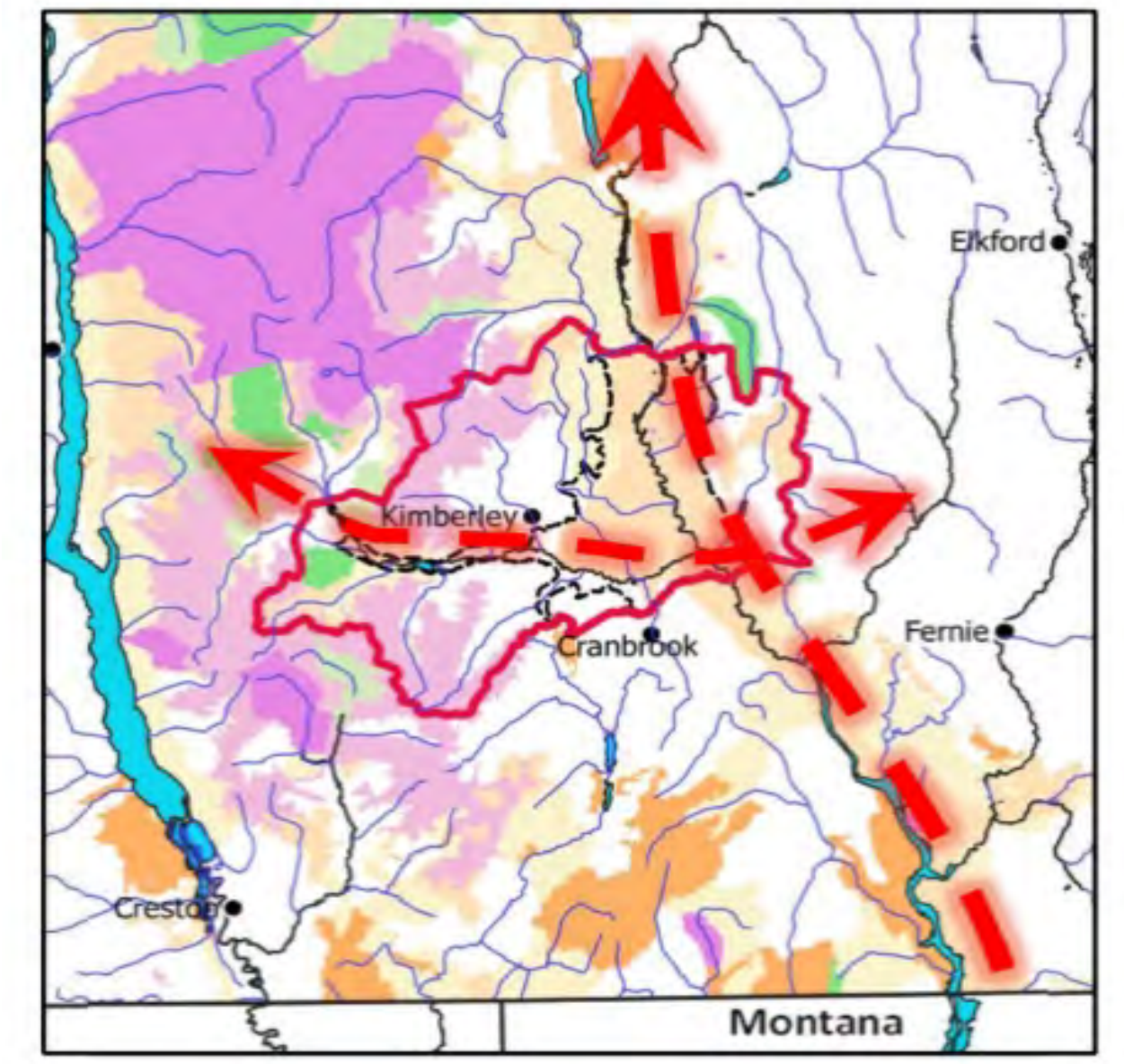

Figure 76. Wycliffe Corridor and regional connectivity based on climate change mapping (Utzig and Holt, 2014).

As temperatures increase and precipitation shifts from snow to more rain, ecosystem changes in the Wycliffe area are predicted to change significantly. While there is variation in the magnitude of those changes, related to uncertainty in the severity of the realized climate change, there are similarities in the various scenarios that shed light on what to expect in the Wycliffe Corridor. All scenarios predict a shift in the valley bottom to grassland/steppe (Figure 77) with no trees except in moist riparian areas. the lower slopes of the Purcell and Rocky Mountains generally will shift from dry montane spruce to some combination of ponderosa pine, dry Douglas-fir and/or grassland/steppe while the upper elevation Engelmann spruce-

subalpine fir subzones will generally disappear. Upper elevations will shift from dry and wet subalpine forest to some type of cedar-hemlock forest ranging from dry, moist or wet interior cedar/hemlock.

These shifts may not be smooth and will likely be mediated by wildfire, disease (insect infestation), wind throw, or drought. The transition to grassland/steppe may be troublesome depending on the availability of the appropriate seed bank for these species in the area.

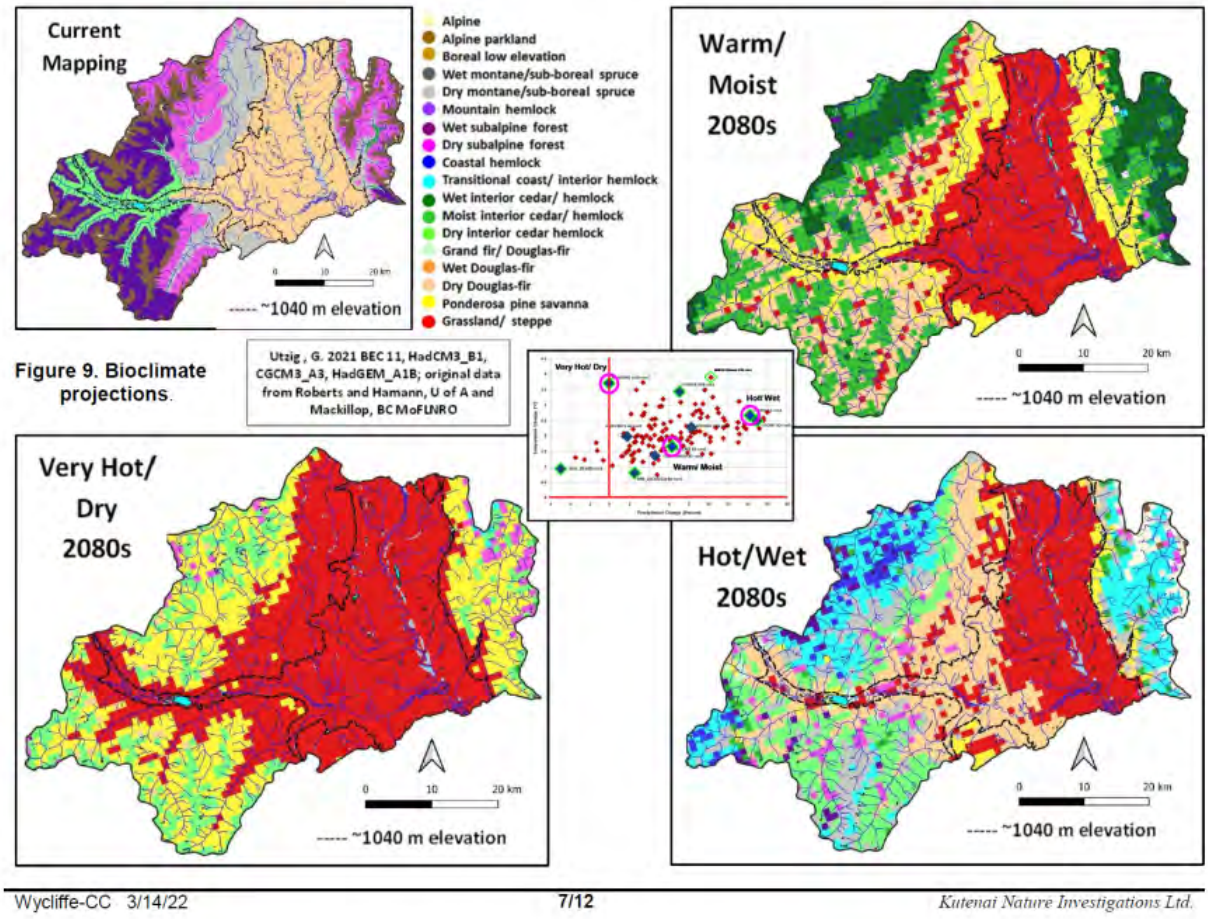

Figure 77. Climate model predictions for the Wycliffe Corridor (Utzig, 2022).

Changes to the way water flows into and through the system will also bring profound changes to the ecosystems. The projected shift from closed forests, mixed open forests, and savanna ecosystems to extensive open grasslands across the floor of the Rocky Mountain Trench, and potentially along the lower reaches of the St. Mary River, increases the importance of riparian ecosystems within the Wycliffe Corridor. Drought and demand for water will become an increasing issue. Increasing temperatures and drought across the corridor will increase the

importance of perennial water sources for species utilizing the corridor, be they springs, lakes, ponds, wetlands, or streams. Wetlands that occur within the corridor will also be affected by climate change. Increasing drought due to reductions in snow accumulation, decreased summer precipitation and increased evaporation will all contribute to lower water levels and/or potential seasonal loss of some wetlands and ponds, especially those fed by local surface water. Wetlands fed by regional water tables may be more resilient. Flows in smaller streams that do not have high elevation or regional water table sources will also be affected.

Climate disruption is projected to drive major shifts in ecosystems within the corridor, reduce the availability of water sources, and increase the need for regional connectivity. Extreme events, wildfire and pest infestations are likely to increase stress on forested ecosystems and provide the triggers for a shift to grassland/steppe communities in the lowest elevations of the corridor over the coming decades.

Key recommendations to mitigate these changes include:

- Thinning overstocked stands and controlled burning to reduce drought stress and the risk of catastrophic fire.
- Increasing protections for existing riparian habitats along the St. Mary and Kootenay Rivers are a high priority to maintain the connectivity function of these watersheds. Given the transition to grassland/steppe ecosystems, this will be important to maintain some degree of moist ecosystems for forest cover to provide habitat for shifting species. Also, these riparian wetland habitats may provide mitigation against extreme weather events that bring flooding and excessive erosion. Riparian habitat along smaller streams will also play an important role for connectivity in the corridor. Forest retention in these riparian habitats will also contribute to carbon sequestration.
- Inventory, monitoring and classification of current wetlands, ponds and seeps can inform prioritization of their management to optimize their ability to persist.

3.5 MULTI-CORRIDOR PROJECTS

Habitat enhancement and restoration projects are designed to support a spectrum of 34 federally listed species at risk and over 40 species of special concern and local interest. Projects targeting great blue heron and bats, specifically, occurred throughout the four Kootenay Connect Priority Place's focal corridors and are summarized in the following two sections.

3.5.1 GREAT BLUE HERON

The great blue heron is an important species at risk that was surveyed as part of Kootenay Connect Community-Nominated Priority Places in Year 2. For several years, significant declines have been reported in the numbers of active and successful nests across the Kootenay region (Figure 78), stimulating its inclusion as a focal species in Kootenay Connect. In 2020, Marlene Machmer of Pandion Ecological Research updated known breeding site locations occupied by great blue herons in all four Kootenay Connect priority focal areas of the Columbia Wetlands, Wycliffe, Creston Valley, and Bonanza Corridor. A total of 18 heron breeding sites were surveyed of which seven sites (161 individual nests) were confirmed as occupied in three of the four focal corridors – i.e., two sites in the Creston Valley, four sites in the Columbia Wetlands, and one site in Wycliffe area. Of these seven occupied sites, six sites had successful nests and one site experienced nest failure. In total for these sites, the nest failure rate was 66 of 161 nests (41%), which is relatively high for herons (Machmer, 2021). Nest failure was thought to be related to bald eagle and corvid harassment, nest-site competition with other birds, and human disturbance. Notable was the lack of active nest sites observed in the Bonanza Biodiversity Corridor even though herons have been observed over the years along Bonanza Creek.

In terms of conservation stewardship of herons on Crown land in 2020, Pandion Ecological Research delineated and mapped a WHA boundary of high-quality nesting habitat in the Parson area (Figure 79); an application was submitted to the provincial government and is still awaiting approval. The proposed Great Blue Heron WHA would incorporate all the active heron nest trees in mature Douglas fir, plus include adjacent mature forest and buffering from roads and human disturbance, as well as two small wetlands along with nests of pileated woodpecker, brown creeper, and those used by cavity-nesting ducks (such as wood ducks). The adjacent private landowner to the south is extremely vigilant and has been a heron nest steward for several years. Twelve of the 14 active heron nests at this site were successful again in 2021, producing an estimated 26 fledglings. It is hoped that these values will provide a compelling case for approval of this site as a Great Blue Heron WHA.

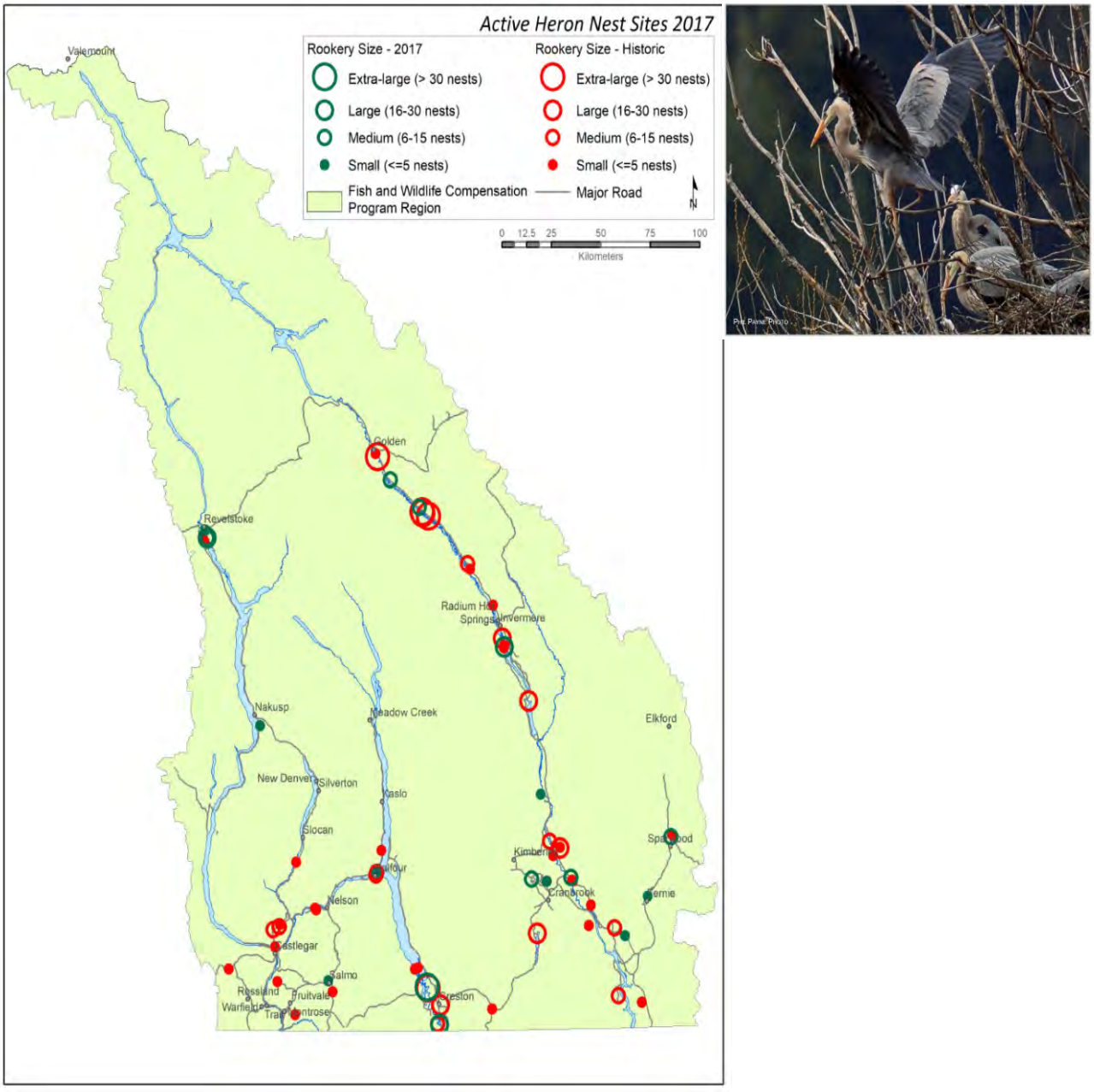

Figure 78. Great blue heron rookeries across four focal corridors of Kootenay Connect that were surveyed for occupancy and fledgling success (Machmer, 2021).

Figure 79. Proposed Wildlife Habitat Area for great blue heron on Crown land near Parson in the Columbia Wetlands (Machmer, 2021).

3.5.2 BAT CONSERVATION

The Wildlife Conservation Society Canada's (WCSC) Western Bat Conservation program is a lead partner in Kootenay Connect. Given that bats are facing unprecedented levels of threats, Kootenay Connect has been supporting WCSC to establish baseline data for measuring impacts, experimenting with roost habitat enhancement, and monitoring the efficacy of mitigation strategies. Over the past four years as part of Kootenay Connect, WCSC has been filling knowledge gaps to inform effective conservation strategies and building resiliency into bat populations through habitat recovery and enhancement.

WCSC's research includes acoustically monitoring bats by recording their echolocation calls using bat detectors to document changes in species diversity and relative abundance through

annual recording and trend analyses (Lausen et al., 2023). Long-term monitoring of bat activity is being used to inform conservation and management across the continent – this large-scale standardized monitoring program is called the North American Bat Monitoring Program (NABat). The sampling grid across US and Canada is based on 10 km x 10 km grid cells that are monitored for at least one week during the same time period each year. WCSC biologists are recording bats using detectors in 55 grid cells across the province with 16 cells located in the Columbia Basin and six of which occur in Kootenay Connect's four priority focal corridors: Creston Valley (1), Bonanza Biodiversity Corridor (2), Wycliffe Corridor (1), and Columbia Valley (2) (Figure 80).

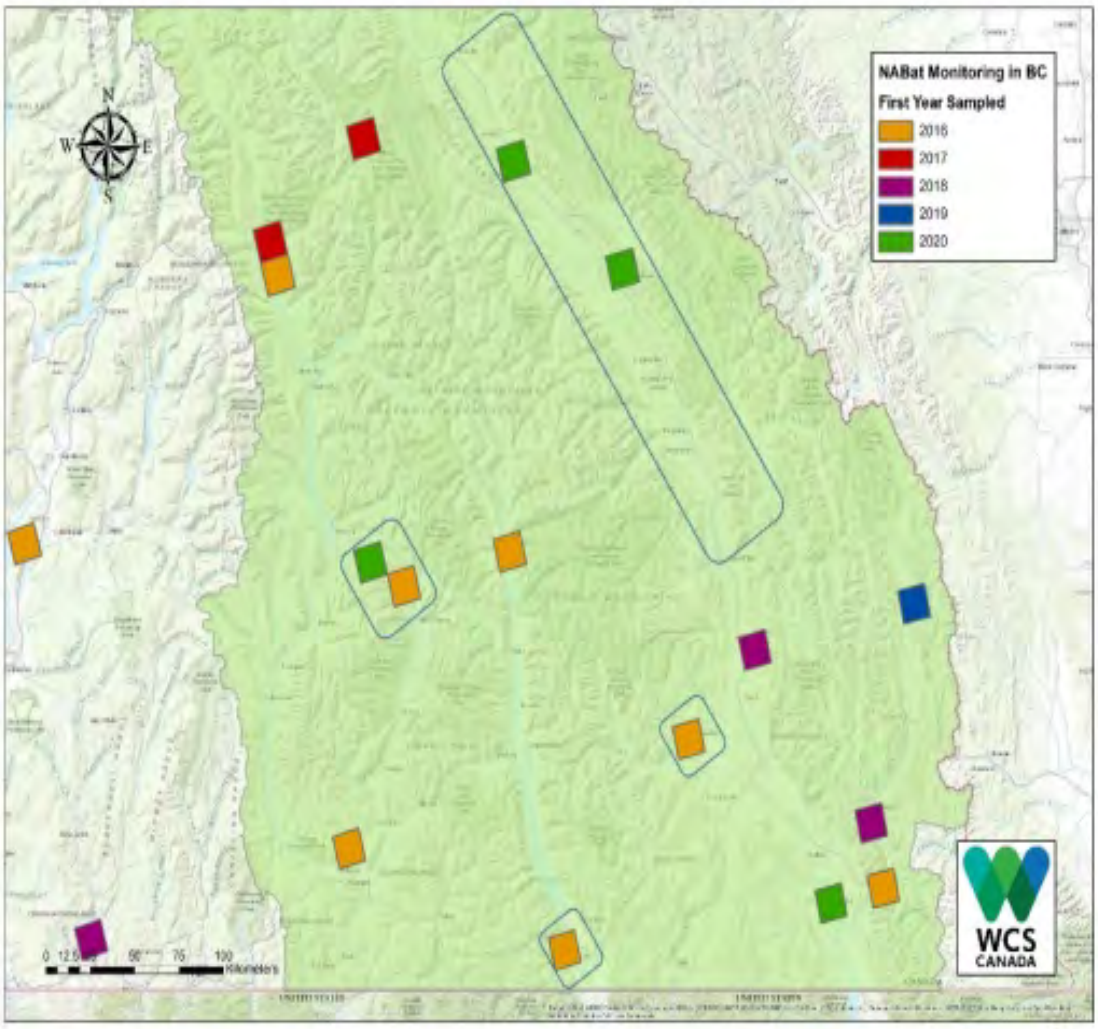

Figure 80. NABat grid cells in the Columbia Basin. Squares roughly delineate current Kootenay Connect focal corridors in which WCSC's work took place as part of larger initiatives (Rae, 2021).

Across all six Kootenay Connect sites, 12 species of bats have been detected: big brown bat, Californian myotis, eastern red bat, fringed myotis, hoary bat, little brown myotis, long-eared myotis, long-legged myotis, silver-haired bat, Townsend's big-eared bat, western small-footed myotis, and Yuma myotis. Northern myotis has been detected in other grid cells outside the current Kootenay Connect grid cells (Figure 80). Many of these bat species are considered endangered by COSEWIC including: little brown myotis and northern myotis, the former being found across the Columbia Basin and later found only in the northern part of the Basin (though its southern boundary is not well known); and the recently listed migratory bat species – hoary, silver-haired and eastern red bats – which have been detected in Kootenay Connect focal corridors (Lausen et al., 2023) (Figure 81).

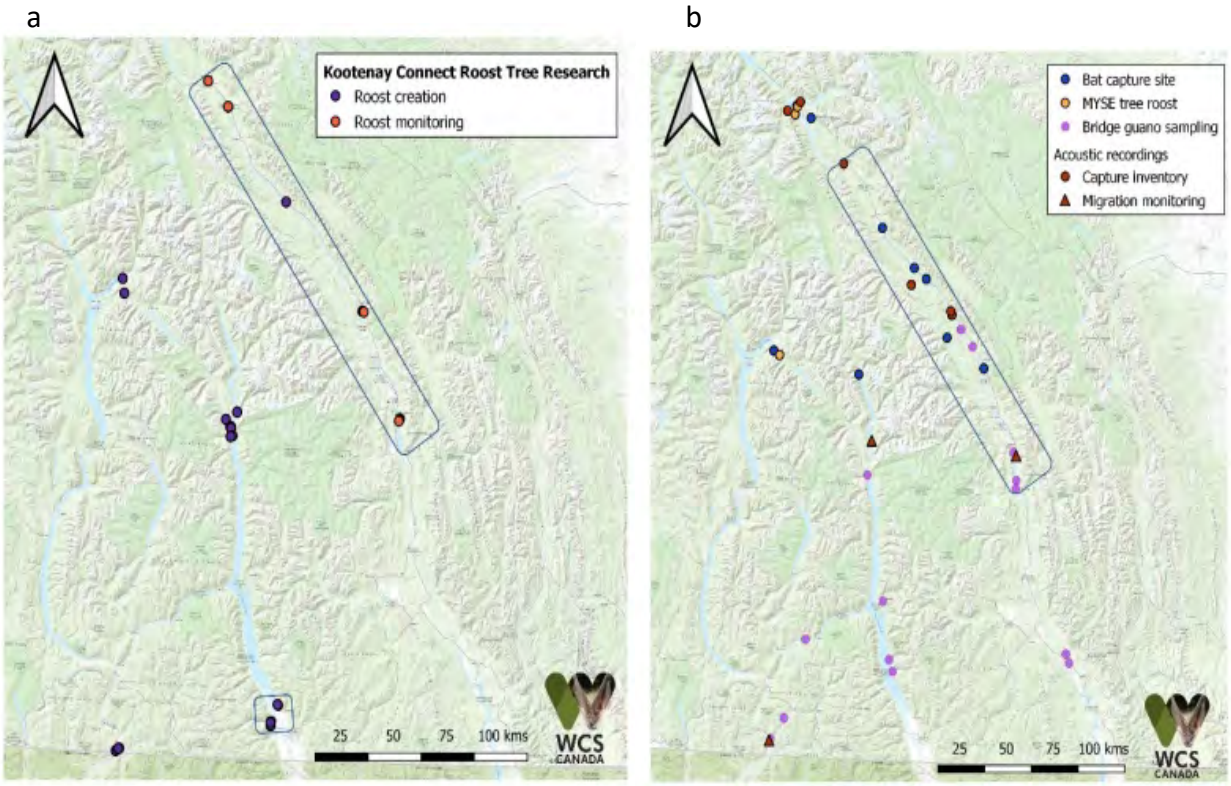

Figure 81. a) New roost trees that were created in 2020-2021 and monitored in 2022; b) inventory sites for bat capture and acoustics surveys including bridges where guano was sampled for genetic analyses and three migration monitoring sites. (Source: E. Low, 2023).

Enhancing Habitat Features to Benefit Northern Myotis Bats

Timber harvest in many upland areas surrounding the northern portion of the Columbia Wetlands has undoubtedly reduced the availability of tree roosts for many species. Although there is little guidance available for how to mitigate for lost tree roosts, an initiative in BC to

create crevice roosts in trees using chainsaws (Todd Manning, pers. comm.) is building on work of others (Griffiths et al., 2018). WCSC is also experimenting with BrandenBark™, a plastic cover for poles that mimics decaying bark. As part of Kootenay Connect CNPP, WCSC has been applying these techniques in areas where bat species at risk are likely to benefit (Quamme and Lausen, 2020).

The goal of the roost enhancements has been to create tree or tree-like roosts that will benefit both little brown myotis and northern myotis (Figure 82) in areas where there are few buildings and little remaining old growth forest. In order to target northern myotis, WCSC has conducted on-the-ground effort to identify where this species still occurs in the southern edge of their provincial (and western North American) range.

In the East Kootenay's Columbia River drainage, in particular, WCSC has carried out nearly 20 nights of capture and acoustic inventory trying to locate northern myotis (Figure 82). They have found this species in remnant old growth cedar patches to the north of current Kootenay Connect focal corridors (e.g., Golden, Duncan Lardeau). This finding has provided context for WCSC's tree roost enhancement efforts. For example, extensive timber harvest has left little remaining habitat in the Bugaboo and Spillimacheen drainages, areas that likely were once part of the northern myotis's range. Future Kootenay Connect habitat enhancement may target this area for some tree-roost creation like those that occurred west of Golden in Marl Creek and Burges James Gadsen Provincial Parks. The hope is that these created tree-roosts that mimic old growth will eventually serve to connect northern myotis to forested upland areas within the Columbia Valley once the upland trees have reached maturity and can provide natural roost crevices.

In 2022, WCSC and partners created 55 new tree roost structures for a total of 92 created in the Columbia Basin since 2020 with 29 of these located within Kootenay Connect focal corridors (Lausen et al., 2023). Monitoring of these structures is ongoing, using guano traps, acoustics, and capture techniques. Genetic analysis of 2022 samples is pending; however to date, WCSC has determined all types of tree-roost structures including BrandenBark™ on poles and on trees (Figure 83a), and wildlife tree creation using chainsaws (Figure 83b), have had documented use by bats. Remarkably, most BrandenBark™ structures are used within their first year after creation. For example, the BrandenBark™ pilot pole in Kootenay Connect's Columbia Valley Corridor was used in its first spring by a maternity colony of little brown myotis to raise pups.

a b

Figure 82. a) Little brown bat, and b) northern myotis, are endangered bats in BC and Canada. Northern Myotis was radio-tracked (transmitter on back in right photo) by WCS Canada to locate tree roosts in 2022. (Photos: left, Cori Lausen; right, Jared Hobbs).

a b

Figure 83. a) BrandenBark™ installations mimic old growth forest roosting sites for old growth dependent bats which monitoring shows are readily used by bats after construction; and b) an arborist creates snags and crevices with chainsaws which have been found to be immediately useful to bats. (Photos: WSCS).

EIGHT OTHER KOOTENAY CONNECT CORRIDORS

Over the four years of Kootenay Connect Community-Nominated Priority Places, we continued to advance activities in our first four priority focal corridors (Creston Valley, Bonanza, Columbia Wetland and Wycliffe; as described above) plus added the remaining eight corridors that we report on within the following Results section (refer to Figure 1). Between June 2020 and November 2022, we held Kootenay Connect workshops in each of these remaining eight focal corridors, some in partnership with KCP's Conservation Action Forums: Duncan Lardeau (July 2020), Columbia Lake (October 2020), Golden (a virtual event, November 2020), Slocan River Valley (virtual events, March and October 2021), Elk Valley (a virtual event, October 2021), Retallack (November 2021), South Country (a virtual event, January 2022), and South Selkirks-Lower Columbia (November 2022).

Kootenay Connect's focus in these eight focal corridors has been to bring new scientific information and intention to link valley bottoms and surrounding uplands. In each of these areas, protected conservation lands act as the center point of species at risk and large mammal conservation. Our role has been to coordinate local conservation efforts into a landscape level vision of ecological corridors and connectivity as a strategy to join and expand the excellent efforts of the local conservation and stewardship interests.

Table A-1 through Table A-5 (Appendix B) summarize corridor-specific ecological values including key species of interest, habitats and habitat features, ecological processes, and ecological threats. This information was compiled during our Kootenay Connect workshops and KCP Conservation Action Forums in consultations with regional experts, which informed creation of GIS data layers with biological, ecological, and human use attributes.

3.6 DUNCAN LARDEAU

3.6.1 GEOGRAPHIC DESCRIPTION

The Duncan Lardeau is a broad valley bottom floodplain and delta at the north end of Kootenay Lake formed by the free-flowing Lardeau River and the regulated Duncan River that join downstream of the Duncan Dam for 12 kilometers before entering the lake. This rich floodplain, locally referred to as the flats, supports rare and critical habitat for species at risk and is preferred habitat for nearly all species of local wildlife in this otherwise rugged, high elevation landscape. Its deciduous woodlands support many species of nesting songbirds; and this area is the first suitable migration stopover for dozens of waterfowl and shorebird species north of Creston along the 150-km stretch of Kootenay Lake. The valley also serves as the first east-west "land bridge" north of Creston, for large and small wide-ranging mammals, forming a vital

movement linkage between the large wilderness areas of the Purcell Wilderness Conservancy to the east and Goat Range Provincial Park to the west (Figure 84).

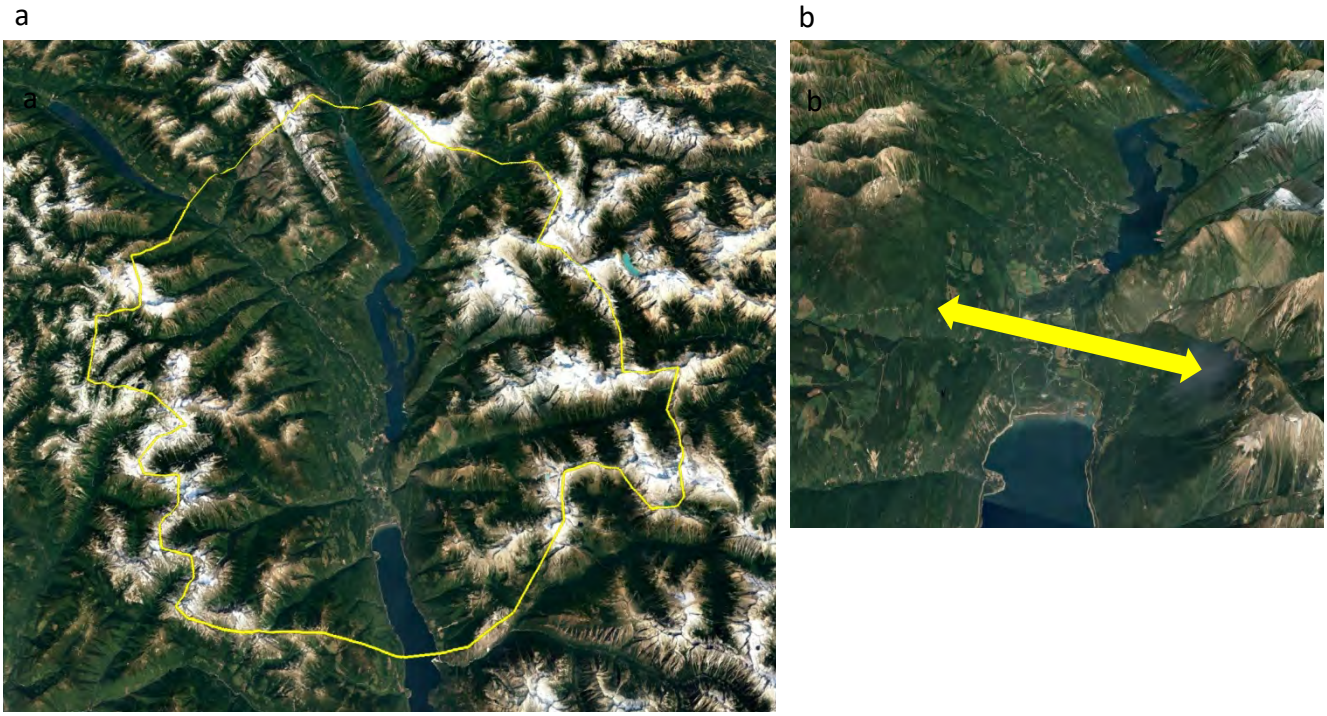

Figure 84. a) Google Earth view of the Duncan Lardeau Valley as defined by workshop participants; and b) a close up of the "land bridge" between the Purcell and Selkirk Mountains between Kootenay Lake (foreground) and Duncan Reservoir (top). (Source: Kootenay Connect).

Since completion of the Duncan Dam in 1967 as part of the Columbia River Treaty, hydrologic and ecosystem changes have permanently altered this landscape (Utzig and Schmidt, 2011; BC Hydro, 2017). Despite these impacts, the Duncan Lardeau Valley has exceptional ecological values worthy of enhancement and protection (Herbison, 1996). The overarching goal of conservation work in this area is to compensate for/mitigate the hydrological changes from the effects of the upstream dam (as feasible and practical), enhance and secure habitat for local species at risk, and facilitate cross valley east-west, and north-south connectivity (Figure 85).

Ecological connectivity in this area includes amphibians, fish, local and migratory birds, small, medium, and large mammals including carnivores, ecological processes, ecosystem services, and climate change resilience. A legacy of conservation of the flats by the provincial government, NTBC, and local biologists and conservationists has created a reliable baseline to guide future efforts (Herbison, 1996, 1999). The flats are being managed to enhance black cottonwood riparian habitats for wildlife and biodiversity through mimicking historic water regimes. This floodplain area is also important for species that use upland habitats. Previous

wildlife surveys have documented provincially red-listed western grebe and woodland caribou (Central Mountain population) in addition to blue-listed western painted turtle, great blue heron, bobolink, little brown myotis, Townsend's big-eared bat, and grizzly bear.

Figure 85. Several ecologically significant conservation lands are owned and managed by The Nature Trust of BC (NTBC) and the provincial government in the Duncan Lardeau Valley. In 2007, NTBC added this 80-hectare (198-acre) parcel of land to the existing network of conservation properties. (Photo: NTBC).

The Duncan Lardeau is located within KCP's Duncan-Trout Lake Conservation Neighbourhood. KCP has not yet hosted a Conservation Action Forum in this region, thus the workshop organized by Kootenay Connect in July 2020 initiated an important discussion of conservation priorities and potential projects to enhance the ecology of this landscape. Kootenay Connect developed and shared GIS maps of human disturbance, land ownership patterns, and biological values that informed the discussion.

3.6.2 LEADING CONNECTIVITY CONSERVATION GROUPS & ALLIES

Organizations working toward conservation of the Duncan Lardeau Valley include The Nature Trust of BC, Nature Conservancy of Canada, Friends of the Lardeau, Wildlife Habitats for Tomorrow, Friends of Kootenay Lake Stewardship Society, Kootenay Conservation Program, and Living Lakes Canada in addition to local professional biologists, interested citizens, provincial government, and the Regional District of Central Kootenay.

3.6.3 KOOTENAY CONNECT WORKSHOP

The 2020 workshop began with a review of land ownership patterns within the Duncan Lardeau focal corridor. Approximately 500 ha of the valley bottom are conservation lands either held and managed by NTBC or the provincial government that provide an important conservation

core for this area (Figure 86). Although somewhat outdated, the Duncan-Lardeau Flats Conservation Properties Land Management Plan (Krebs et al., 2013) remains a guiding document for managing the private-Crown complex of conservation lands.

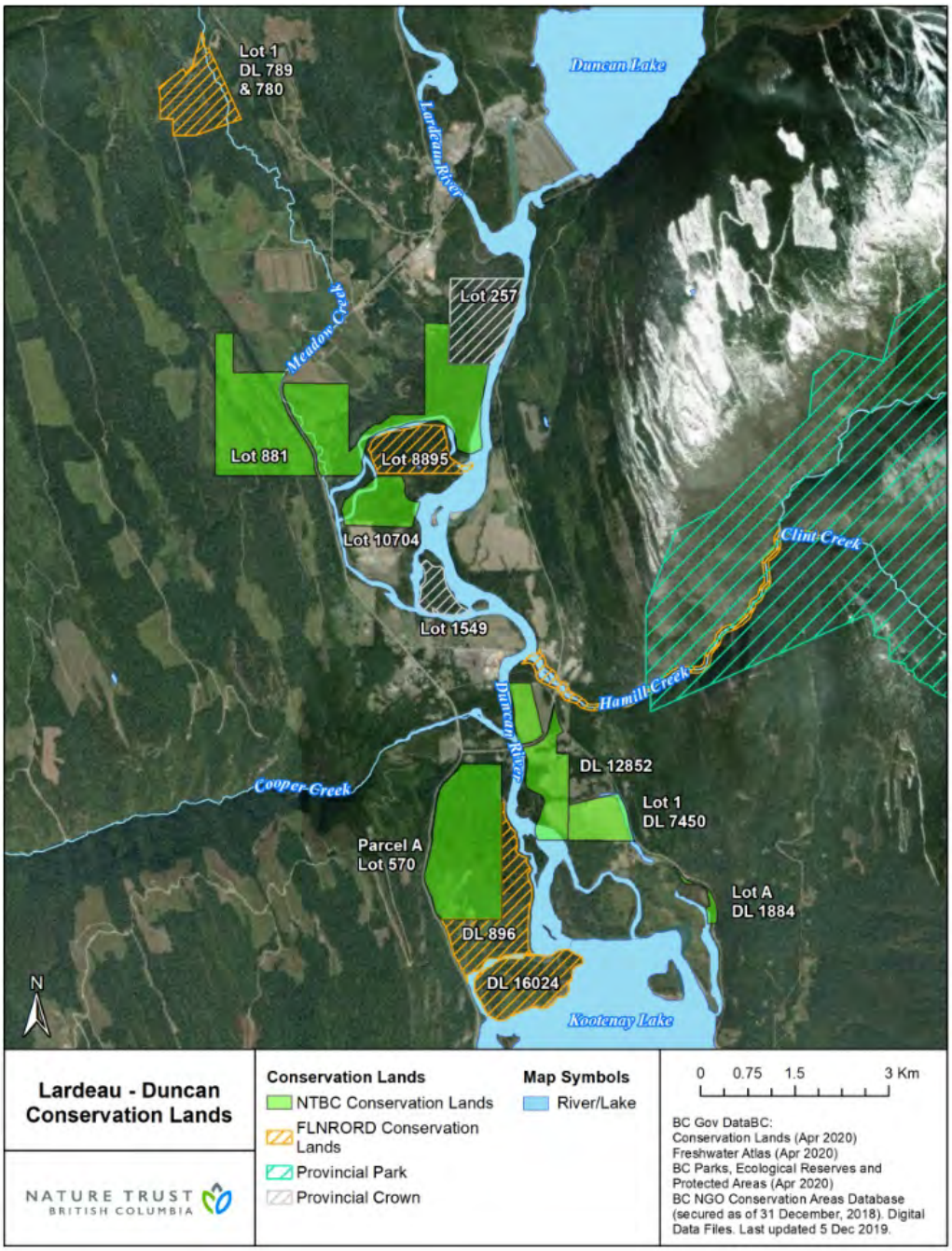

Figure 86. Approximately 500 ha of conservation lands between Kootenay Lake and Duncan Reservoir are owned and managed by The Nature Trust of BC and the provincial government. (Source: NTBC).

3.6.4 PRIORITY CONSERVATION ACTIONS FOR THE DUNCAN LARDEAU CORRIDOR

Priority conservation actions identified at the Kootenay Connect workshop include:

- Analyze how a cross-valley corridor linking the Purcell and Selkirk Mountain ranges and two large provincial parks (Purcell Wilderness Conservancy and Goat Range) functions for wildlife.
- Identify private properties of high conservation value that might be candidates for acquisition to expand the existing private-Crown land conservation complex.
- Research the effectiveness of conservation tools and designations to protect conservation values, such as Wildlife Management Areas, Section 16, and Environmentally Sensitive Areas.
- Enhance Crown land conservation status on some of the undesignated Crown land in the area by revisiting Goal 2 provincial protected areas: 1) the entire lakeshore at the head of the Kootenay Lake; and 2) riparian areas on both sides of the Lardeau River from outflow of Trout Lake to confluence with the Duncan River.
- Continue field inventory of beaver activity and assessment of habitat suitability.
- Update the wetland mapping that was done in 2012 and target wetland restoration in areas that would encourage/support beaver activities.
- Develop a multi-jurisdictional invasive plant management plan to remove and/or contain infestations such as reed canarygrass, burdock, Canada thistle, yellow hawkweed, etc.

Two additional outcomes of the workshop were achieved. First, a local working group was formed to continue bringing a landscape-scale perspective to conservation opportunities in the valley. Second, components of a multi-year workplan for habitat restoration and enhancement projects was developed and recently found traction when the Duncan Lardeau Corridor was added to Kootenay Connect Community-Nominated Priority Places with ECCC's extended funding through 2026.

Over the next three years, Kootenay Connect CNPP-funded projects in the Duncan Lardeau are focused on restoring and enhancing wetlands and other riparian habitats for species at risk and locally vulnerable species along the valley bottom floodplain and identifying valley bottom-upland connectivity.

Specific activities include:

- Beaver population recovery efforts that incorporate a) field inventories of existing beaver activity and assessed habitat suitability to inform floodplain enhancement activities to aid beaver re-establishment and persistence and identified areas to translocate beavers; and b) translocations of beavers to augment the existing population.
- Updating wetland mapping from 2013 to guide wetland restoration in areas that would encourage/support beaver activities such as creation of channels and ponds to supplement surface and subsurface water supplies to identified wetland complexes. Comparisons of species composition, water depth, aerial extent, and other factors between 2013 and 2023 will be used to determine the trajectory of change, help predict future conditions, and guide restoration, such as beaver-inspired canals, to enhance hydrologic connectivity between the main Duncan-Lardeau River with adjacent wetlands. Such habitat enhancements will benefit many SAR such as great blue heron, American bittern, sora, western toad, and western painted turtle, as well as reduce invasive reed canary-grass.
- Confirming occurrences of a suite of species including western painted turtle, western toad, Pacific treefrog, great blue heron, common nighthawk, bobolink, bank swallow, and secretive marsh birds such as Virginia rail, American bittern, and sora. Surveys will include locations where they have been previously recorded to identify data gaps as well as potential threats to species and habitats.
- Building from initial Kootenay Connect corridor modelling (Figure 87), ground-truth and map cross-valley large carnivore and ungulate travel corridors that link the Purcell Wilderness Conservancy Park and Goat Range Provincial Park.

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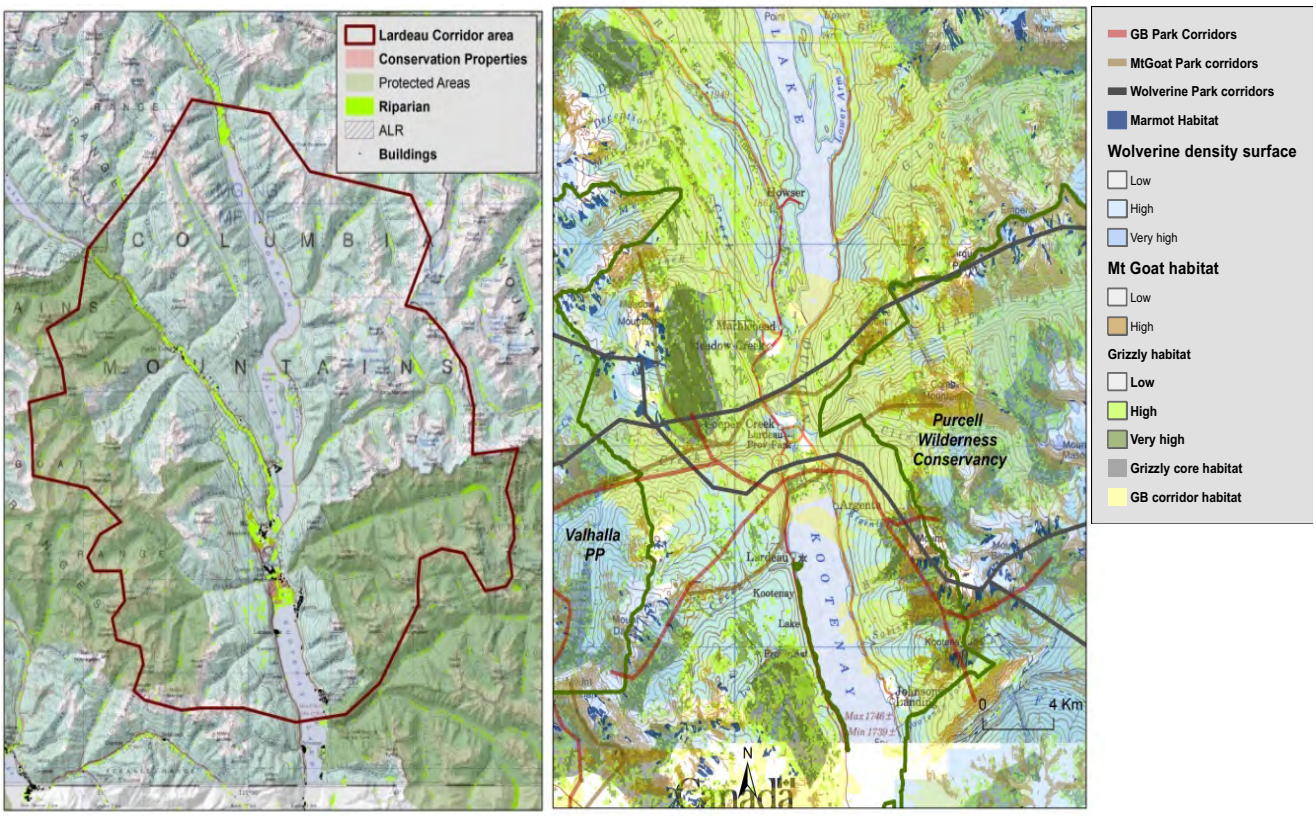


Figure 87. a) The Duncan Lardeau Valley is a 'land bridge' between Kootenay Lake to the south and Duncan Reservoir to the north; and b) multi-species corridor modeling between protected areas in the Purcell and Selkirk Mountain ranges provide an initial assessment of connectivity for this area. (Source: Kootenay Connect).

3.7 COLUMBIA LAKE

3.7.1 GEOGRAPHIC DESCRIPTION

Columbia Lake near Canal Flats is the headwaters of the Columbia River which flows north and widens to form a shallow lake system that supports a myriad of species at risk and several important east-west and north-south options for wildlife movement. Kootenay National Park to the east and the Purcell Wilderness Conservancy to the west make excellent ecological bookends for landscape level continuity across the diverse ecosystems and habitat types that extend from the higher elevation and drier Rocky Mountains across rich wetlands and grasslands in the valley bottom lands to the wetter Purcell Mountains.

Ecosystem changes from human settlement and use have stimulated various government agencies and private land trusts to protect much of the area around Columbia Lake using a broad variety of public and private conservation designations. For example, the East Side Columbia Lake Wildlife Management Area (ESCLWMA) is an extensive ~69 km^2 area that encompasses habitat on the east side of the lake and wraps around the south end to include an important riparian-wetland area (Figure 88). On Columbia Lake's northeast corner, the 290-ha Columbia Lake Provincial Park connects to the ESCLWMA along the lakeshore and encompasses a riparian-wetland complex at the north end of Columbia Lake (Figure 89). Numerous conservation properties owned by NCC and NTBC, including the iconic Hoodoos and Lot 48, significantly benefit wildlife and the habitats they depend upon. This area is a local connectivity hub as several large mountain drainages (Kootenay River from the east, and Findlay and Dutch Creeks from the west) converge near Columbia Lake and its two wetland complexes north and south of the lake.

The Columbia Lake Corridor is an excellent area and opportunity for integrating wildlife-friendly Regional District planning initiatives on private lands to promote coexistence. Increasing tourism and recreational development that relies on the natural beauty of this landscape must remain within limits that continue to support the rich biodiversity and wildlife that defines Columbia Lake. The Kootenay Connectivity Working Group has chosen the Columbia Lake Corridor as its pilot area to test inter-jurisdictional policy development around creation and recognition of Ecological Corridors (see Section 2.3).

Figure 88. Wetland complex at the south end of Columbia Lake that is the headwaters of the mighty Columbia River. (Photo: NTBC).

In October 2020, Kootenay Connect hosted a workshop to identify conservation priorities and potential projects to enhance habitat connectivity within Columbia Lake landscape. Kootenay Connect teamed up with the Canal Flats Wilderness Club to co-host the workshop in Canal Flats because of the rod and gun club's growing concern that the Columbia Lake area had been experiencing an unsustainable increase in development pressure that was threatening to eliminate options for wildlife corridors at its north and south ends. The discussion was informed by Kootenay Connect's series of GIS maps of human disturbance, land ownership patterns, and ecological and biological values.

3.7.2 LEADING CONNECTIVITY CONSERVATION GROUPS & ALLIES

Organizations working toward conservation of the Columbia Lake area include the Canal Flats Wilderness Club, East Kootenay Wildlife Association, Columbia Lake Stewardship Society, Columbia Wetlands Stewardship Partners, Ktunaxa Nation Council, Shuswap Band, The Nature Trust of BC, Nature Conservancy of Canada, Farmland Advantage, Kootenay Conservation Program, Fish and Wildlife Compensation Program, BC Parks, and Ministry of Water, Land and Stewardship Resources.

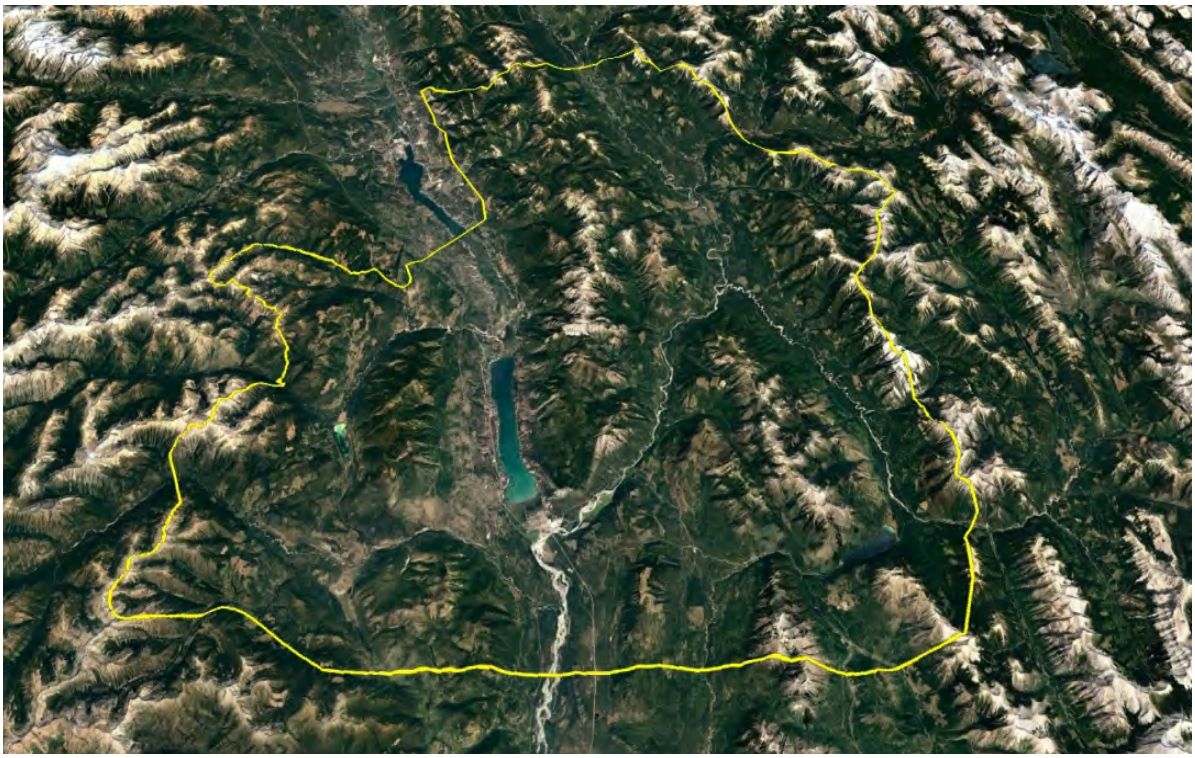


Figure 89. Google Earth view of the Columbia Lake Corridor as defined by workshop participants. (Source: Kootenay Connect).

3.7.3 KOOTENAY CONNECT WORKSHOP

At the 2020 workshop, Kootenay Connect presented new GIS maps for the area that included species at risk occurrences, wildlife corridors for multiple species, existing conservation lands, hydrology, human use, and planning jurisdictions (Figure 90). Mapping of sensitive ecological communities around Columbia Lake provided detailed information on rare wetland types used by a variety of species (Figure 91). Information-sharing led to the identification of conservation opportunities at the north and south ends of Columbia Lake, as well as the east and west sides, in order to increase connectivity in both east-west and north-south dimensions. The north and south end riparian-wetland habitat provides excellent potential for large-scale upland cross-valley connectivity corridors, as well as being arenas for small-scale conservation opportunities for species at risk.

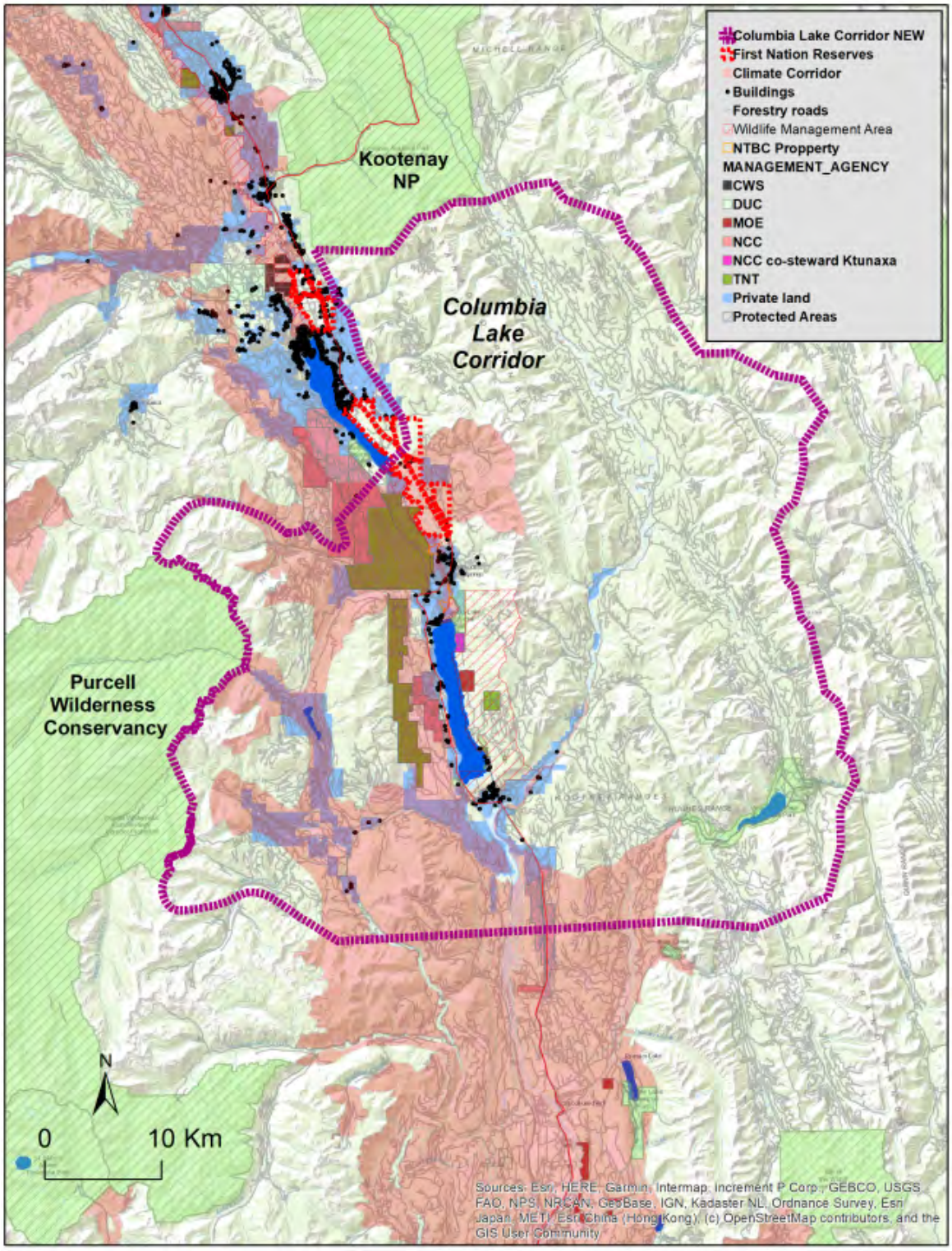


Figure 90. Columbia Lake Corridor with human developments (houses, roads, other infrastructure), landownership, and Official Community Plan boundaries. (Source: Kootenay Connect).

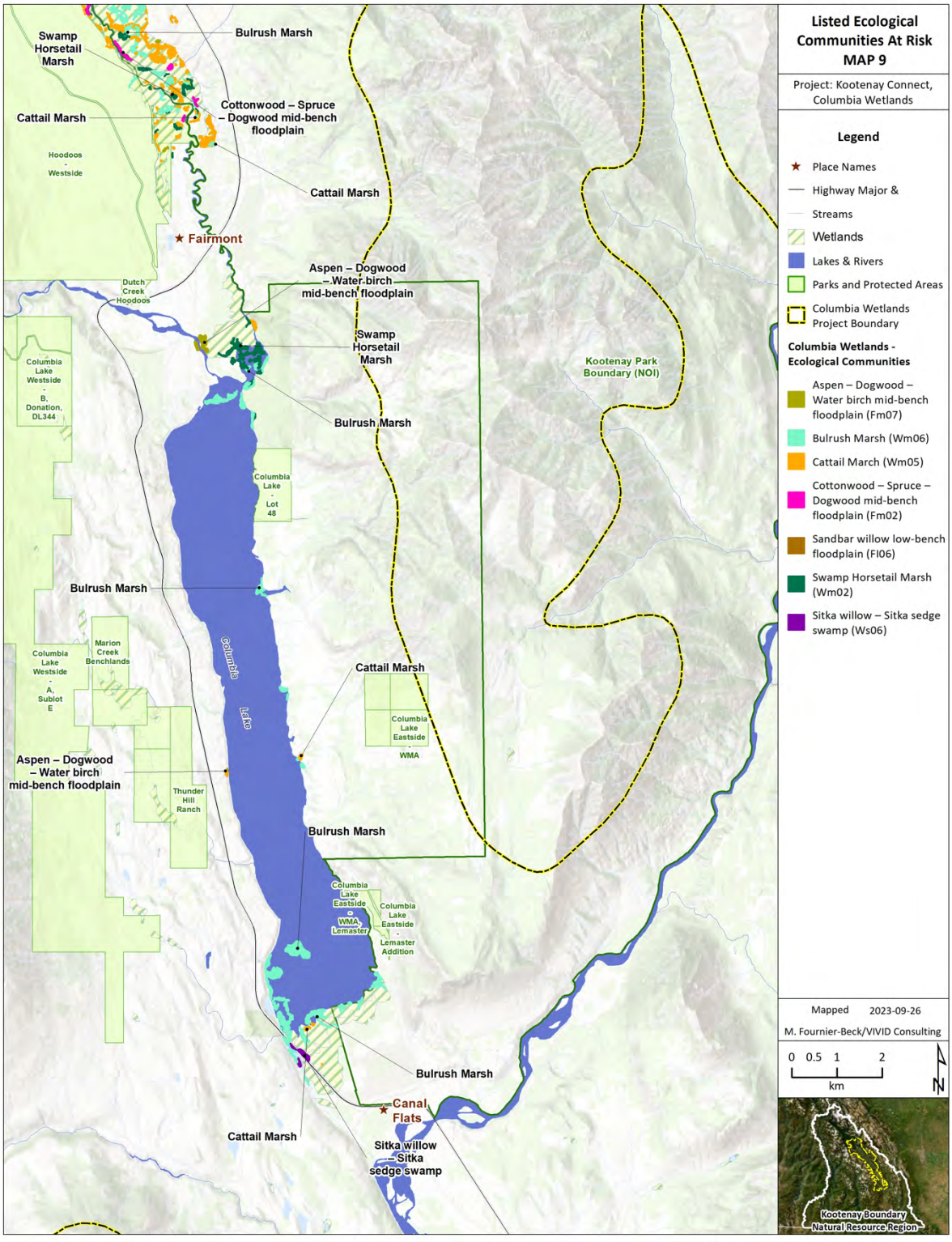


Figure 91. Ecological plant communities at risk along the Columbia Lake and Columbia River (Durand, 2020).

3.7.4 PRIORITY CONSERVATION ACTIONS FOR THE COLUMBIA LAKE CORRIDOR

Priority conservation actions identified at the Kootenay Connect workshop include:

South end of Columbia Lake

- Encourage the Village of Canal Flats to create a protective buffer between the south end of Columbia Lake along the WMA and Village of Canal Flats to limit development and recreational access.
- Manage the growing demand for human access to the trails through the environmentally- and culturally sensitive wetlands and lakeshore by encouraging low-impact use and enjoyment.
- Extend conservation management of the south end of Columbia Lake along the WMA and Village of Canal Flats to the east to Sabine-Desmet area along the Kootenay River to protect important habitat and salt licks for sheep and goats as well as important critical habitat for flammulated owls, movement corridors for bears and cougars in addition to burbot spawning in the old Kootenay River channel.

Important species at risk and critical habitat occurs in the Columbia Lake area, including nesting and basking features for western painted turtles, great blue heron rookeries, and WHAs for Lewis's woodpecker, American badger, and flammulated owl, plus several locations of the rare alkali saltgrass–foxtail barley plant community (Darvill, 2020; Figure 92).

At a landscape scale, the Columbia Lake Corridor contributes important habitat connectivity between the Rocky and Purcell Mountain ranges at the southern end of the 180 km-long Columbia Wetlands. Riparian area-wetland complexes located at the north and south end of Columbia Lake had previously been identified as cross-valley corridors for grizzly bear (Proctor et al., 2015); and based on further modelling and mapping by Kootenay Connect, these rich areas provided potentially important connectivity and movement habitat for other wildlife species such as elk (Figure 92).

There is considerable potential for increasing east-west connectivity at the north end of Columbia Lake to Fairmont and Lake Windermere as well as the south end of the lake – where the headwaters of the Kootenay River pass south within 1 km of the headwaters of the Columbia River system flowing north – an important location to protect cross-valley connectivity particularly from Mount Sabine to the Kootenay River to benefit mountain goats and bighorn sheep.

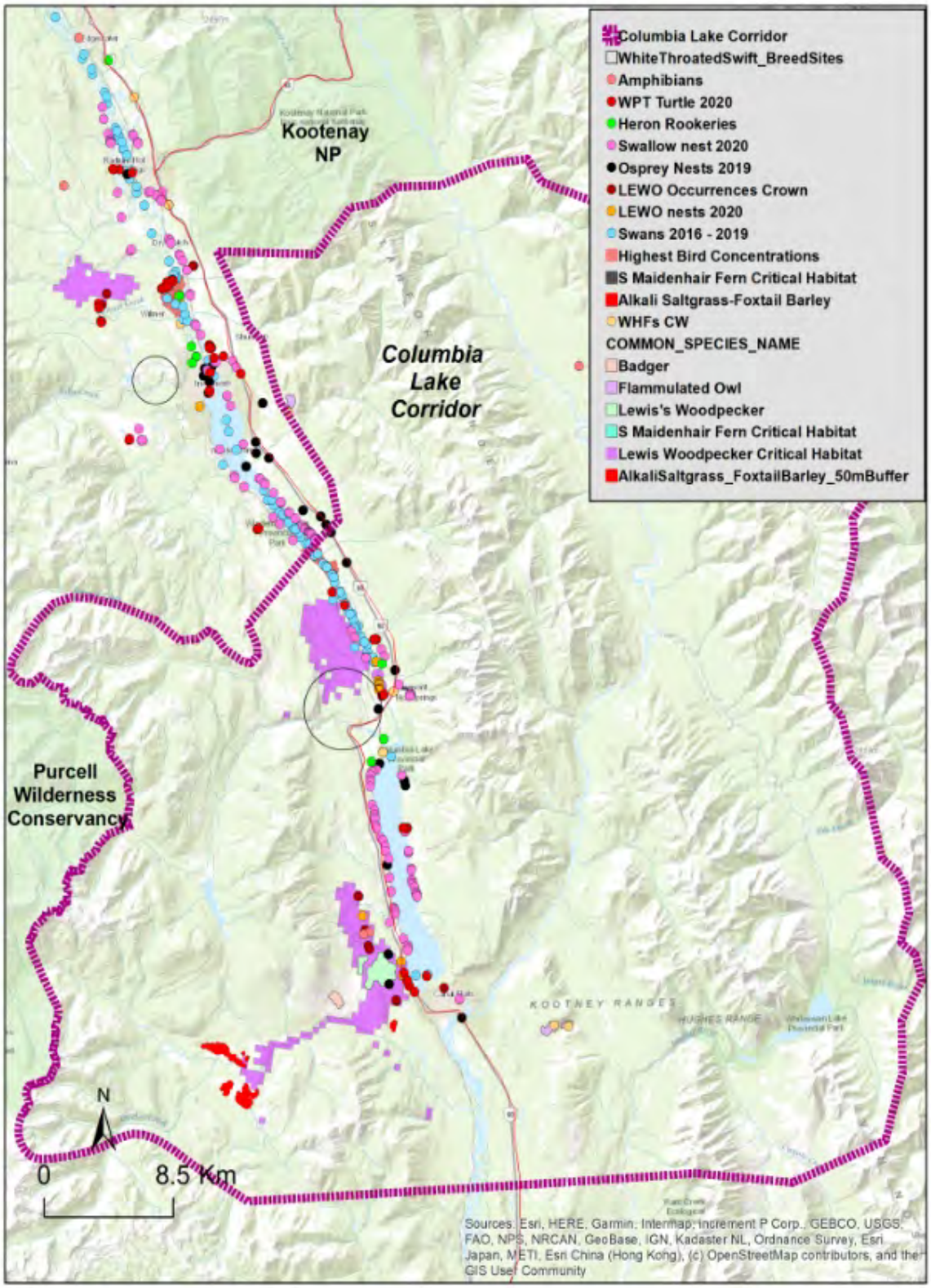


Figure 92. Species at risk occurrences in the Columbia Lake Corridor (Darvill, 2020, 2021).

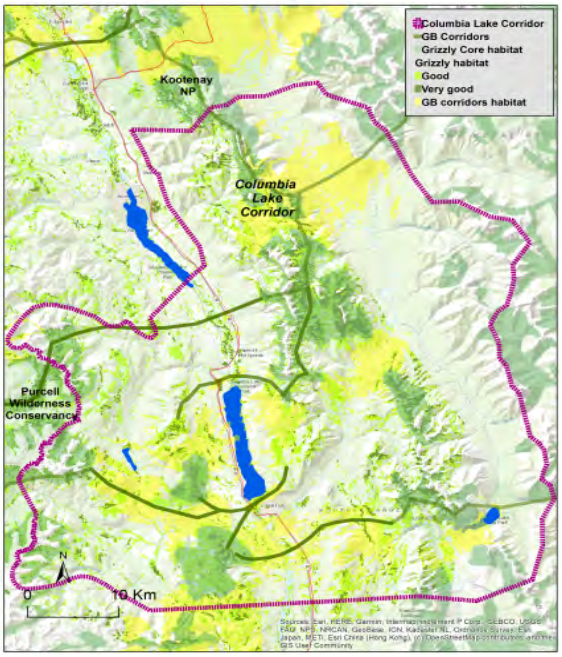
North end of Columbia Lake

- Assess hydrologic impacts and consider restoring Dutch Creek to its original channel.
- Explore potential private land acquisitions by land trusts for cross-valley connectivity at the north end of Columbia Lake.
- Evaluate stewardship and conservation opportunities for the Columbia River corridor between Fairmont Hot Springs and Lake Windermere (i.e., the area between the lakes including Tatley Slough) because this braided section of river and wetlands is especially important for birds as a north-south flyway.
- Integrate any activities with Ktunaxa Nation Council and Aksiq'nuk on the east side of the Columbia River and include NTBC's Hoodoos property at Dutch Creek of 3,930 ha (9,711 acres) on the west side of the riparian/wetlands complex.

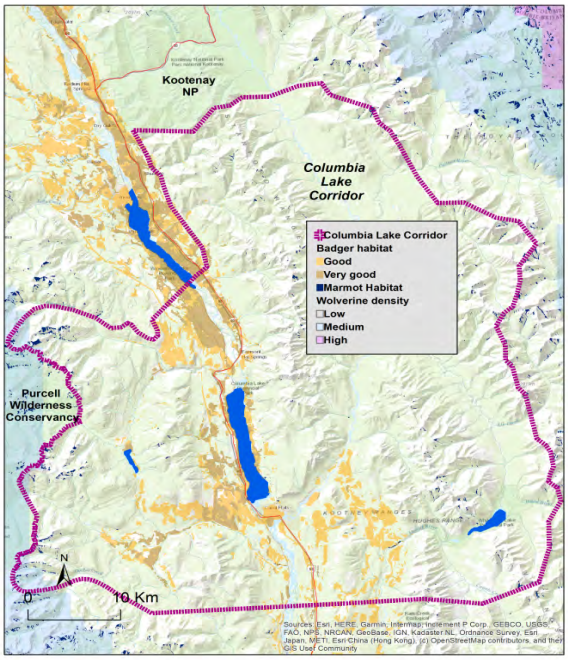
Several maps prepared by Kootenay Connect with possible locations for wildlife corridors for grizzly bear, elk, mountain goat, and American badger were reviewed during the 2020 workshop. Recommendations from provincial biologists led to subsequent mapping of predicted elk, bighorn sheep, and mountain goat corridors and mineral licks. Kootenay Connect commissioned the extension of a radio telemetry-based elk habitat model that had been developed for the South Country to be applied across the Columbia Lake area to improve the confidence in predicted multi-species connectivity areas (Figure 93a-f).

An example illustrating the concept of wildlife corridors was demonstrated by a radio collared grizzly bear that crossed the Columbia Valley within the Columbia Lake Corridor on his way from the Purcell Mountains to Kootenay National Park (Figure 94a). Figure 94b, details the bear's movements across conservation lands and weaving between buildings to avoid humans (yellow dots) in the land between Lake Windermere and Columbia Lake.

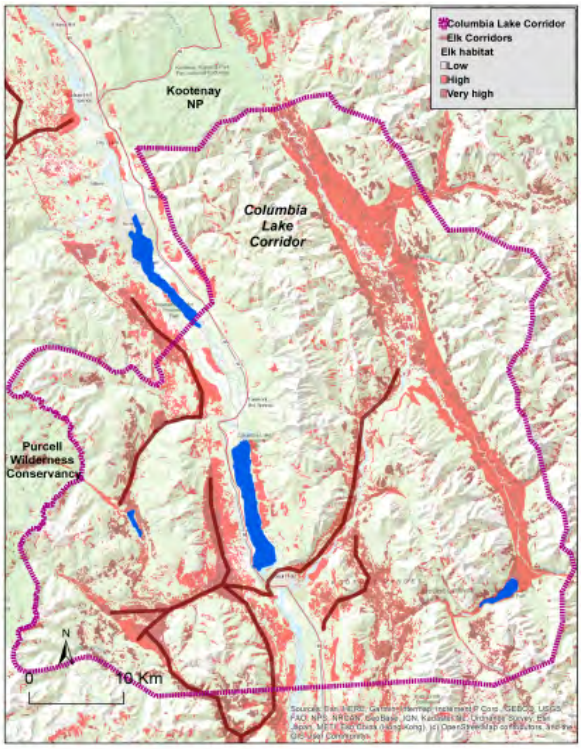
a) Grizzly Bear



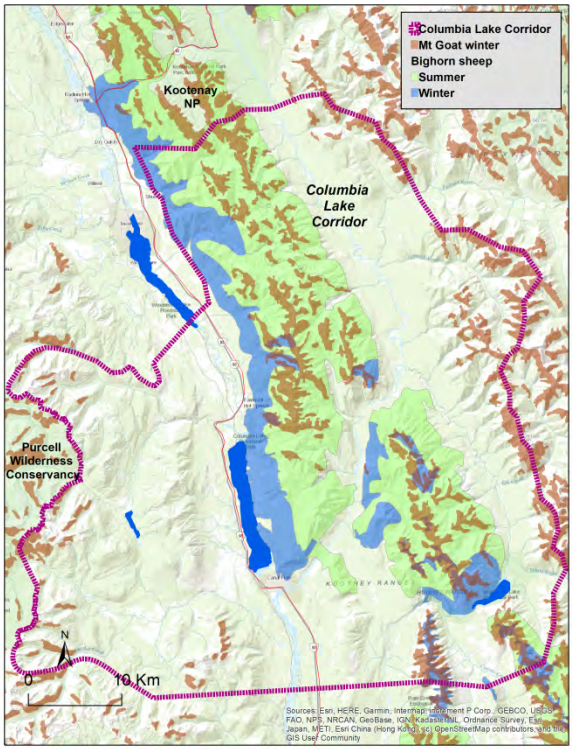
b) Wolverine & American Badger



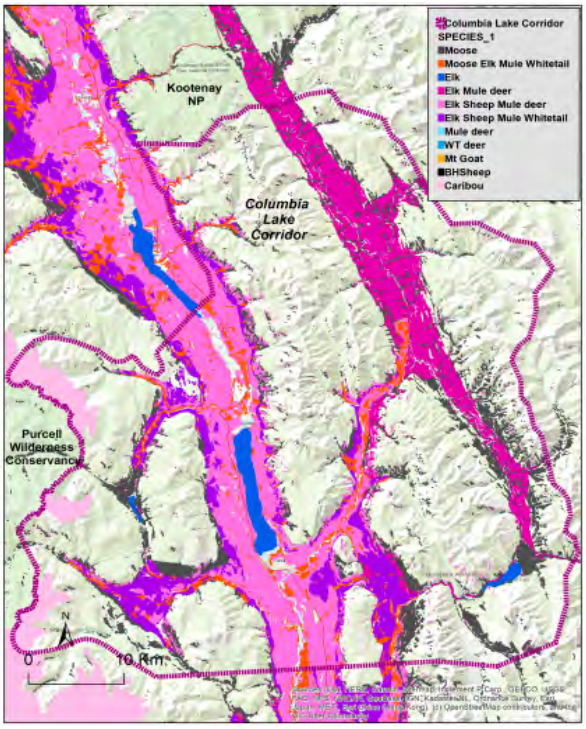
c) Rocky Mountain Elk



d) Bighorn Sheep & Mountain Goat



e) Ungulate Winter Range



f) Multi-species Corridors

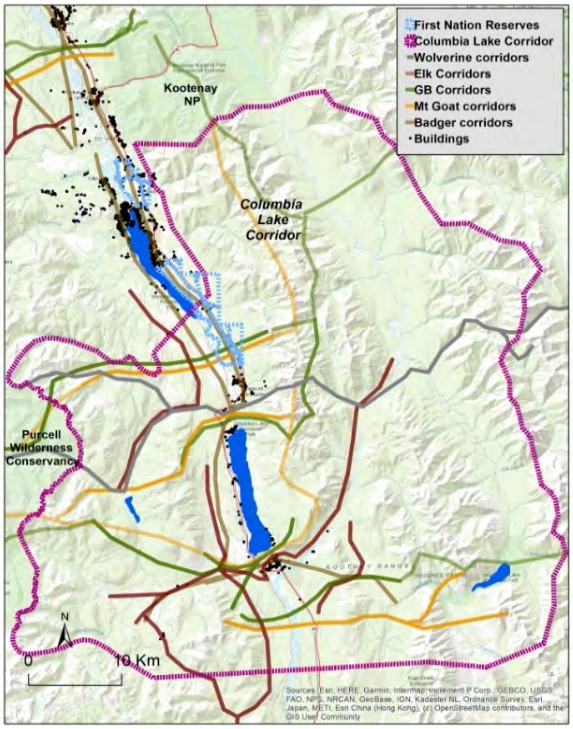


Figure 93. Kootenay Connect maps of the Columbia Lake Corridor: a) grizzly bear habitat and corridor model (Proctor et al., 2015); b) composite of wolverine density (Mowat et al., 2020) and American badger (Kinley et al., 2013); c) bighorn sheep data (Poole and Ayotte, 2020) and mountain goat winter range distribution model (Ross and Vander Vennen, 2021), d) elk summer and winter habitat model (Mulligan, 2020a, 2020b); e) mapped ungulate winter range (Province of BC); and f) multi-species corridors (Proctor, 2021) within the larger Columbia Lake Corridor.

a

b

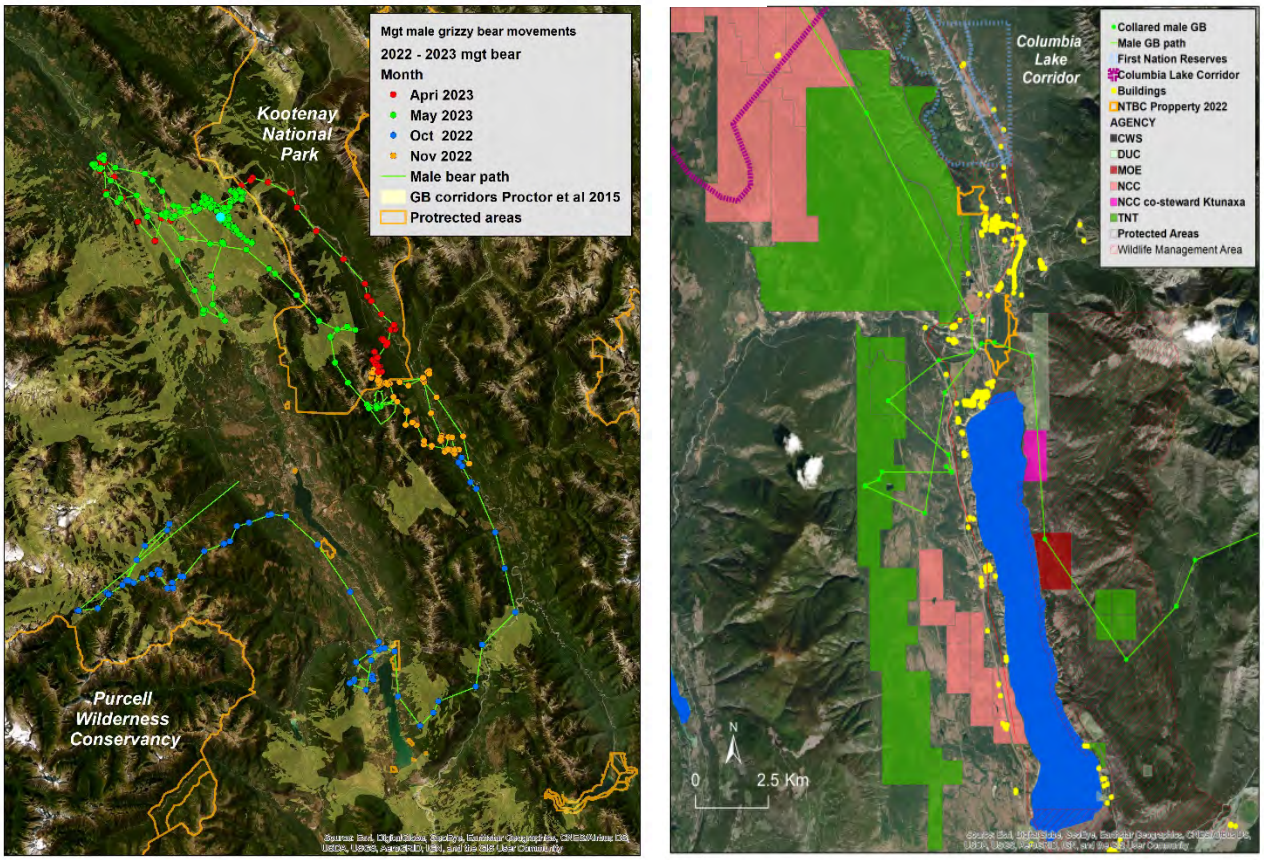


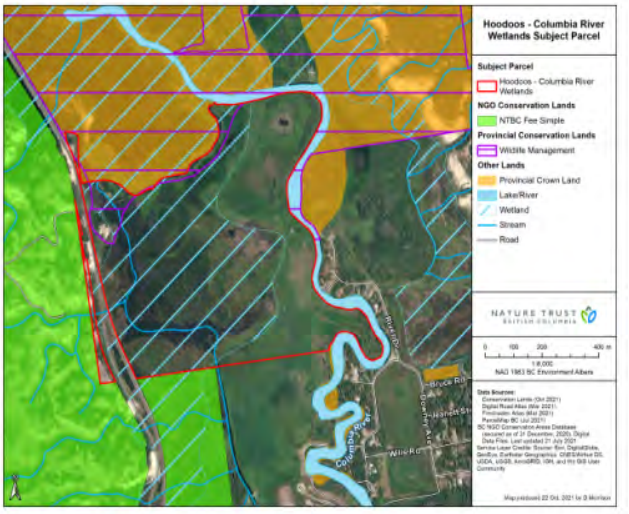
Figure 94. Radio-collared male grizzly bear's movements: a) green line shows the bear's travel route in the fall of 2022 from the Purcell Mountains across the Columbia Lake Corridor to end up in Kootenay National Park and then in spring of 2023, he traveled back across the Columbia Valley in the Spillimacheen-Brisco Corridor predicted in Proctor et al. (2015); and b) more detailed view of the grizzly bear's movements at the north end of Columbia Lake that avoided residences (yellow dots) and passed through several land trust and provincial government conservation lands and protected areas (Proctor, 2023).

The 2020 Kootenay Connect workshop was a catalyst that brought groups together to consider landscape-scale conservation opportunities in the Columbia Lake area. Given the high level of interest, a multi-year workplan for habitat restoration and enhancement projects was developed with The Nature Trust of BC, Nature Conservancy of Canada, provincial government, and the Columbia Wetlands Stewardship Partners. The Columbia Lake Corridor has been added to Kootenay Connect CNPP with ECCC's extended funding through 2026. Over the next three years, CNPP-funded projects in the Columbia Lake Corridor are focused on hydrological and wetland assessments on the west side of the lake, restoring and enhancing open forests and grasslands, and conserving cross-valley connectivity at the north and south ends of Columbia Lake.

3.7.5 NEW CONSERVATION LANDS

There are a considerable number of protected areas (WMAs, BC Parks, Ecological Reserves, WHAs, and private land trust and provincial conservation lands) within the Columbia Lake Corridor. Recent additions to this conservation complex were two private properties purchased by NTBC between Columbia Lake and Lake Windermere that contribute to wildlife connectivity between the Rocky and Purcell Mountains. The 57-ha (Figure 95a) and 67-ha (Figure 95b) properties are both strategic valley bottom wetlands that contribute to 4,047 ha of continuous conservation lands in and around the corridor. These properties provide east-west connectivity for American badger, elk, and grizzly bear in addition to important habitat for bank swallow, great blue heron, long-billed curlew, and Lewis's woodpecker.

a



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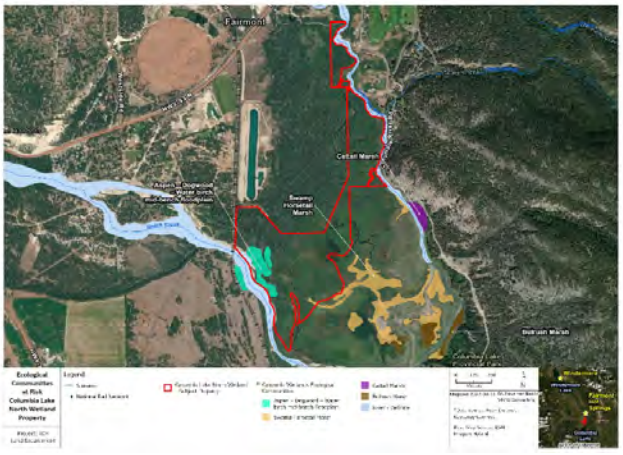


Figure 95. Two properties in the Columbia Lake Corridor between Columbia Lake and Lake Windermere acquired by The Nature Trust of BC: a) Hoodoos Columbia Wetlands acquired in 2021; and b) Columbia Lake North Wetlands acquired in 2022. (Photos and Maps: NTBC).

3.8 GOLDEN AREA

3.8.1 GEOGRAPHIC DESCRIPTION

The Golden Corridor extends between Spillimacheen and the southern boundary of the Columbia Shuswap Regional District to just north of the TransCanada Highway 1 at Donald. Nestled between Kootenay-Yoho National Parks to the east and Glacier National Park to the west, the Golden area is well-known for its ecological treasures such as diverse wetland and riparian habitats and active floodplains along the Kicking Horse River and Columbia River and Wetlands. The 180-km-long Columbia Wetlands is one of the few remaining pristine floodplain wetlands left in North America; and it contains the only undammed section of the entire 2,000-km-long Columbia River (Figure 96).

The Golden area is also well-known for its extensive mountainous terrain where three mountain ranges of the Canadian Rockies, Purcells, and Selkirks converge and is therefore an important inter-mountain connectivity zone. These mountains are home to a number of species at risk that require high elevation habitats to persist, for instance, wolverine, olive-sided flycatcher, whitebark pine, and limber pine. Within the mountains there are also a myriad of small high elevation wetlands that provide immense habitat value for unique and rare plants and that provide refugia for birds, fish, amphibians, mammals, and insects.

Current climate change projections imply that the mountains in the Golden area and north to Mica Dam are likely to remain wet and cold compared to other areas in the Columbia Basin (Utzig, 2020, 2021). Precipitation is likely to decrease in the summer, but not as much as locations farther south in the East Kootenay. If this scenario holds true, the mountains around Golden will be an important climate refugia, where ecological integrity is important to maintain. The mountains are also highly valued by community members and tourists in terms of the exceptional world-class recreational opportunities they provide. In terms of conservation, striking a balance between developing the mountainous environment for recreational opportunities and maintaining ecological values is one of the major issues facing the Golden area (Mitchell et al., 2021).

The current thrust for conservation activity is working to understand the impacts of growing recreation pressure. Information gathered by Kootenay Connect has been used to inform discussions through local groups. This corridor is a portion of the Columbia Wetlands and as such receives conservation attention through the Columbia Wetland Stewardship Partners and their efforts (see Section 3.3 Columbia Wetlands above). The area north of Golden to Donald surrounding the Bleaberry drainage has become the focus of conservation efforts. Local

concern also exists for the benchlands to the west of the Columbia River with their sporadic wetland habitats. Gustafson et al. (2023), on behalf of CWSP, has collated a thorough compilation of ecological, terrain, and human related spatial data to inform local decision-making with the intent that ecological connectivity be maintained, enhanced or restored.

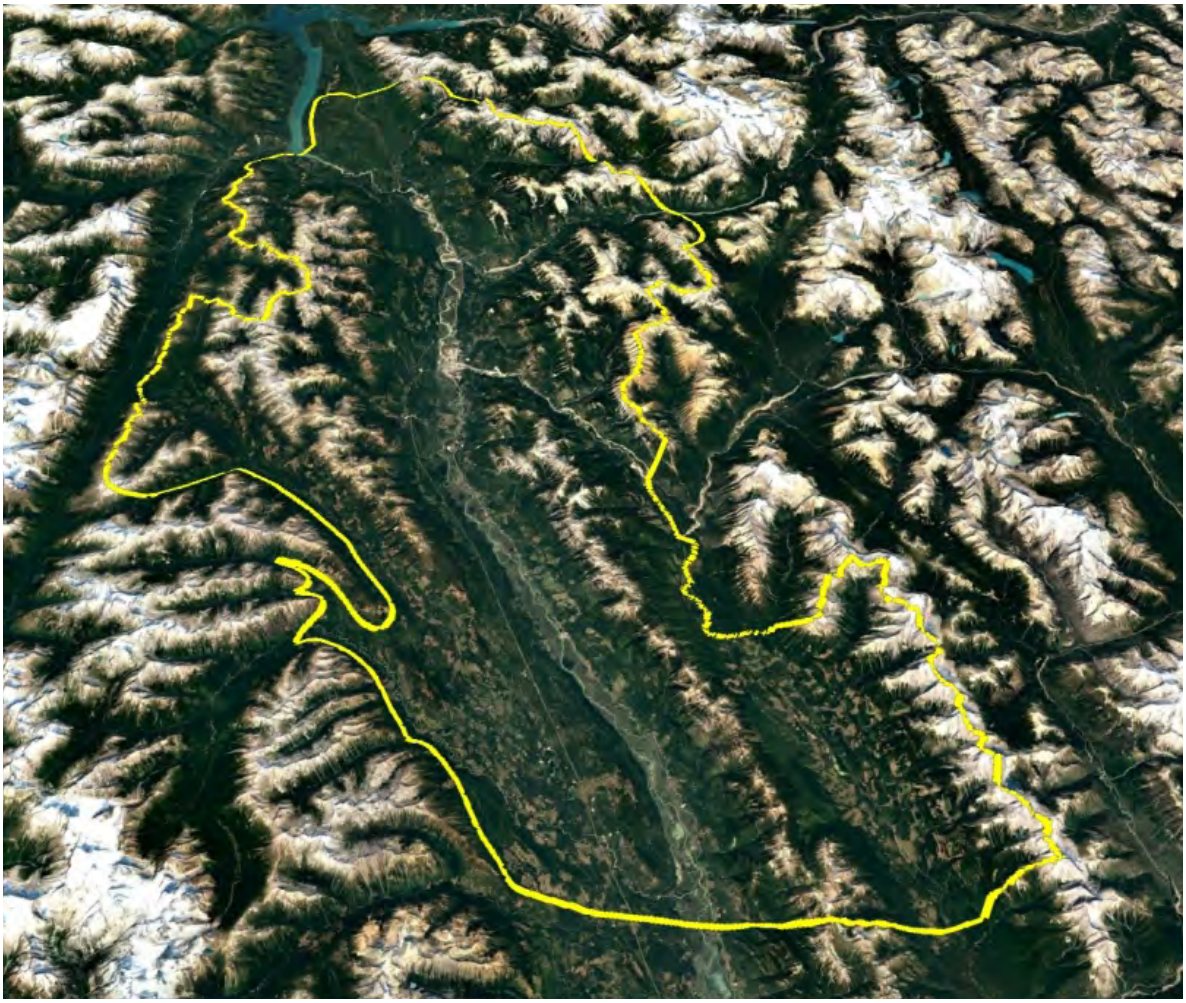


Figure 96. Google Earth view of the Golden Corridor as defined by workshop participants. (Source: Kootenay Connect).

3.8.2 LEADING CONNECTIVITY CONSERVATION GROUPS & ALLIES

Organizations working toward conservation in the Golden area include Golden District Rod & Gun Club, Shuswap Band, Wildlife Conservation Society Canada, Wildsight Golden, Nature Conservancy of Canada, The Nature Trust of BC, BC Wildlife Federation, Columbia Wetlands Stewardship Partners, Columbia Shuswap Invasive Species Society, Kootenay Conservation

Program, Wolf Awareness, independent biologists as well as staff from Parks Canada, the Columbia Basin Trust, and the provincial government.

3.8.3 GOLDEN CONSERVATION ACTION FORUM AND KOOTENAY CONNECT WORKSHOP

In November 2020, Kootenay Connect co-hosted a virtual Conservation Action Forum with KCP and Wildsight Golden that focused on the Golden area. Participants collectively identified ecological threats, conservation opportunities, and collaborative strategies for the area that resulted in common priorities and objectives for on-the-ground conservation and stewardship activities. Kootenay Connect contributed new research and GIS mapping that informed discussions of species at risk, important habitat, cross-valley corridors, and potential impacts of climate change (Figure 97, 98, 99). For more details, refer to *Golden Conservation Action Forum Summary Report*[30]. During the Forum, scientific recommendations led to identifying *conservation targets* (including species at risk (Table A-1); habitat types (Table A-2); habitat features (Table A-3); ecological process (Table A-4); and *ecological threats* (Table 5; Appendix B). This group process of identifying important biological and ecological values within the Golden area provided a robust foundation for setting common conservation priorities.

3.8.4 PRIORITY CONSERVATION ACTIONS FOR THE GOLDEN CORRIDOR

Over 60 actions were initially recommended by scientific experts and participants at the Forum that would make the most difference in the Golden area. Of these 60 actions, five were collectively determined to be priority actions that served as a starting place for breakout groups to develop mini action plans that incorporated policies, objectives, and activities that aligned with participants' organizational and programmatic interests.

Priority actions identified at the Golden Conservation Action Forum were:

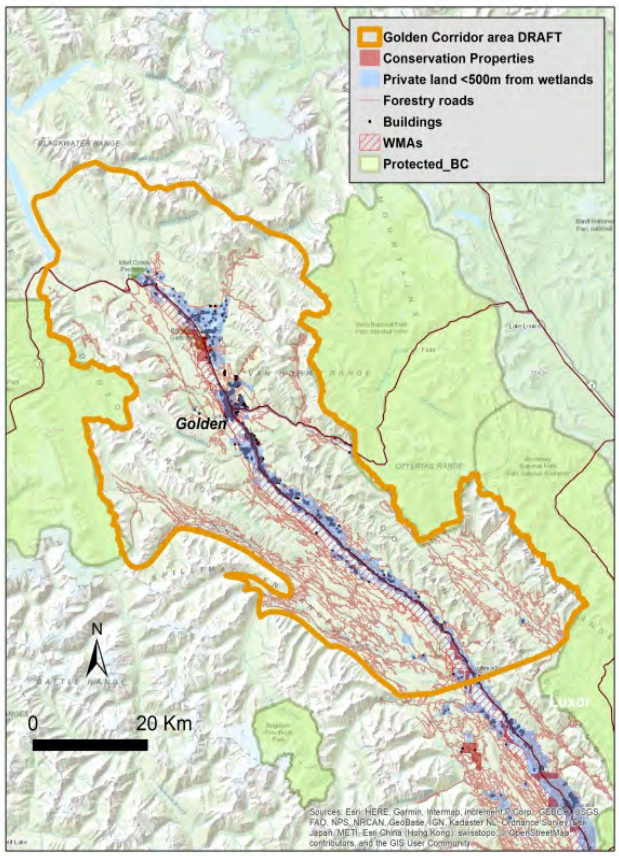
- Combine science and Indigenous Knowledge to protect habitat for species at risk and biodiversity.
- Identify and prioritize for conservation of multi-species wildlife corridors.
- Reduce intensity of human disturbance in backcountry, sensitive areas and wildlife corridors.

[30] https://kootenayconservation.ca/wp-content/uploads/2021/03/Golden-CAF-Summary-Report_FINAL-18Dec2020-rev.pdf

- Mitigate recreational impacts by incorporating recreation and ecological data to inform land use decision-making.
- Build climate disruption, adaptation and mitigation thinking into all conservation activities.

Through both CWSP and the Kootenay Connectivity Working Group, Kootenay Connect is supporting initiatives to champion connectivity in this region. We will continue to provide strategic support for identifying multi-species wildlife corridors and connectivity and bring a climate lens to the necessity of connectivity to ensure wildlife and ecosystems can shift with a changing climate. Data and maps generated by Kootenay Connect will be available to help inform local, provincial, and federal government decision-making.

a



b

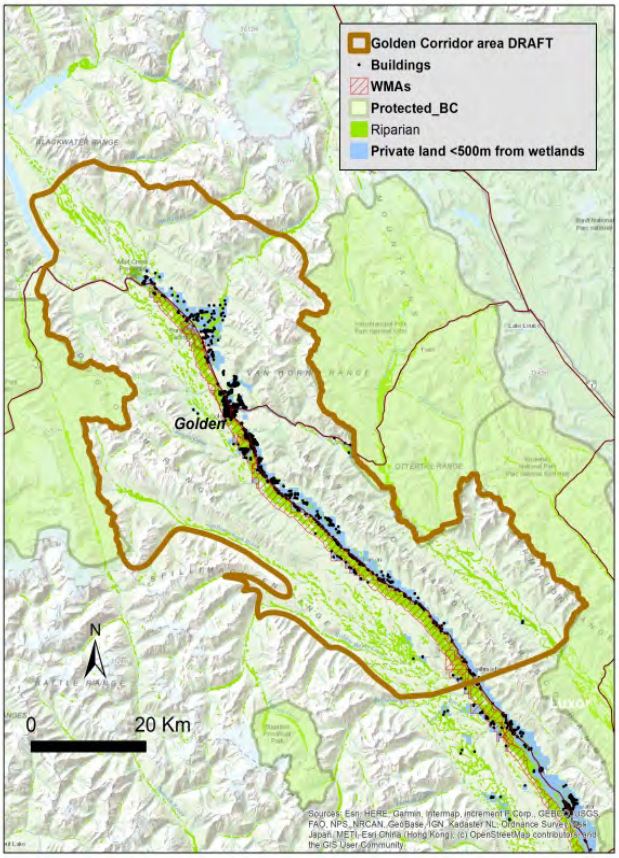


Figure 97. a) Human footprint in the Golden area; and b) juxtaposition of riparian habitat, Wildlife Management Areas, private property, and buildings. (Source: Kootenay Connect).

a

b

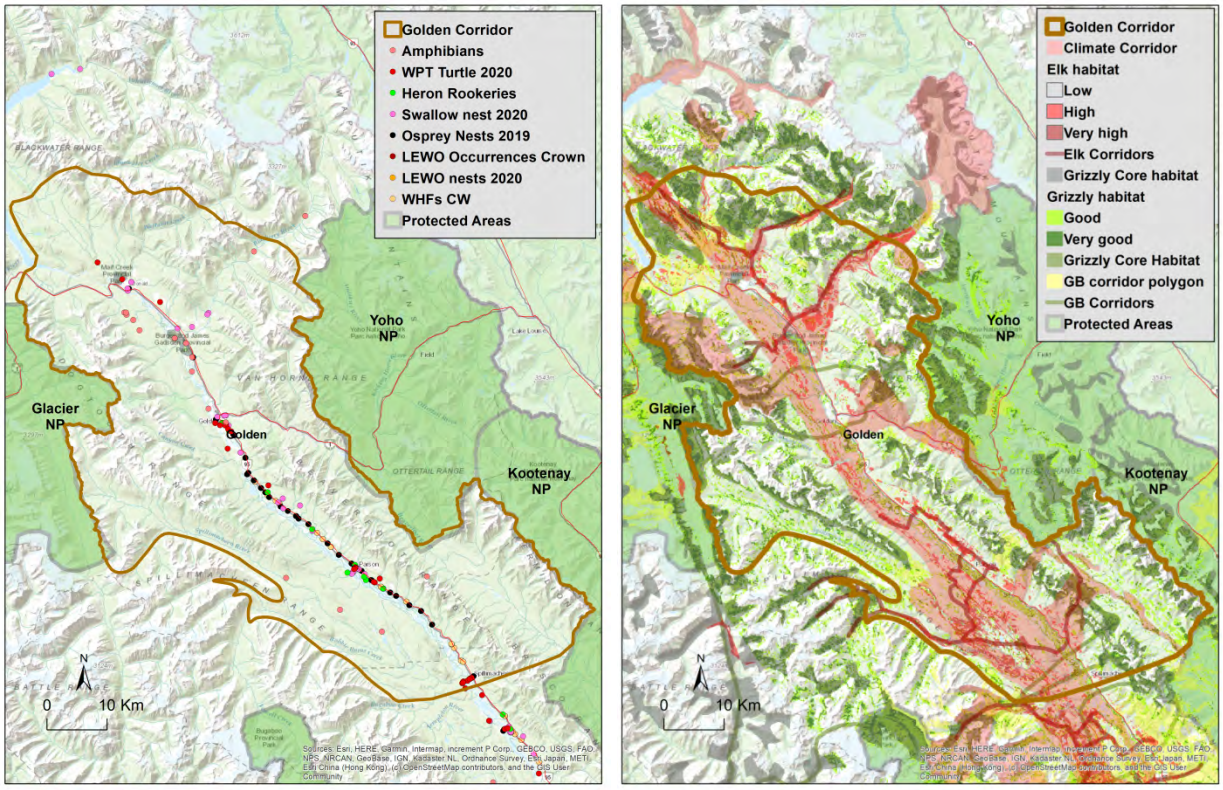


Figure 98. a) Species at risk in the Columbia Wetlands (Darvill, 2021); and b) overlay of climate change corridors (Utzig, 2021) with grizzly bear (Proctor et al., 2015) and elk (Mulligan, 2020b) habitat with potential cross-valley corridors in the Golden area.

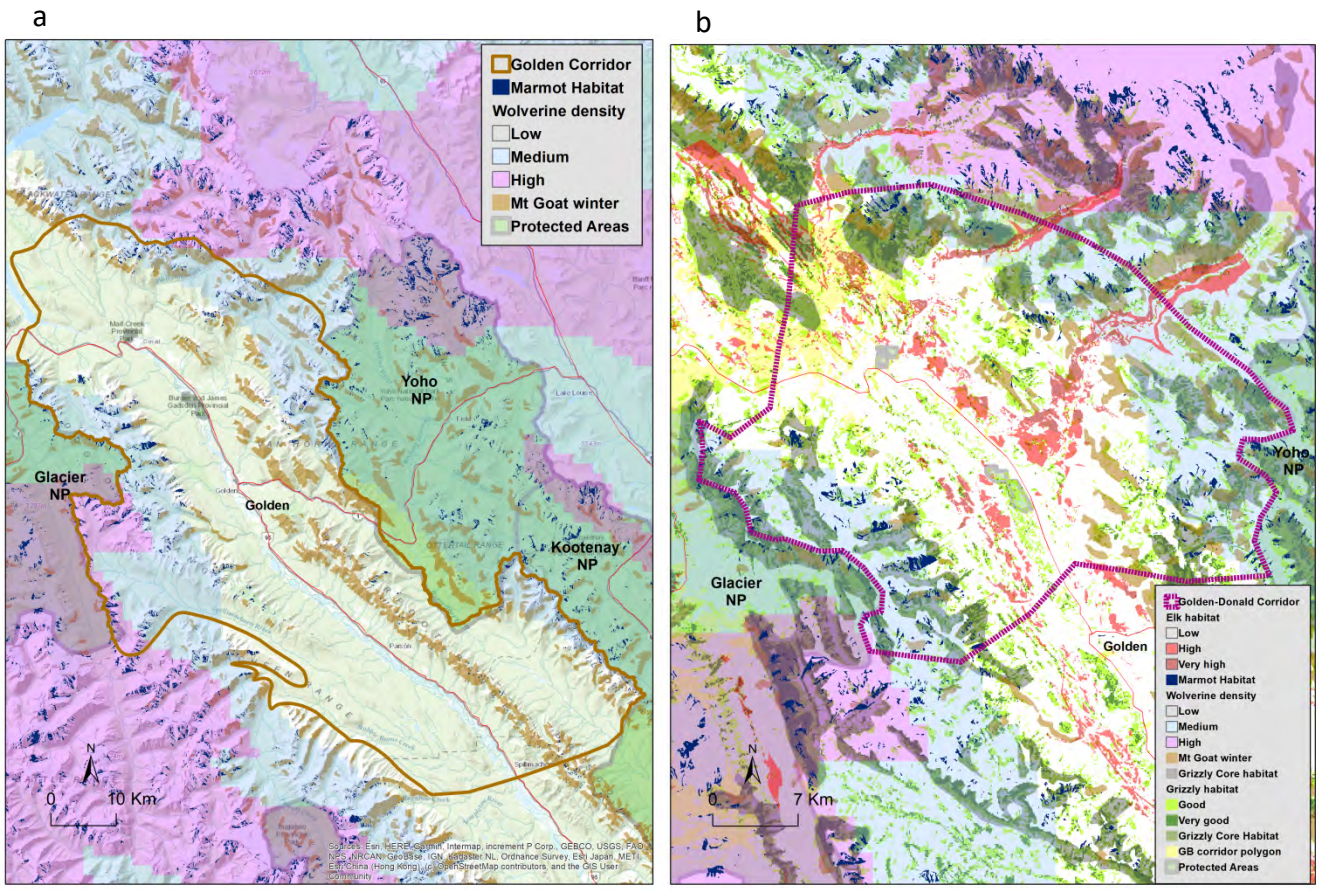


Figure 99. Wolverine density (Mowat et al., 2020), marmot (Kortello et al., 2019), and Mountain Goat (Ross and Vander Vennon, 2021) in the Golden area; and b) close up of several species habitat models in the Donald – Blaeberry area of the Golden Corridor. (Source: Kootenay Connect).

3.9 SOUTH COUNTRY

3.9.1 GEOGRAPHIC DESCRIPTION

The South Country, located in the far southeastern corner of the East Kootenay, extends from the U.S. border north approximately 57 km to the Bull River. Kootenay and Elk Rivers flow through this area into the Koocanusa Reservoir just north of Kikomun Provincial Park (Figure 100, 101). The valley bottom, which varies in width from approximately 3 km to up to 14 km along BC Highway 93, contains a long-standing ranching community and a series of small villages (e.g., Wardner, Jaffray, Baynes Lake, and Grassmere).

The valley is a combination of open dry forests and grasslands. The area is important winter range for elk, moose, bighorn sheep, and white-tailed and mule deer. Black bear are prevalent and grizzly bear are occasional and seasonal. Rare and threatened species and ecosystems also occur throughout the area including long-billed curlew, American badger, Lewis's woodpecker, western painted turtle, western screech owl, flammulated owl, Williamson's sapsucker, Spalding's campion, pinewood peavine, Montana larkspur, and more. Thirty-five WHAs occur throughout the area protecting at least 10 species and 2 rare ecosystems. Riparian and shoreline habitat is extensive, yet many wetland and riparian habitats were lost by flooding during the creation of the Koocanusa Reservoir which continues to challenge establishment of more riparian habitat during its annual water drawdowns.

Figure 100. Low elevation grasslands and open forests define the South Country Landscape. The Ktunaxa's cultural burning practices have been critical in maintaining this ecosystem. (Photo: Yaq̓it ʔa·knuqƛi 'it First Nation).

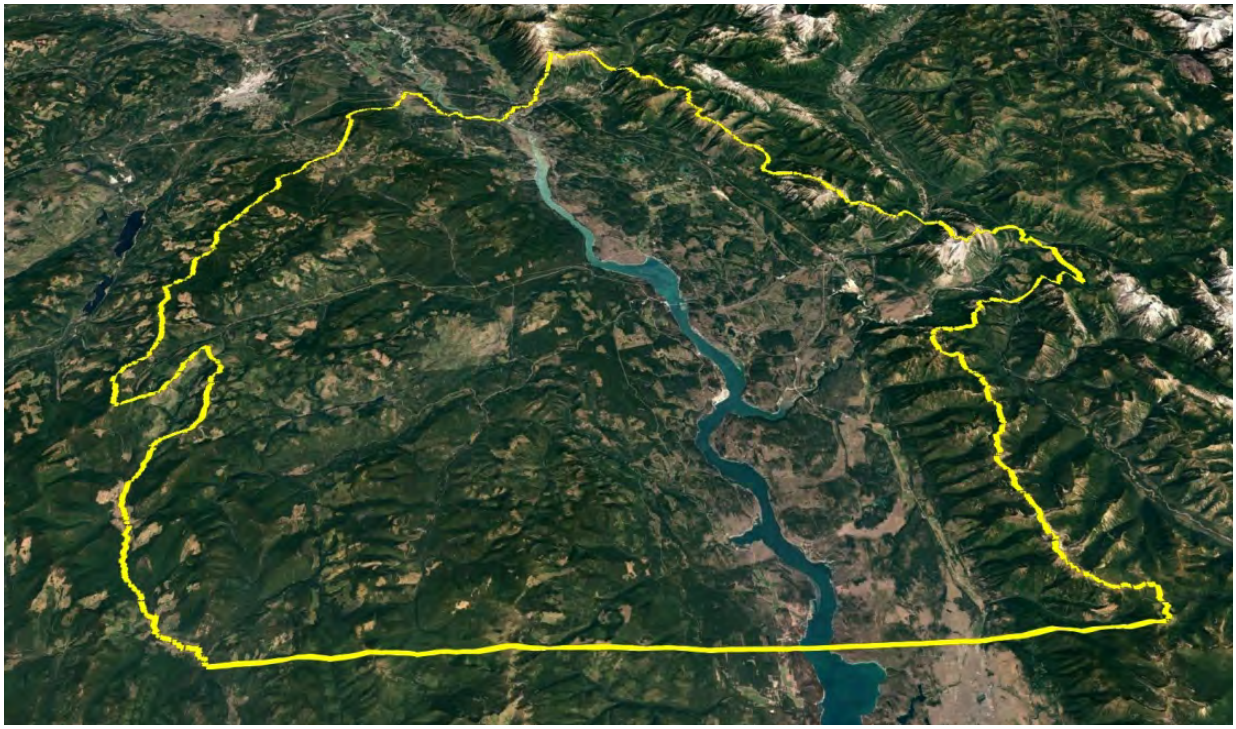


Figure 101. Google Earth view of the South Country Corridor as defined by workshop participants. (Source: Kootenay Connect).

3.9.2 LEADING CONNECTIVITY CONSERVATION GROUPS & ALLIES

Yaq̓it ʔa·knuqƛi ‘it First Nation (Tobacco Plains Band) has a strong presence and conservation ethic in the area and complements the East Kootenay Invasive Species Council, The Nature Trust of BC, Nature Conservancy Canada, and Rocky Mountain Trench Natural Resources Society who are also actively involved in conservation. A Koocanusa Recreation Steering Committee which consists of the Province of B.C., Ktunaxa National Council, Regional District of East Kootenay and Columbia Basin Trust, has recently completed a Recreation Strategy for the Valley after extensive consultation (Figure 102).

a b

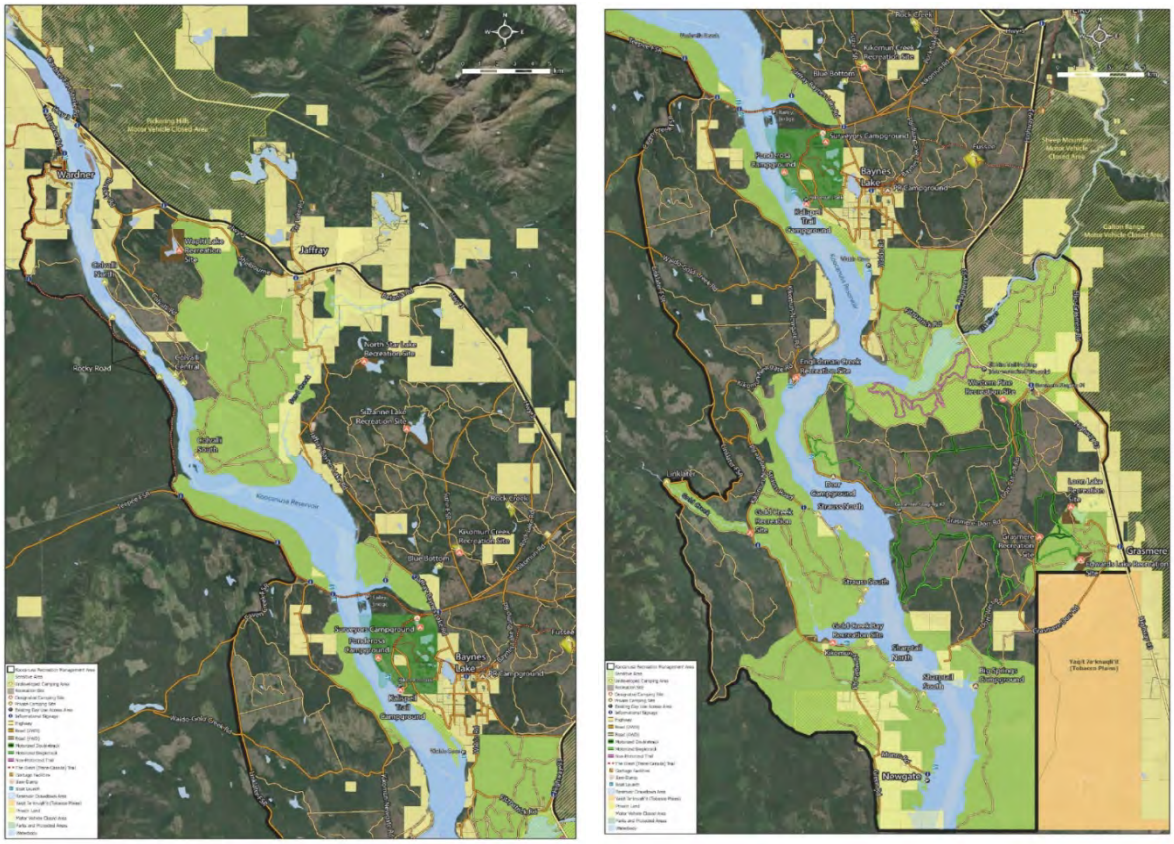


Figure 102. Detailed map of the Koocanusa Recreation Strategy: a) the northern section, and b) the southern section. (Koocanusa Recreation Strategy, 2021).

3.9.3 SOUTH COUNTRY CONSERVATION ACTION FORUM AND KOOTENAY CONNECT WORKSHOP

In January 2022, Kootenay Connect co-hosted a virtual Conservation Action Forum with KCP and Yaq̓it ʔa·knuqƛi ‘it First Nation that focused on the South Country. While Kootenay Connect was a co-host of the forum, our role was to encourage a corridor group in the South Country to champion connectivity in the region. We will continue to provide strategic support for identifying multi-species wildlife corridors and connectivity as well as data and maps that help inform local and provincial government decision-making. Kootenay Connect will also bring new data to the regional conservation discussion by providing a climate lens to the necessity of connectivity so wildlife and ecosystems can shift with a changing climate.

Other outcomes of the Forum can be summarized in these three top unranked priority actions that were identified:

- Identify, protect, and build resiliency in key habitats that support biodiversity and SAR.

- Restore and improve ecosystem function and adaptive capacity to climate change through the implementation of climate-resilient projects.
- Take a landscape-level approach to identifying integrated climate, ecosystem, and multi-species corridors (north-south and east-west).

Data-based habitat models for grizzly bear, American badger, and elk were used by Kootenay Connect to identify potential corridors (Figure 103), and north of the Koocanusa Reservoir has the potential to be a cross-valley (east-west) corridor for large mammals (Figure 104). Considering the natural pinch point between the north end of the Koocanusa Reservoir and Cranbrook, a possible wildlife corridor might exist between them.

a) Grizzly Bear b) American Badger c) Rocky Mountain Elk

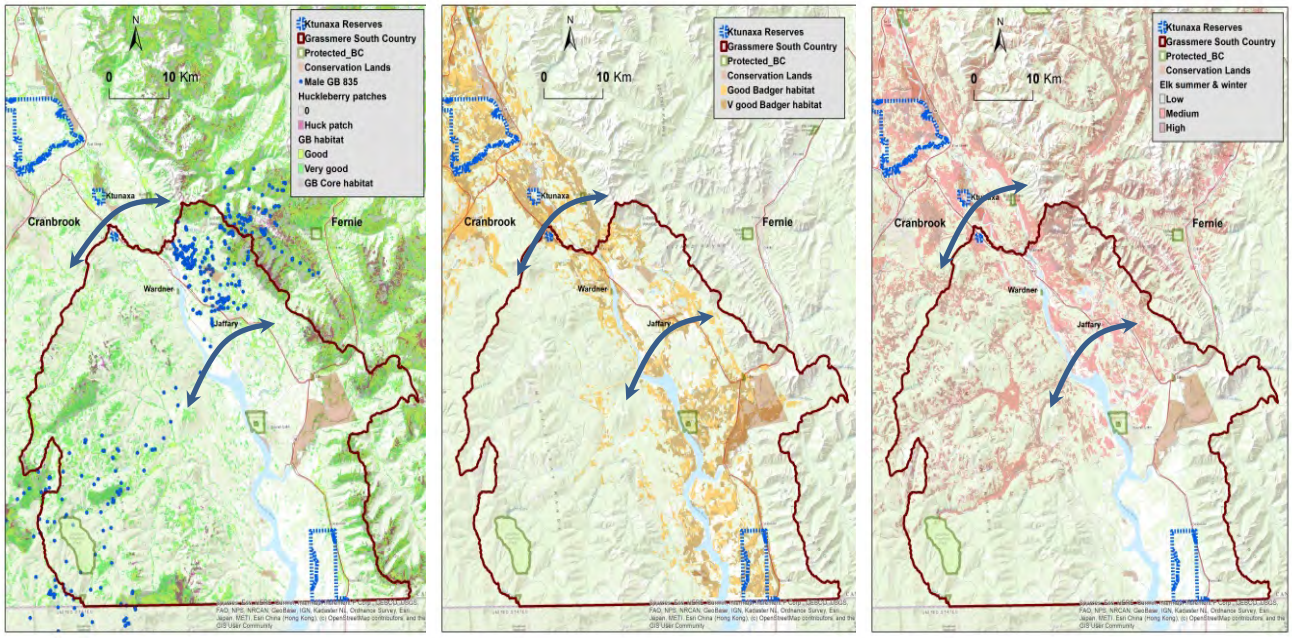


Figure 103. Habitat models for grizzly bear, badger, and elk in the South Country area. a) Grizzly bear habitat model with movements of a male grizzly bear (blue dots) traveling from Yahk into the Rocky Mountains just north of the Koocanusa Reservoir (Proctor, 2015, 2022); b) American badger habitat model (Kinley et al. 2013); and c) elk habitat model (Mulligan, 2020a).

The proposed corridor southeast of Cranbrook in the Wardner-Jaffary area (Figure 103, 104) includes the narrow (~500 m) northern portion of the Koocanusa Reservoir. A radio-collared grizzly bear crossed in this exact location. Elk telemetry data might also be able to show if this is a viable valley crossing area for elk. American badger habitat quality is high in this area and might represent an opportunity for cross-valley connectivity north of Wardner (Figure 103b).

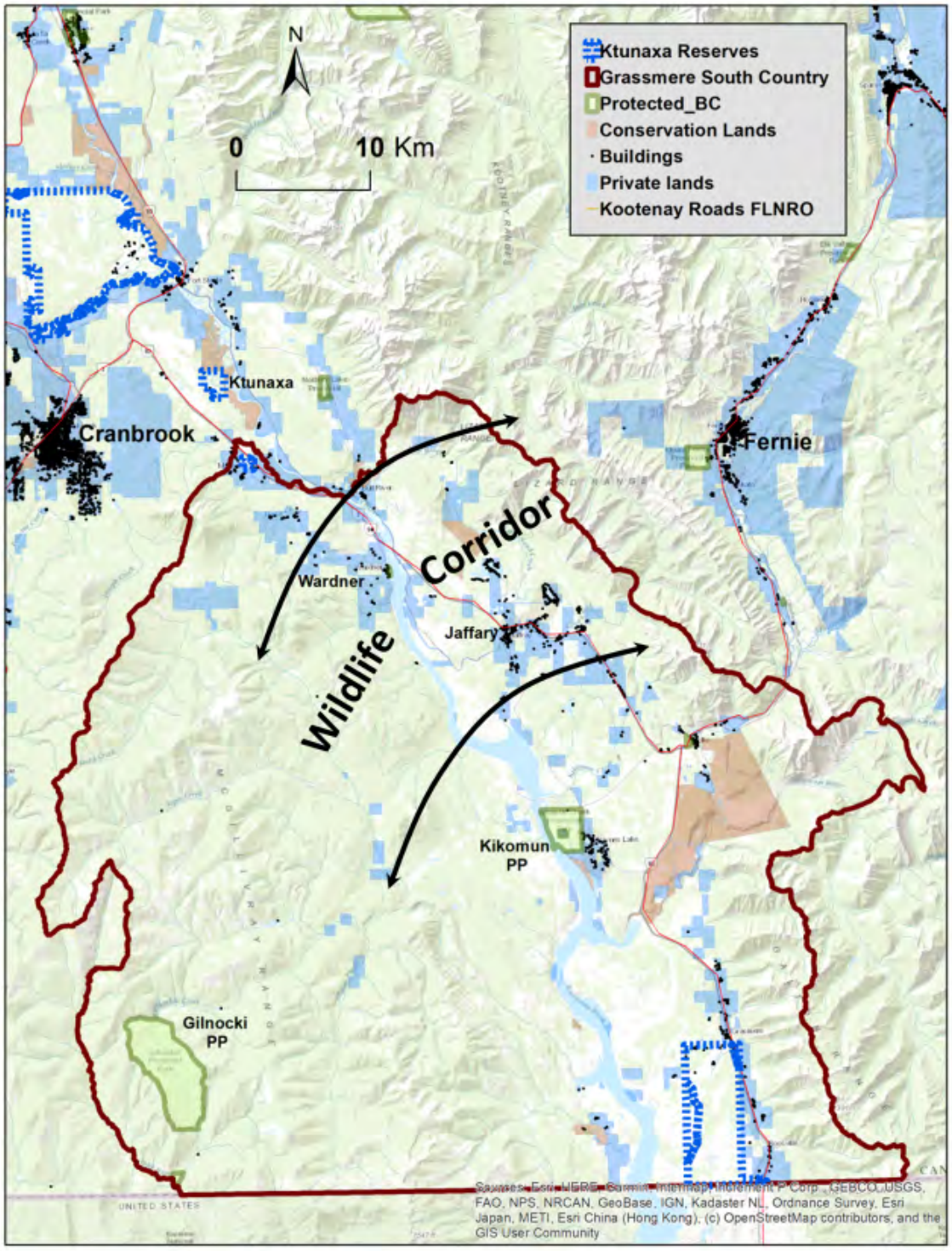


Figure 104. A potential wildlife corridor between the pinch point created by the development footprint of Cranbrook and the Koocanusa Reservoir centers on the Wardner-Jaffray area (Proctor, 2022).

3.9.4 PRIORITY CONSERVATION ACTIONS FOR THE SOUTH COUNTRY CORRIDOR

The 2022 Forum identified a series of conservation priorities that reflect the groups' cumulative experience and local knowledge for actions that would make the biggest conservation impact and begin to address cumulative effects (Figure 105) in the South Country over the next three years. The following list of conservation concerns was developed by workshop participants.

Support recovery of species at risk and focal species

The complete list of recommendations from local workshop participants can be viewed in the *South Country Conservation Action Forum report*[31]. Here we provide a brief overview of topics generated by participants in breakout groups.

- Improve elk hunting regulations for sustainability, Chronic Wasting Disease surveillance, and habitat enhancement.
- Protect priority species such as: Rocky Mountain tailed-frog, Lewis's woodpecker Williamson's sapsucker, long-billed curlew, American badger, bighorn sheep, Spalding's campion, fescue species, and whitebark pine.
- Manage for biodiversity, including riparian habitats, cottonwood stands, willow ecosystems, rare ecosystems, hydrologic connectivity for wetlands vulnerable to climate change, identify and protect hotspots, control invasive species, healthy grasslands, and old growth forests patches.
- Identify, enhance and restore degraded ecosystems including wildlife trees, private land progress (e.g., Farmland Advantage), wildfire resilience, self-regulating climate-resilient invasive species management, grassland forest encroachment, strategic road deactivation and more.
- Manage to increase east-west, north-south, and elevational connectivity for wildlife and ecosystems through multiple means, including, road access management, highway infrastructure for safe passage in high collision areas, minimizing recreation impacts, reducing wildlife conflicts and more.
- Advance climate resilience by including it in decisions and activities, consider mountain and valley hydrological connectivity, temporally and spatially with an eye to water retention in creeks, and wetlands aquifers, plan for drier warmer altered future ecosystems, implement forest fuel reduction and nature-based solutions (e.g., beaver

[31] https://kootenayconservation.ca/south-country/

enhancement for retention of water in valley bottom wetlands), and forestry management through a climate lens.

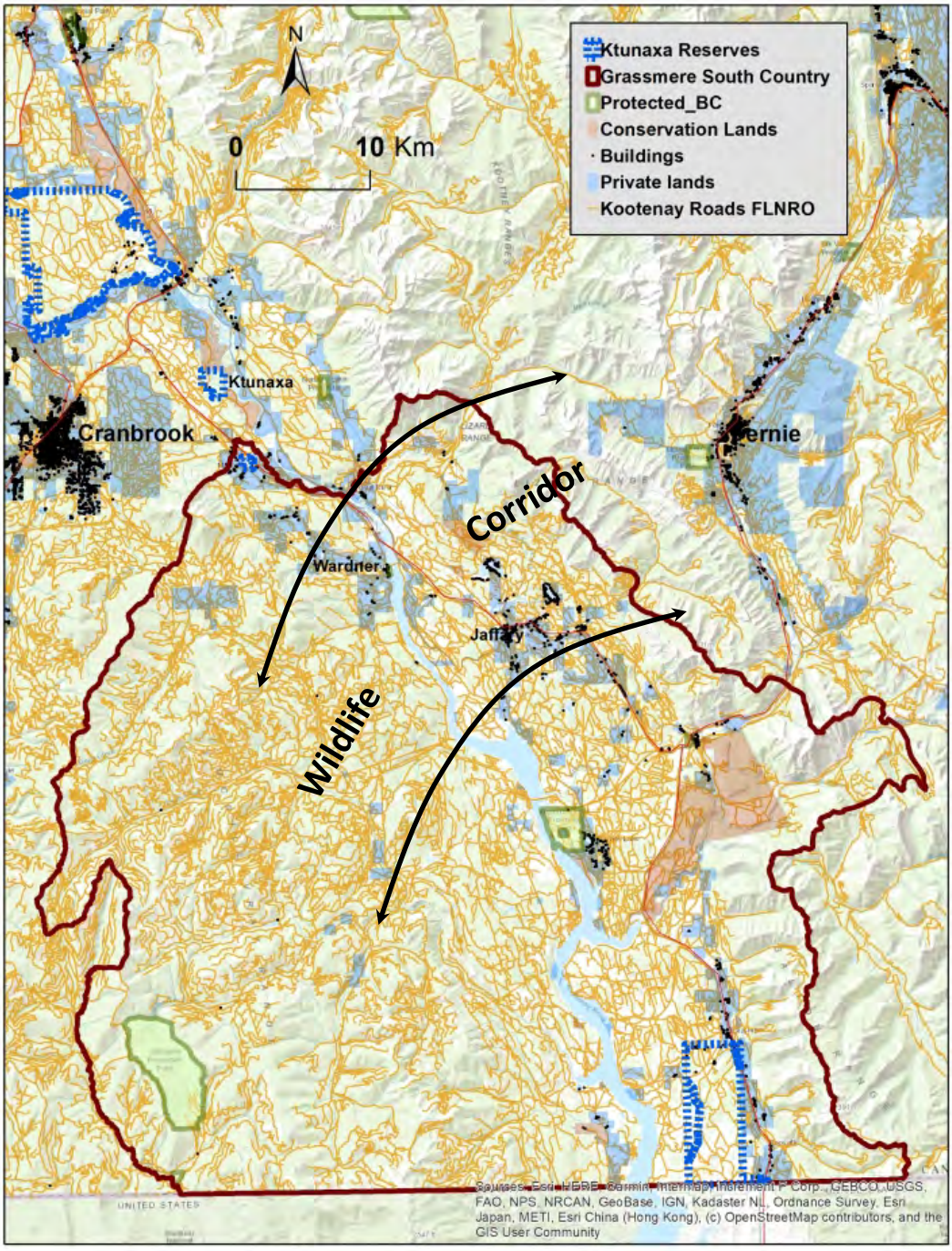


Figure 105. The human footprint illustrates cumulative effects of an extensive backcountry forestry road network. (Source: Kootenay Connect).

An important outcome influenced by this forum was the Yaq̓it ʔa·knuqɬi ‘it First Nation working with the provincial government to enhance ungulate habitat within the Galton Range, specifically the mountain face between Maguire Creek and Red Canyon Creek. Referred to as the “Red Canyon Ungulate Enhancement Project”, the objectives are habitat enhancement that support improving habitat quality for ungulates, particularly bighorn sheep throughout the Galton Range. The Yaq̓it ʔa·knuqɬi ‘it and its partners are taking a landscape-level approach to identifying integrated climate, ecosystem, and multi-species corridors north-south and east-west. Past fire suppression practices have led to forest encroachment on important open forest habitat within the Galton Range, which is home to several ungulate species, including bighorn sheep, Rocky Mountain elk, mule deer, and white-tailed deer. The Red Canyon Ungulate Enhancement Project is focused on developing and implementing prescriptions to remove dense, immature conifers stands to open the canopy, improve sight lines for ungulates, and understory conditions.

3.10 SLOCAN RIVER VALLEY

3.10.1 GEOGRAPHIC DESCRIPTION

The Slocan Valley is an ecologically rich and diverse place in the heart of the West Kootenays framed by the Southern Selkirk Mountains to the east and the Valhalla Mountains to the west. Slocan Lake drains into the undammed Slocan River, which is joined by a major tributary, the Little Slocan River, and eventually flows into the Kootenay River. The Slocan River watershed is a major corridor for life from the macroinvertebrates and rainbow trout in the water to owls, bears, mountain goats, and magnificent cedar trees characteristic of the globally unique Inland Temperate Rainforest. The river and its sub-basins and tributaries provide healthy habitat across the valley, linking dry uplands to valley bottom riparian areas. At a landscape level, the Slocan River's extensive riparian areas and wetland complexes greatly contribute to the regional network of corridors extending north-south from Slocan Lake to the confluence with the Kootenay River, and east-west between Kokanee Glacier and Valhalla Provincial Parks (Figure 106, 107).

Figure 106. Looking south down the Slocan River Valley towards Frog Peak. (Photo: M. Mahr).

The Slocan Valley's varied topography and microclimates result in a diverse suite of ecosystems, including floodplains, wetlands, forests, meadows, and alpine environments that are home to a diverse assemblage of species. Currently, the Slocan Valley Biodiversity Project[32] has recorded nearly 2,260 different species, including 25 provincial or federal species at risk. The valley's rich human history has intersected with this natural diversity in many ways. Approximately 5,000 people reside in a series of small homesteads and farms lining much of the valley bottom and

[32] https://www.inaturalist.org/projects/slocan-valley-biodiversity-project

continue to modify ecological processes such as changes in hydrology, predator-prey cycles, fire dynamics, forest regeneration, and the unpredictable shifting of habitats with climate change. In the last century, this area has experienced extensive logging of the floodplain riparian cedar and cottonwood altering flow and temperature regimes, and increased streambank erosion and farmland sediment deposition (Figure 108). Railroads and roads have further confined the river, altering side channels and wetland complexes, thus simplifying the floodplain.

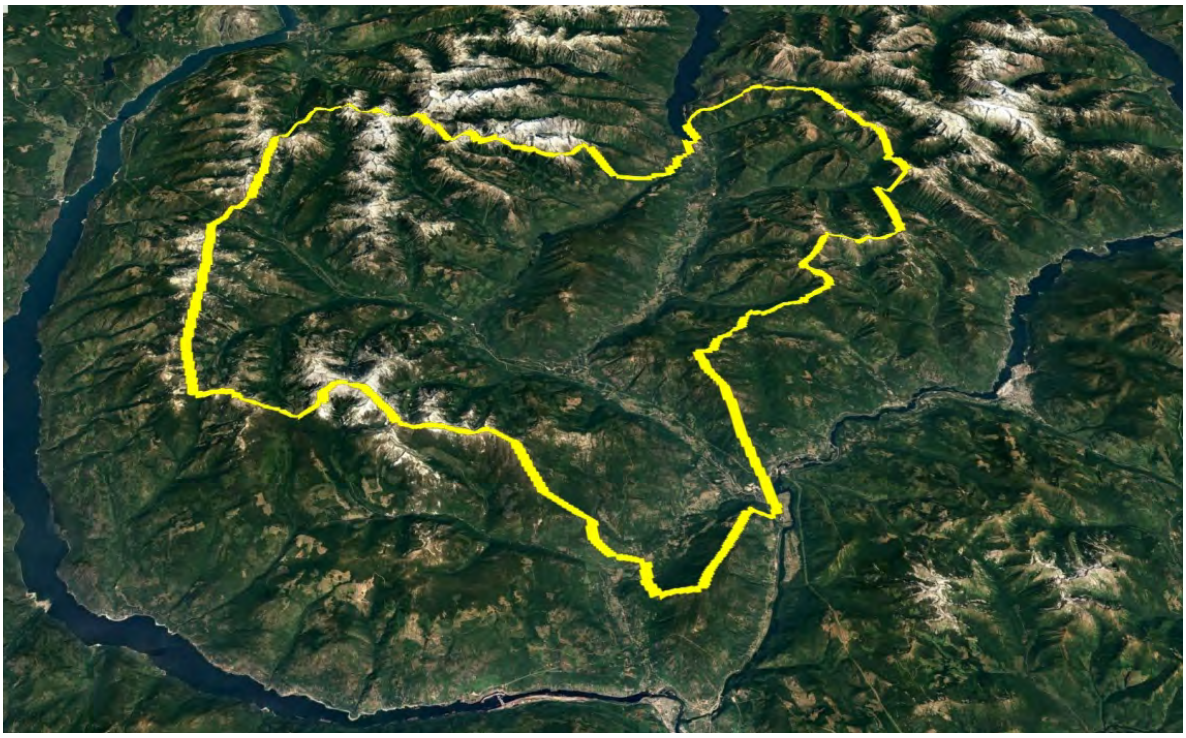


Figure 107. Google Earth view of the Slocan River Valley Corridor as defined by workshop participants. (Source: Kootenay Connect).

3.10.2 LEADING CONNECTIVITY CONSERVATION GROUPS & ALLIES

The Slocan Valley has a rich history of conservation. Active groups include Slocan Lake Stewardship Society (SLSS), Slocan River Streamkeepers (SRS), Slocan Wetlands Assessment & Monitoring Project, The Nature Trust of BC, Nature Conservancy of Canada, Slocan Integral Forestry Cooperative (SIFCo), Elk Root Conservation Farm, Kootenay Conservation Program, Living Lakes Canada, several local professional biologists, and staff from provincial government and the Regional District of Central Kootenay. These groups are working toward a valley-wide coordinated and comprehensive conservation effort to protect and enhance the area's species at risk, biodiversity, species and ecosystem connectivity, and climate resilience.

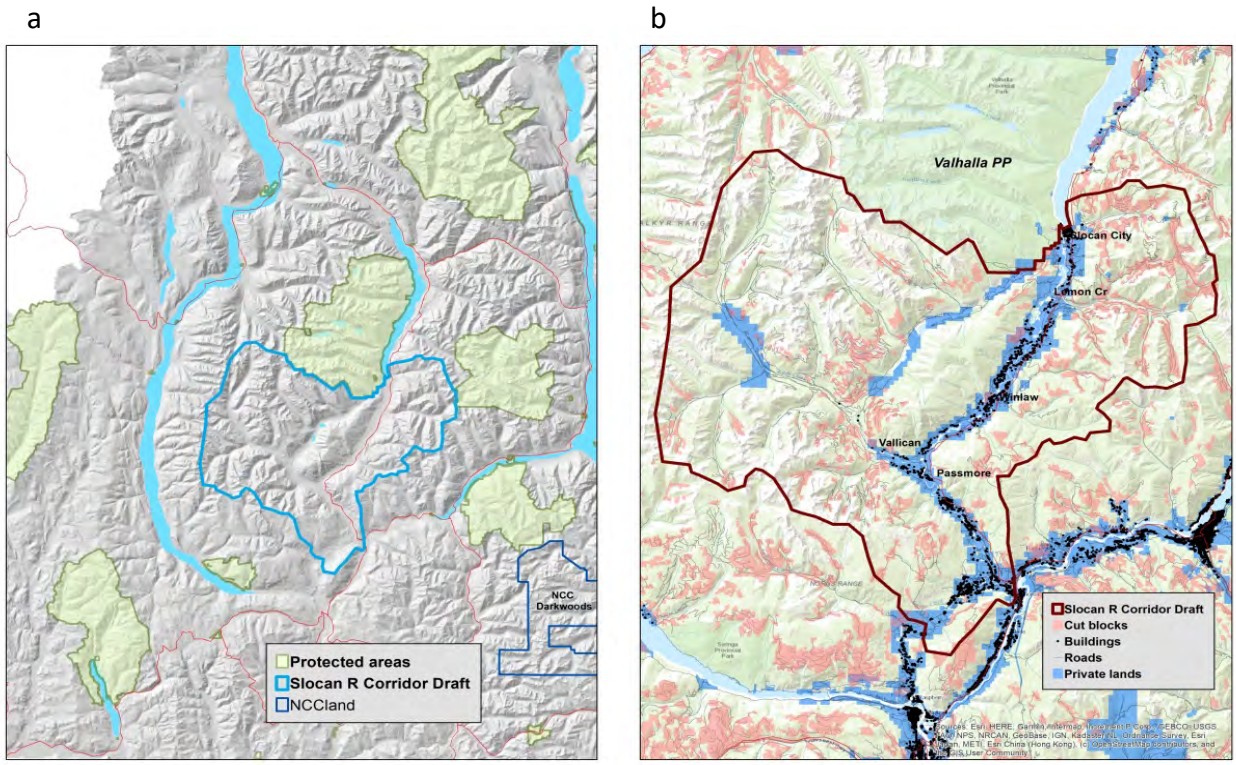


Figure 108. a) Regional perspective of the Slocan Watershed relative to protected areas in the West Kootenay; and b) the human footprint in the Slocan River watershed. (Source: Kootenay Connect).

3.10.3 KOOTENAY CONNECT WORKSHOPS

In March and October 2021, Kootenay Connect co-sponsored virtual workshops with the Slocan River Streamkeepers to identify ecological values, threats, and opportunities for enhancing habitat conservation and landscape connectivity. A series of speakers summarized the considerable past and current conservation efforts in the valley, including wetland and riparian restoration, native plant inventories, fish surveys, macroinvertebrate sampling, water quality and quantity monitoring, and fire prevention/habitat restoration work. Species at risk inventories have included western screech owl, Lewis's woodpecker, and whitebark pine. Opportunities identified for further work included more habitat restoration, SAR inventories, land protection, enhancing landscape connectivity, and education and public outreach.

Cross-valley corridors were identified by Kootenay Connect as potential focal areas for conserving large mammal connectivity along with more localized, finer-scale activities to conserve critical habitat for western screech-owl (which depends on riparian and upland connectivity), and habitat features such as mineral licks and snake hibernacula. A landscape-level approach to conservation of the Slocan Valley could incorporate protecting private land in

the valley bottom and including river islands by land trusts (Figure 109a, b) and eco-friendly forestry in the uplands by tenure-holders. For example, SIFCo aspires to incorporate sustainable forestry management practices to increase protection of old forests, reduce road densities, and increase overall habitat security on Crown land.

a b

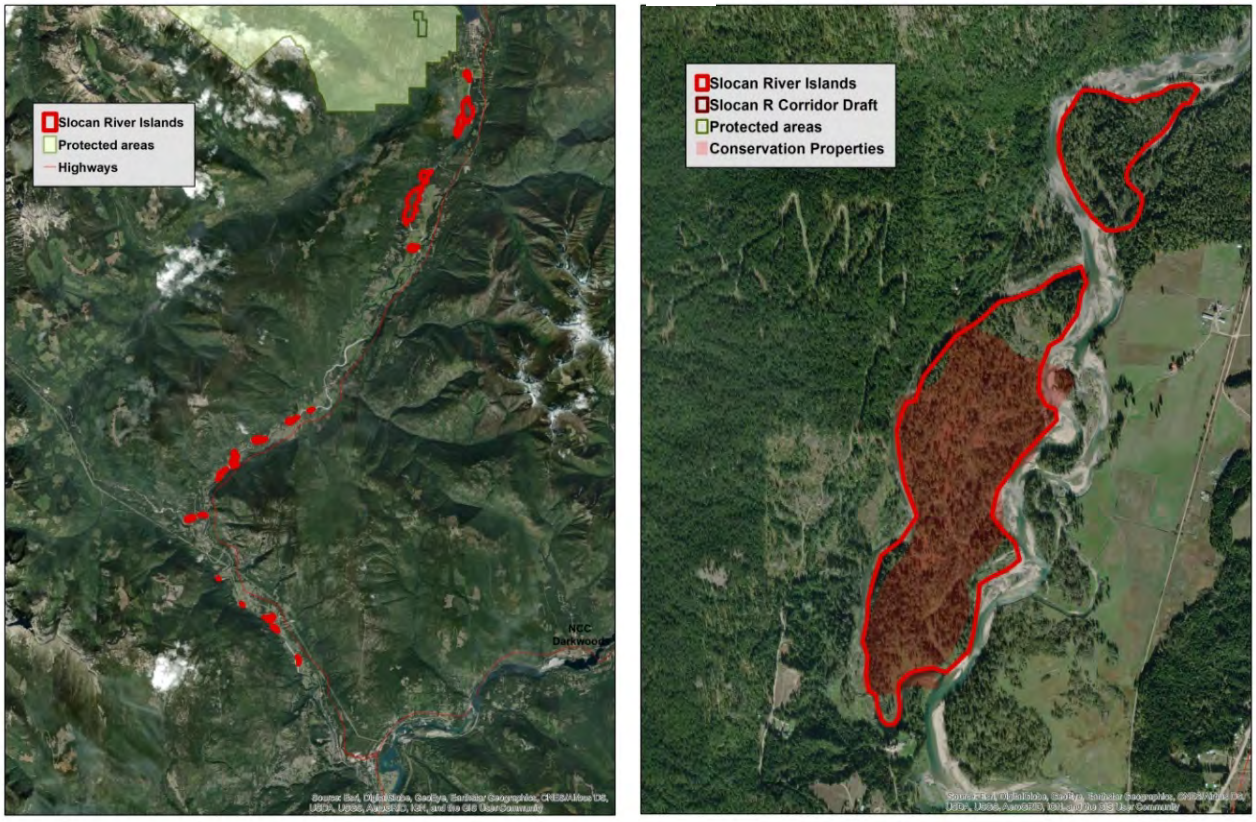


Figure 109. a) Ecologically rich islands within the Slocan River (red); and b) islands protected through land trust acquisitions. (Source: Kootenay Connect).

3.10.4 PRIORITY CONSERVATION ACTIONS FOR THE SLOCAN RIVER VALLEY CORRIDOR

During our 2021 workshops, Kootenay Connect identified two potential cross-valley corridors that provided a starting place for conceiving multi-species, multi-scale habitat conservation projects in the Slocan River Valley (Figure 110). The first corridor spans from Kokanee Glacier Provincial Park through the Lemon Creek drainage just south of Slocan Lake across to Valhalla Provincial Park, referred to below as the "Lemon Creek Corridor" because this corridor centres on the Lemon Creek drainage. The group discussed how to rebuild this corridor with wildlife enhancement and restoration of riparian cottonwoods along the Slocan River.

The second corridor spans from the south end of Kokanee Glacier Provincial Park through Passmore and Vallican to the Little Slocan River drainage to Wolverton Creek, referred to below as the "Passmore Corridor." Below are key actions identified at Kootenay Connect's workshops.

Lemon Creek Corridor

- Identify a suite of conservation targets that will provide a package for various sub-projects to fit into a larger corridor-based project.
- Reduce road densities and motorized access on Crown land from Springer Creek to Lemon Creek to improve habitat security for grizzly bears, wolverine, and other species.
- Investigate non-motorized designation in the backcountry from Slocan Lake to Lemon Creek, which is an important sanctuary for wildlife.
- Initiate a second phase of Sensitive Ecosystem Inventory (SEI) that builds on the preliminary SEI mapping project to: 1) add stand structure and age data to the mapped cottonwood forests in the floodplain; 2) map rare floodplain communities and classify everything to ecosystem type; and 3) guide prioritization of habitats for conservation and restoration.
- Evaluate the habitat value of SEI mapped cottonwood galleries along the Slocan River for western screech-owl.
- Assess options for western screech-owl habitat protection based on private and Crown land ownership to inform land trusts and potential WHA designation on provincial land by overlaying iNaturalist information and western screech-owl habitat information from FWCP-funded inventories (Dulisse and Beaucher, 2006; Hausleitner and Dulisse, 2007).
- Assess how the Owl Walk property along the river below Slocan City plus smaller pieces of Crown land would make a larger landscape corridor for western screech-owl that ties together river islands-riparian area-upland.
- Synthesize information from iNaturalist, western screech-owl and Lewis's woodpecker habitat, and islands and floodplain habitat to help the group build a conservation story and justification with maps.
- Identify private land stewardship and acquisition opportunities using iNaturalist data and the expertise of local experts to help identify priority properties with biodiversity values and habitat connectivity to inform a private land securement and stewardship strategy and identify "shovel-ready" securement and stewardship projects.
- Engage landowners of large riverfront properties with productive riparian habitat to view their land in a landscape context as integral to terrestrial and aquatic connectivity and to encourage further habitat restoration of fish and wildlife.
- Explore potential wetland and riparian habitat restoration projects within this corridor that include installation of bird and bat boxes.

- Continue species at risk inventories through the Slocan Valley Biodiversity Project.

Passmore Corridor

- Identify a suite of conservation targets that will provide a package for various sub-projects to fit into a larger corridor-based project.
- Support restoration and enhancement projects on the Little Slocan River and confluence area with the main Slocan River to protect channels and shorelines, create and restore fish habitat, and enhance wildlife movement corridors.
- Continue efforts to protect Perry Ridge as an ecologically important area and use current information from Kootenay Connect to help build a case for the importance of Perry Ridge connecting north to the Valhalla Mountains and south to Vallican.

a b

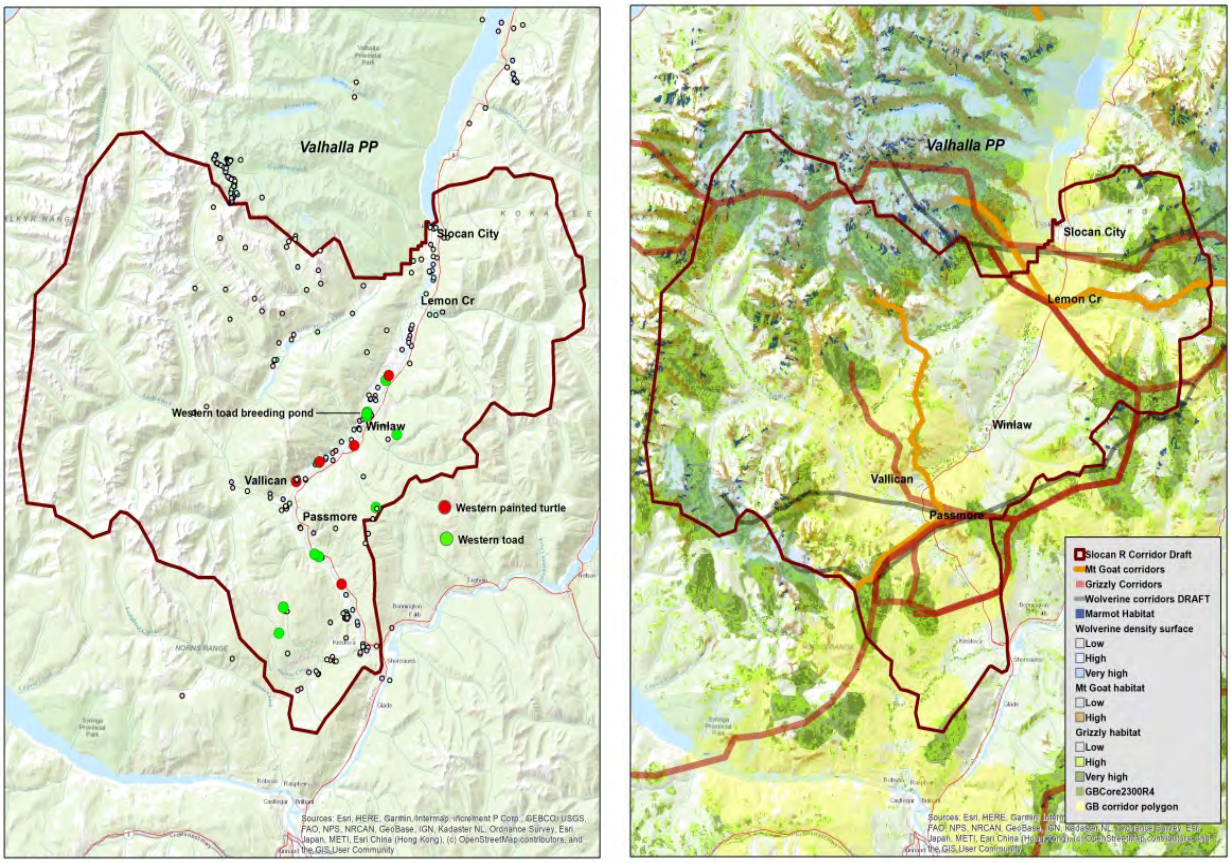


Figure 110. a) Biodiversity survey results with >1,000 species represented based on data from the iNaturalist Slocan Valley Biodiversity Project; and b) potential multi-species corridors across the Slocan Valley based on data from the Trans-border Grizzly Bear Project, province of BC, and local wolverine researchers. (Source: Kootenay Connect).

3.10.5 KOOTENAY CONNECT COMMUNITY-NOMINATED PRIORITY PLACES

The local working group that formed during the Kootenay Connect workshops is currently contributing to new projects developed by SLSS, SRS, and ONA supported through the extension of ECCC's funding for Kootenay Connect CNPP through 2026. Over the next three years, CNPP-funded projects in the Slocan Valley are focused on inventorying rare and at-risk species relying upon riparian-wetland habitats in the Slocan River floodplain; identifying and classifying sensitive ecosystems in the valley bottom; and enhancing key sites to stabilize riparian zones, improve vegetation, and creating and/or installing habitat structures for birds and turtles. All projects include strategic planning involvement and ground site assessments that engage ONA to share biocultural values and ratify site-specific conservation activities.

Specific activities include:

- Collecting and weaving together biological and Indigenous knowledge to identify and map species at risk in approximately 2,000 ha of valley bottom along the Slocan River.
- Continuing to add SAR to iNaturalist for the Slocan Valley Biodiversity Project and the BC Conservation Data Centre provincial databases; and contributing other wildlife data to BC Wildlife Species Inventory.
- Updating 2012 SEI mapping of the Slocan River Valley to re-classify and map at-risk (provincial red- and blue-listed) ecological communities along the Slocan River resulting in:
    - Slocan River Valley Species and Ecosystem Inventory Report and maps showing the current state of riparian ecosystems for approximately 10,000 ha of riparian zone.
    - Identification of important sensitive areas, e.g., cottonwood, wetlands, Ponderosa pine community types, to inform prioritization of conservation opportunities at selected sites and islands along the Slocan River.
- Stabilizing several kilometers of riparian zones through revegetating areas; and enhancing adjacent wetland habitats with bird structures, modified wildlife trees, and basking logs, where needed.

3.11 ELK VALLEY

3.11.1 GEOGRAPHIC DESCRIPTION

The Elk Valley Corridor includes the north-south valley from Elkford to the U.S. border in the East Kootenay. The area is bisected by the east-west Crowsnest Highway 3 and adjacent to the BC/Alberta border. Conifer forests dominate upland habitat and the Elk River is the center point of variably-sized riparian wetland habitats along its course in the valley bottoms between Elko and Sparwood (Figure 111, 112). The Highway 3 transportation and settlement corridor is one of the main fractures in the otherwise continuous trans-boundary habitat in the southern Canadian-northern US Rockies portion of the Yellowstone to Yukon region (Proctor et al., 2015, 2012).

Along this portion of the Rocky Mountains' spine there are significant protected areas to the north and south that have kept the region reasonably wild, with the full spectrum of ungulate and large carnivore species including elk, moose, white tailed and mule deer, bighorn sheep, and mountain goat as well as large carnivores such as grizzly and back bear, wolf, cougar, lynx, and wolverine. Wildlife corridors in this area have been identified by several research projects and are being managed to benefit wildlife movement. There is a significant coal mining presence in the area and this valley is experiencing increased development due to expanding mining, human settlement, and recreational pressure. In some regards, the window for connectivity conservation is closing in the Elk Valley, especially for north-south connectivity within this biologically diverse and internationally important transboundary region.

Figure 111. Meandering channels of the Elk River east of Fernie. (Photo: NCC).

3.11.2 LEADING CONNECTIVITY CONSERVATION GROUPS & ALLIES

Considerable conservation research, stewardship, and resource management has occurred in the Elk Valley region. Groups working in the area include the Elk River Alliance, Ktunaxa Nation Council, BC Backcountry Hunters & Anglers, Sparwood and District Fish and Wildlife Association, Elkford Rod and Gun Club, East Kootenay Wildlife Association, Nature Conservancy Canada, The Nature Trust of BC, Wildsight Elk Valley, Kootenay Conservation Program, Elk Valley Regional Land Trust, Miistakis Institute, BC Ministry of Water, Land & Resource Stewardship, and several independent biological researchers, including Dr. Clayton Lamb.

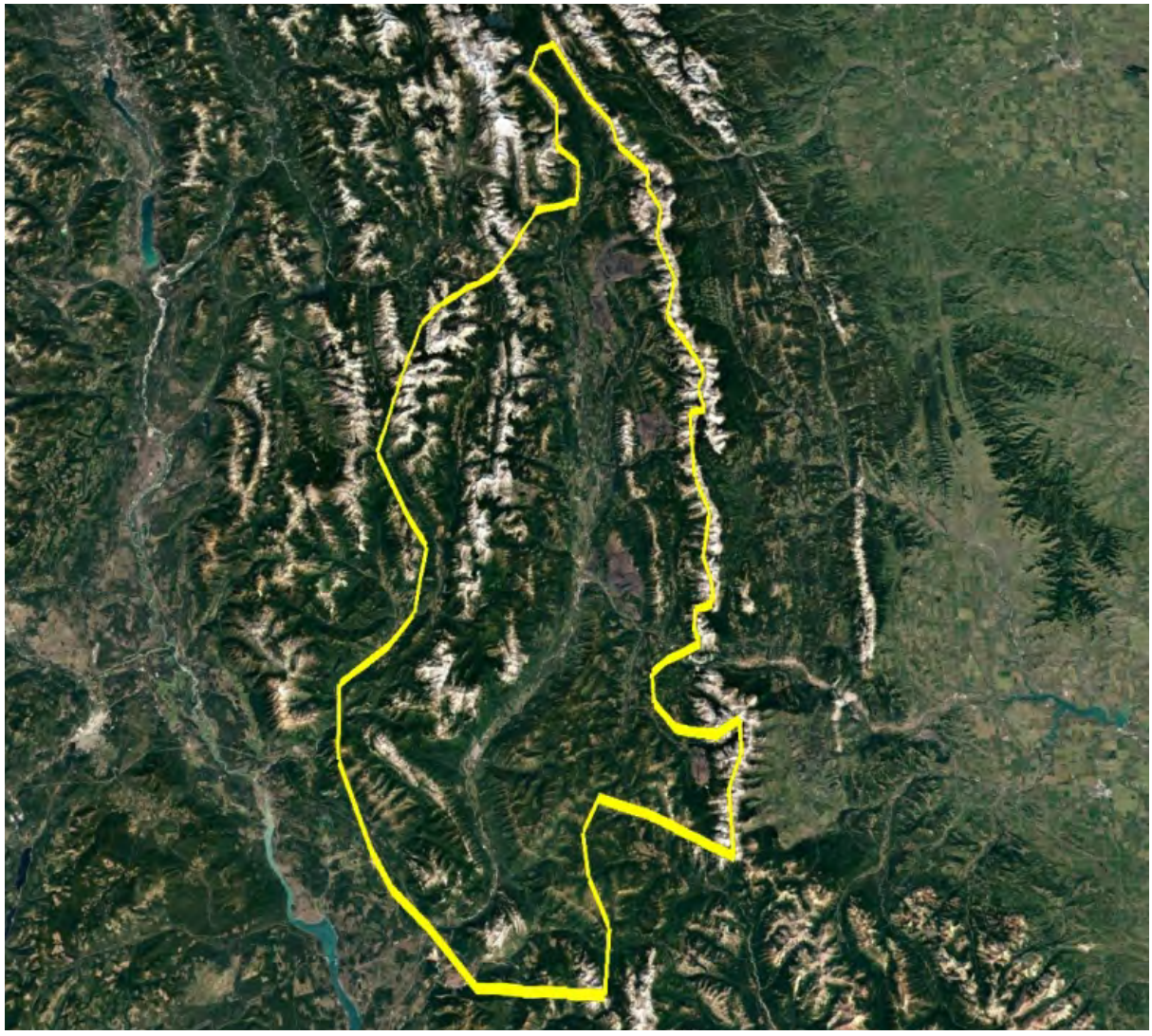


Figure 112. Google Earth view of the Elk Valley Corridor as defined by workshop participants. (Source: Kootenay Connect).

3.11.3 ELK VALLEY CONSERVATION ACTION FORUM & KOOTENAY CONNECT WORKSHOP

A KCP Conservation Action Forum was held in the Elk Valley in May 2019[33]. Participants prioritized the following areas for conservation and management attention:

- Take a landscape-level approach to wildlife and ecological connectivity by mapping, protecting, and maintaining existing key habitats and corridors.
- Integrate private land trusts to purchase key high-quality habitats and biodiversity hotspots, where feasible.
- Implement an effective access management program by enhancing and enforcing existing efforts by, for example, managing landscape to 0.6 km/km^2 and 60% secure habitat with >500m from open roads for the benefit of grizzly bears and other large mammals such as elk, bighorn sheep, and mountain goat.
- Restore and enhance bighorn sheep habitat across all elevations.
- Map, prioritize, protect, secure, and enhance high quality habitats including riparian, wetland, and floodplain habitat.
- Reduce human-wildlife conflict within the Highway 3 transportation corridor and human settlements.

A follow up workshop co-sponsored with Kootenay Connect was held October 2021 where participants identified the following additions to the above items:

- Consolidate conservation efforts across groups into a cooperative umbrella working group for efficiency and better integration of goals.
- Deliver stronger communications by developing a compelling conservation narrative to inform the public, politicians, and potential funders.
- Help secure funding for activities such as ongoing multi-species corridor analyses.
- Integrate climate resiliency into the Elk Valley narrative and activities.
- Integrate Teck into conservation initiatives through funding and actions.
- Develop more biodiversity hotspot and natural assets mapping.

In the Elk Valley Corridor, Kootenay Connect has explored how best to take a landscape approach to connectivity that reaches beyond the transportation and human settlement

[33] https://kootenayconservation.ca/wp-content/uploads/2020/04/KCP-Elk-Valley-CAF-Summary-Report_25June2019.pdf

corridor (Figure 113) and to identify champions who will develop a conservation narrative into a fundable package to help them carry out their goals. A considerable amount of wildlife habitat data exists for the area. A limited selection is presented in Figure 114. To date, no formal conservation initiative seems to have formed from our efforts although conversations continue to occur with local biologists and groups. That said there are some excellent conservation projects occurring in this area that would benefit from more long-term funding to benefit the region's wildlife. For example, key initiatives such as Reconnecting the Rockies and the Elk Valley Cumulative Effects Management Framework are discussed below.

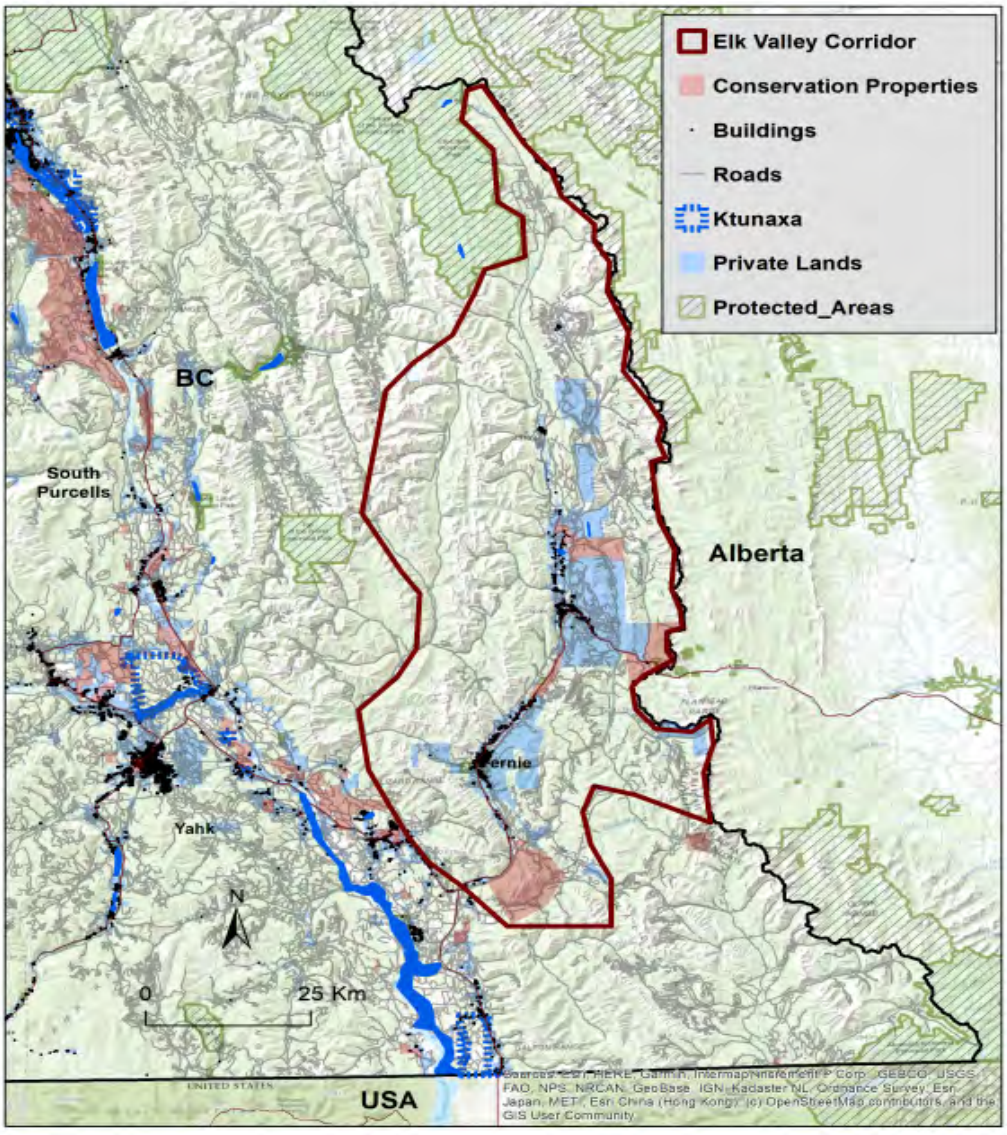
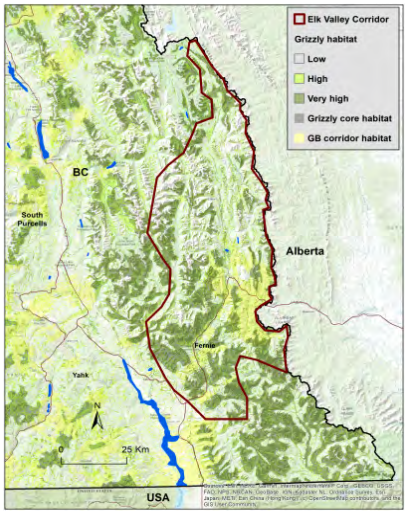
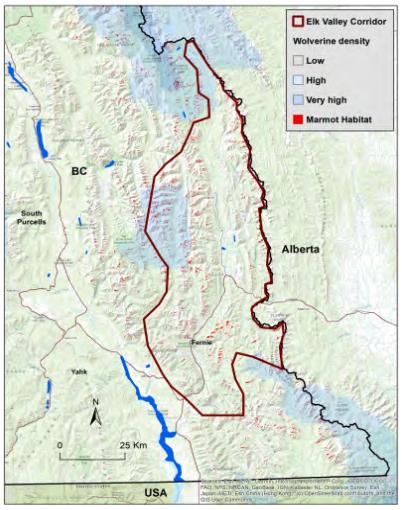


Figure 113. Human footprint concentrated along the major transportation corridor of Highway 3 in the Elk Valley along the Alberta border (coal mining not included). (Source: Kootenay Connect).

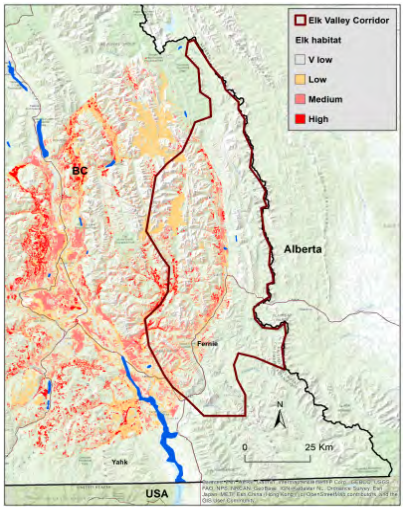
a) Grizzly Bear



b) Wolverine



c) Rocky Mountain Elk



d) Mountain Goat

e) Bighorn Sheep

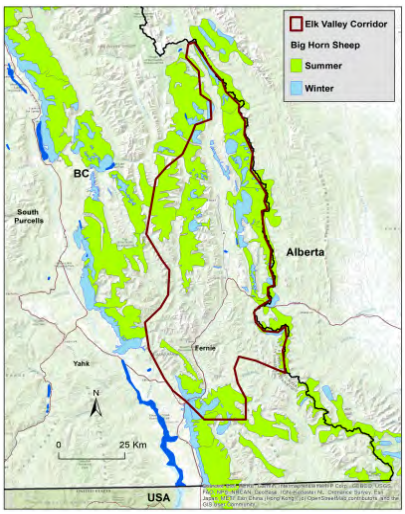
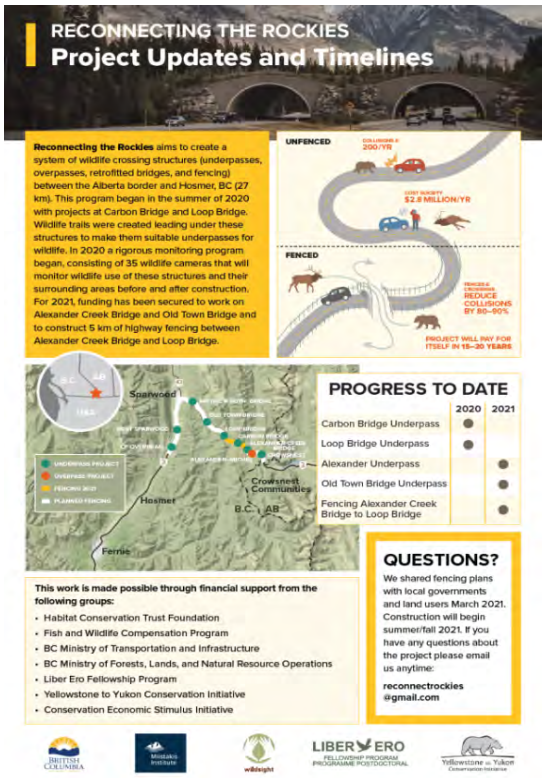


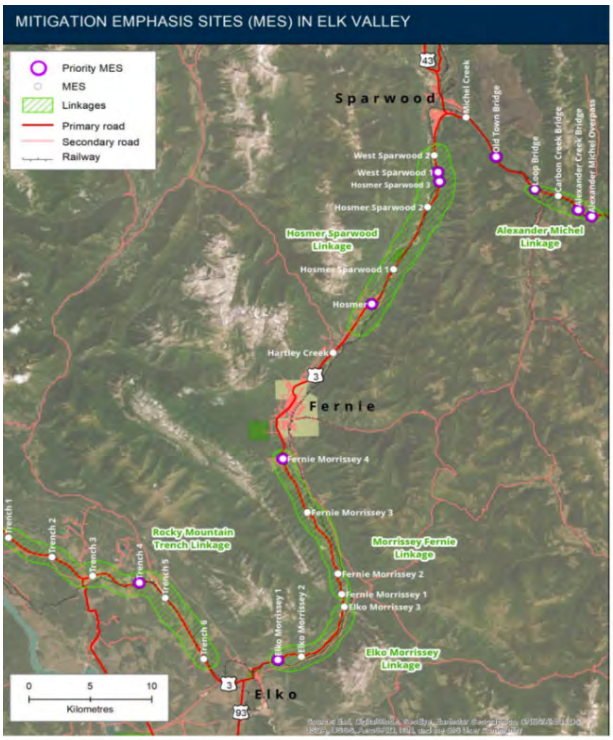
Figure 114. Habitat maps for a) grizzly bear (Proctor et al., 2015); b) wolverine (Mowat et al., 2020); c) elk (Mulligan, 2020a, 2020b); d) mountain goat (Ross and Vander Vennen, 2021); and e) bighorn sheep (Poole & Ayotte, 2020) in the Elk Valley area of southeast BC. (Source: Kootenay Connect).

3.11.4 PRIORITY CONSERVATION ACTIONS FOR THE ELK VALLEY CORRIDOR

Reconnecting the Rockies is a consortium of groups working to alleviate wildlife mortality from vehicle collisions on Highway 3 through studying patterns of animal movement, mitigating attractants along highways (such as removing and composting roadkill ungulates), and building a series of highway crossing structures (underpasses, overpasses, retrofitted bridges and fencing) to provide safe passage for wildlife (Figure 115). To date, four underpasses have been

created below bridges along Highway 3 near Sparwood, allowing ungulates and other wildlife to safely cross the highway.





Proposed highway mitigation sites from Lee, Clevenger, and Lamb 2019.

Enclosure built by BC's Ministry of Transport and Infrastructure to aid in responsible disposal of roadkill carcasses. The enclosure is ~1600m2 and is fully electric fenced and electric gated to ensure no entry of large carnivores.

A $6.3M Highway 3 bridge replacement over Lizard Creek, near Fernie, BC, taken summer 2019. This bridge replacement includes an engineered wildlife underpass.

Figure 115. Examples of how research has informed highway mitigation planning, transportation management, and location of wildlife crossing structures. (Sources: Lee et al. 2019; C. Lamb, Pers. comm.).

Another important initiative in the Elk Valley is the BC government's cumulative effects analysis for wildlife that is guiding the development of an access management plan for the area (Elk Valley Cumulative Effects Management Framework Working Group, 2018) (Figure 116).

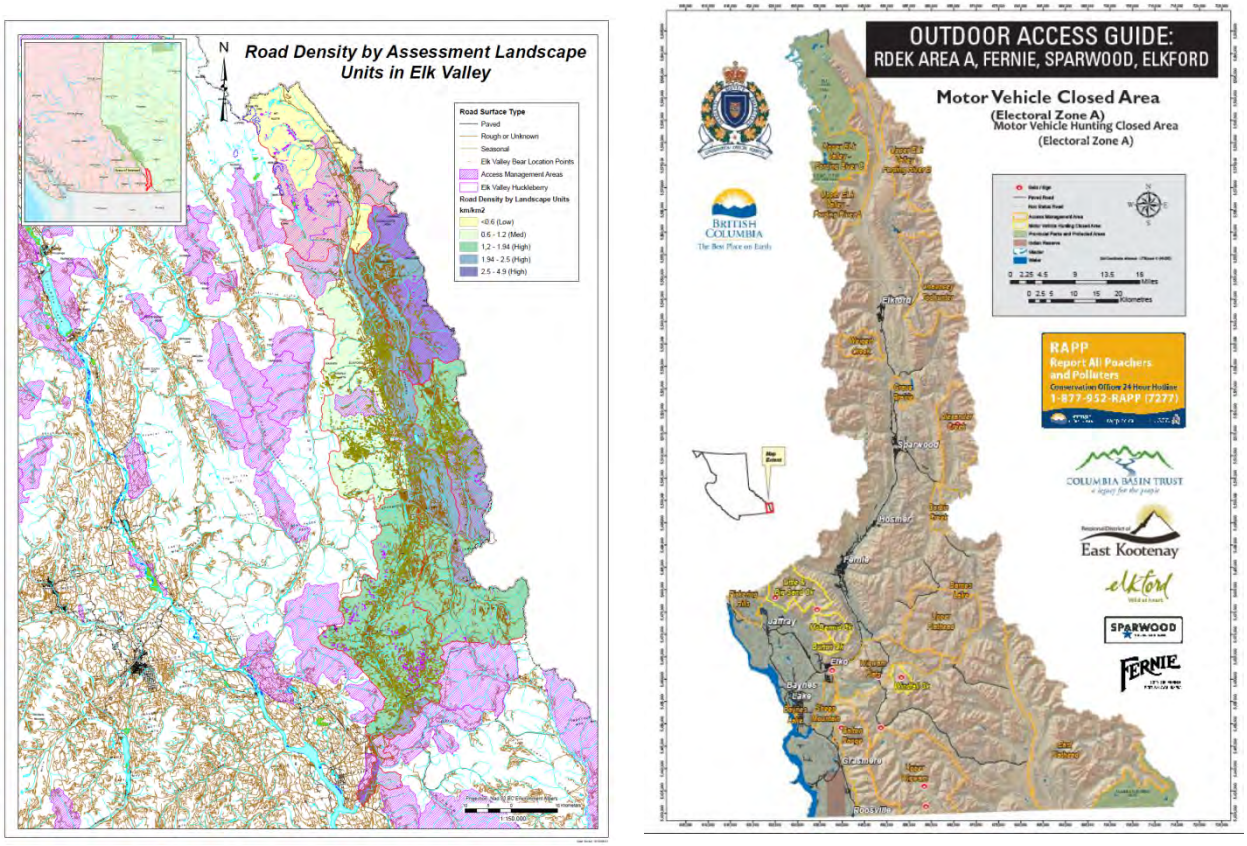


Figure 116. Cumulative effects analysis by the BC government has informed efforts to limit access management in the Elk Valley. (Source: Elk Valley Cumulative Effects Management Framework Working Group, 2018).

3.12 RETALLACK

3.12.1 GEOGRAPHIC DESCRIPTION

The Retallack Corridor encompasses a remote mountain pass along Highway 31A that links the South and Central Selkirk Mountains between the towns of Kaslo (to the east) and New Denver (to the west) (Figure 117). This focal corridor is centered on the old mining town of Retallack that operated until the late 1960s. The corridor is well-known for its biodiversity including grizzly bear, wolverine, mountain goat, and a regionally significant population of western toads. Unlike other Kootenay Connect focal corridors centered on riparian-wetland complexes in valley bottoms, it is the remoteness of this mountainous landscape with its habitat diversity and features that influences how the Retallack Corridor functions as an important ecological corridor in our region. At the center of the mountain pass are the shallow connected lakes of Bear and Fish Lakes that are the headwaters of Kaslo Creek flowing east. On the west side of this hydrologic divide, are the headwaters of Seaton Creek with approximately 8 km of riparian-wetland complexes shaped by extensive beaver activity that run along the highway leading towards Slocan Lake. Going up in elevation in all directions are tributaries and pocket wetlands in sculpted basins and moist avalanche chutes abundant in grizzly bear foods (Figure 118).

Figure 117. Looking east from Bear Lake located at the mountain pass along Highway 31A towards Whitewater Mountains and Mount Brennan in the Retallack Highway 31A Corridor. (Photo: M. Mahr).

Figure 118. Google Earth view of the Retallack Corridor connecting the Goat Range Provincial Park to the north and Kokanee Glacier Park to the south. (Source: Kootenay Connect).

The Retallack Corridor runs north-south straddling Highway 31A and is an important landscape connection between Kokanee Glacier and Goat Range Provincial Parks (Figure 119). The corridor area is anchored by these two protected areas: Kokanee Glacier Provincial Park (320 km^2) is located within a large habitat peninsula created by the two large lake systems of Kootenay and Slocan Lakes, Highways 3A and 6, and associated human settlement bordering the east and west sides. It is further isolated to the south by the West Arm of Kootenay Lake/ Kootenay River and associated human settlement along Highway 3. It is this habitat fragmentation surrounding three sides of this corridor that elevates its importance for protection as a landscape linkage across Hwy 31A on the northern perimeter of its peninsula.

North of Highway 31A, Goat Range Provincial Park (880 km^2) is less influenced by the large lakes and human settlements and provides important undeveloped connectivity to the Duncan-Lardeau Valley to the east (see Section 3.6), and the Bonanza Biodiversity Corridor (see Section 3.2) and Valhalla Provincial Park to the west.

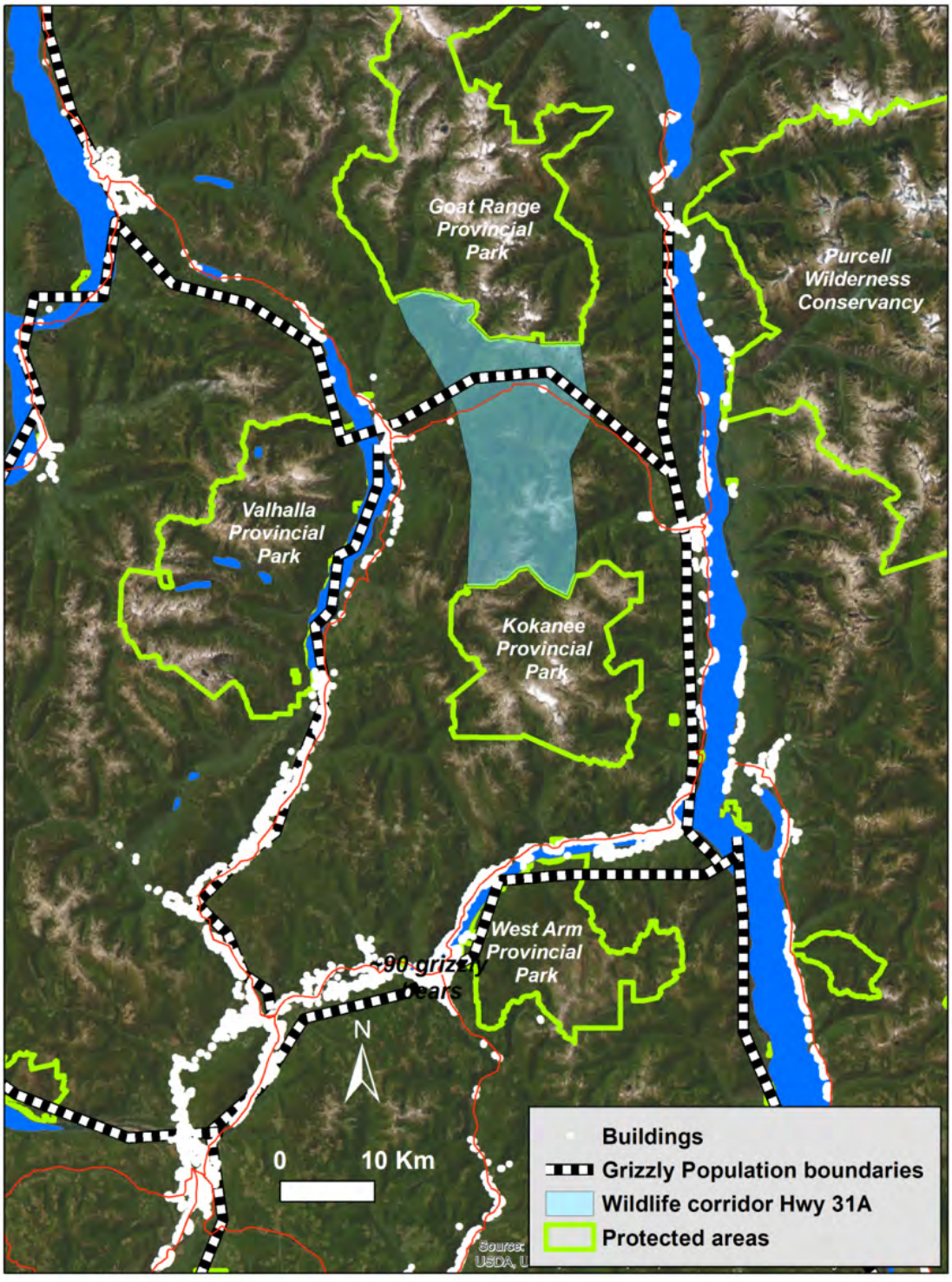


Figure 119. Habitat peninsula created by human settlement and large lakes surrounding Kokanee Glacier Provincial Park south of Hwy 31A. (Source: Kootenay Connect).

3.12.2 LEADING CONNECTIVITY CONSERVATION GROUPS & ALLIES

Groups engaged in conserving biodiversity and habitat connectivity in the Retallack Corridor include the Valhalla Wilderness Society (VWS), The Wild Connection, along with the long-enduring stewardship interests of the Sinixt, Ktunaxa, and Sylix Okanagan Nations.

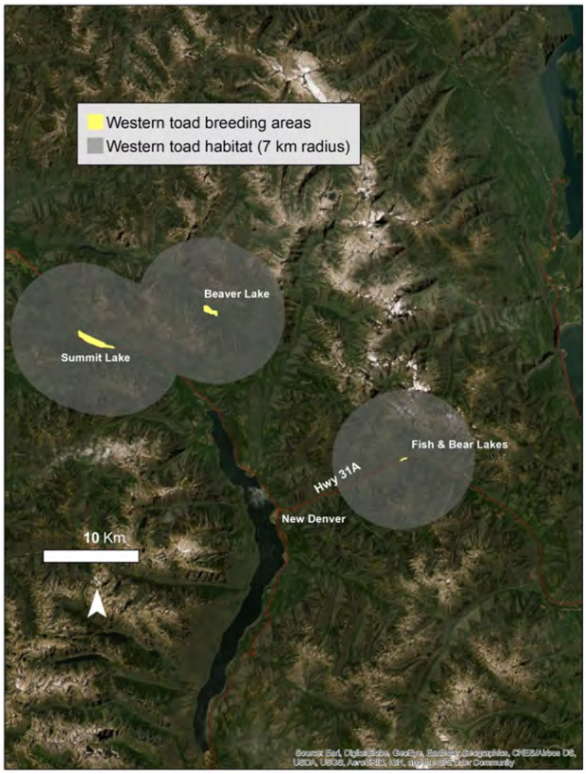
Given its remoteness, little conservation action has occurred in this corridor. VWS established the Retallack Old Growth Cedars Trail over 30 years ago to protect a 1-km loop trail through an ancient forest of giant cedar trees along Kaslo Creek. This area has since been expanded and labeled an Old Growth Management Area by BC Timber Sales to protect it from logging.

More recently, conservation research and associated activities in the corridor led by VWS have focused on migrating western toads and efforts to mitigate highway mortality. A 2-km section of Highway 31A along Fish and Bear Lakes is a major breeding hotspot for thousands of western toads (McCrory and Mahr, 2016). Since 2015, VWS's researchers and volunteers have studied the migration patterns of breeding adult toads and toadlets to document the timing, number, and location of highway crossings to identify hotspots. Between 2015-2022, over 4,500 migrating adult toads have been removed or diverted safely from the highway as they travel between their upland habitat to Fish Lake to breed and then return; and approximately 150,000 toadlets have been successfully diverted by fencing as they travel from their nursery at Fish Lake to the uplands to mature (Figure 120, 121). This research has informed the selection of two locations for toad underpasses that are being planned by VWS and BC's Ministry of Transportation and Infrastructure.

The Retallack Corridor is best known for its exceptional bear habitat and bear-viewing opportunities, for example along the Whitewater Creek Trail where bears use avalanche paths in the spring. The entire area including the corridor between Kokanee Glacier and Goat Range Provincial Parks is excellent and remote grizzly bear habitat and a well-known grizzly bear hotspot. Habitat modeling has verified this pattern for grizzlies (Proctor et al., 2015, 2023; Figure 122a), and wolverine (Mowat et al., 2020; Figure 122b) and mountain goat (Ross and Vander Vennen, 2021) also frequent the high quality habitat on both sides of the Highway 31A mountain pass.

Figure 120. Breeding western toads at Fish-Bear Lakes in the Retallack-Highway 31A Corridor. (Photo: M. Mahr).

a



b

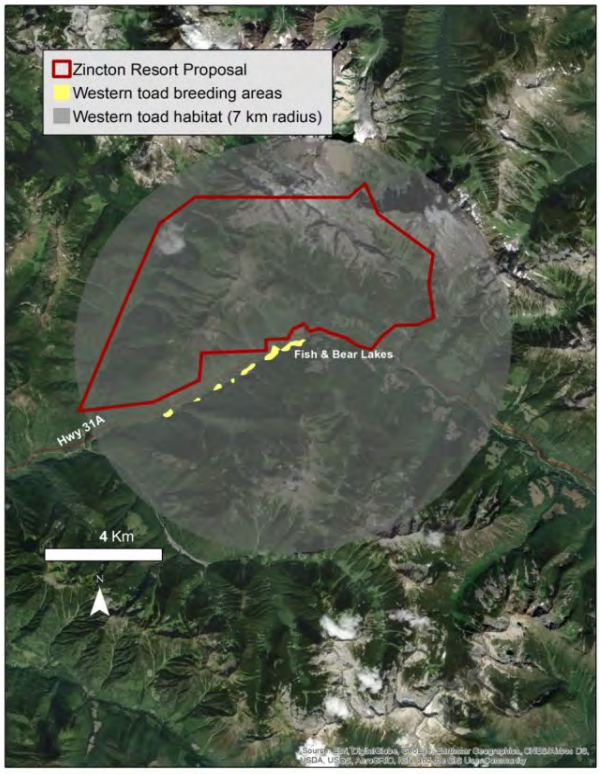


Figure 121. a) Major western toad breeding ponds (yellow) in the local region with a 7-km radius (grey shaded area) illustrating the average distance toads within a population could travel to their breeding areas at Fish and Bear Lakes, Summit Lake and Beaver Lake; and b) a significant western toad breeding area at Fish and Bear Lakes (yellow) central in the Retallack Corridor and relative to the proposed Zincton lift and backcountry ski proposal. (Source: Kootenay Connect).

3.12.3 PRIORITY CONSERVATION ACTIONS FOR THE RETALLACK CORRIDOR

Kootenay Connect held a virtual meeting with local and First Nations biologists in the fall of 2021. The discussion focused on accumulating existing scientific information about the biophysical attributes of the landscape and wildlife using the Retallack Corridor to help identify and fill knowledge gaps. Land uses in this corridor include extensive mining and logging. Yet, likely the biggest most recent change to come to this area is increasing recreational pressure. Presently, recreation tenures operate on both sides of the mountain pass along Highway 31A that include cat skiing, mountain biking, and hiking. For example, an application for a hybrid ski-lift and backcountry ski touring development has been proposed at Zincton within the heart of the wildlife corridor (Figure 122b). Analyses and application of scientific research results suggest the level of disturbance to important huckleberry patches may reduce the effectiveness of these critical and vital habitats for grizzly bears within this corridor, and thus compromising the ability of this area to function as a wildlife corridor for some species (Proctor et al., 2023). To increase our collective understanding of the importance of this area for wildlife, Kootenay Connect gathered existing data to help inform surrounding local communities, First Nations, and government making land use decisions determining the corridor's fate.

As recreational and logging tenures dominate areas of this landscape, the concern is that any proposed new developments could permanently fragment this relatively intact area. Due to the peninsular nature of the habitat to the south of Hwy 31A, the area surrounding Kokanee Glacier Provincial Park has the potential to become a habitat island in the Hwy 31A transportation corridor (Figure 119). For example, Proctor et al. (2012) demonstrated the regional fragmentation patterns of grizzly bear distribution into small, fragmented populations, some of which have high conservation risk due to those patterns (Figure 122a). The population south of Hwy 31A was estimated to hold 30 grizzly bears, an extremely small population if fragmentation patterns persist. It will be important to manage this area to ensure connectivity across Hwy 31A to alleviate this fragmentation pattern. Patterns in wolverine density (Mowat et al., 2020) suggest a similar threat of fragmentation may result from excessive recreational development of this sensitive area with otherwise limited options for connectivity (Figure 122b).

The biologists assembled in 2021 concluded that designating a multispecies wildlife corridor should be a top priority for this linkage area between Kokanee Glacier and Goat Range Provincial Parks. In addition, more science-based, Indigenous, and local knowledge is needed to inform conservation options and land use decisions this remote and wild region.

a) Grizzly Bear

b) Wolverine

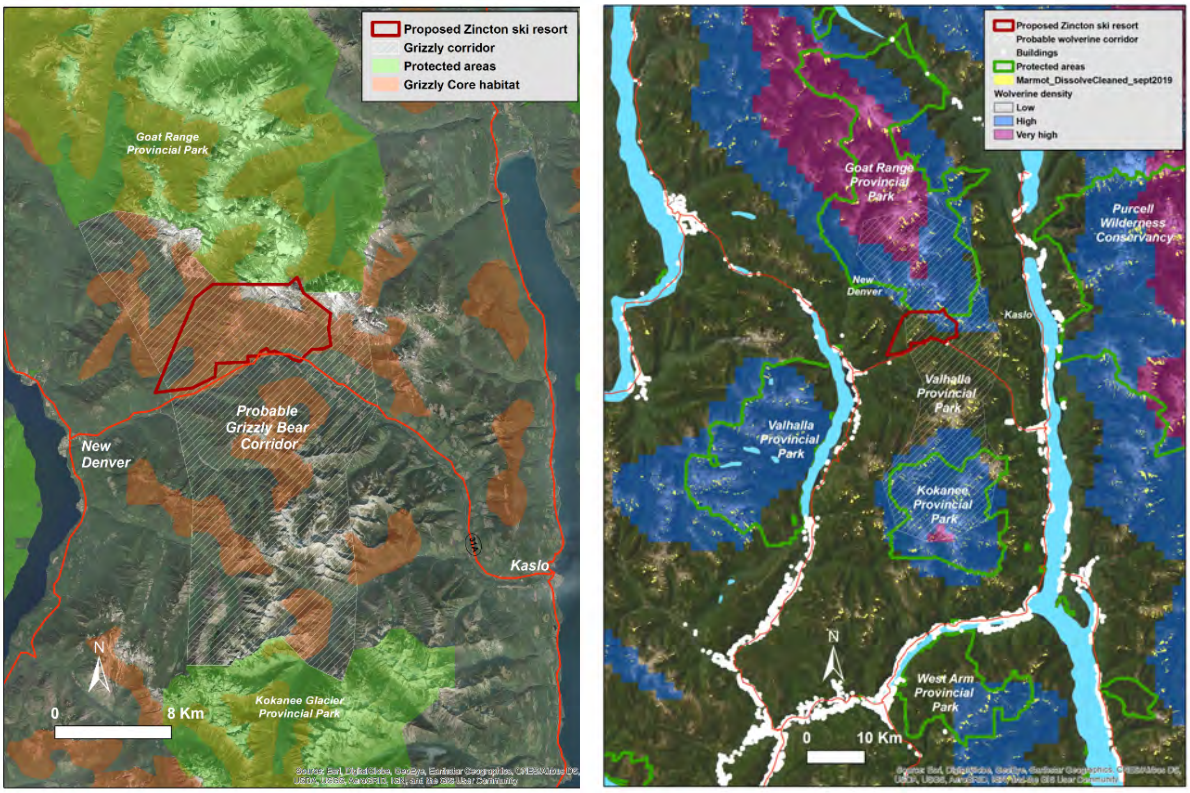


Figure 122. a) Grizzly bear core habitats (Proctor et al., 2015); and b) wolverine density (Mowat et al., 2020) in the Selkirk Mountains within a proposed corridor (white) centered on Retallack-Zincton area along Highway 31A that connects Kokanee Glacier and Goat Range Provincial Parks in relation to a proposed ski resort (red).

3.13 SOUTH SELKIRKS-LOWER COLUMBIA

3.13.1 GEOGRAPHIC DESCRIPTION

South Selkirks-Lower Columbia includes the southwestern portion of the South Selkirk Mountain Range north of the Canada-US border (Figure 123). The Salmo River drains the eastern portion, and the Columbia River drains the western portion. Just west of the Columbia River is the 964-ha Fort Shepherd Conservation Area which is the largest intact parcel of land within the rare, very dry, warm Interior Cedar Hemlock biogeoclimatic subzone of BC that holds an impressive diversity of flora and fauna. The combination of grasslands, brushlands, dry forests, cliffs, caves, wildlife trees, and dry rocky slopes provide excellent habitat for species at risk. As one moves toward the south and east the habitats become drier. Species at risk and of interest and concern include Monarch butterfly, little brown myotis bat, silver-haired bat, bank and barn swallows, black swift, bobolink, great blue heron, Lewis's woodpecker, western toad, North American racer, western painted turtle, western skink, grizzly bear, native bees and more. The area has a mosaic of landownership (Figure 124) and extensive disturbance and permanent loss of land and water from Teck Resources smelting and mining activities, hydroelectric dam and reservoir development, and large-scale timber harvesting (Figure 125).

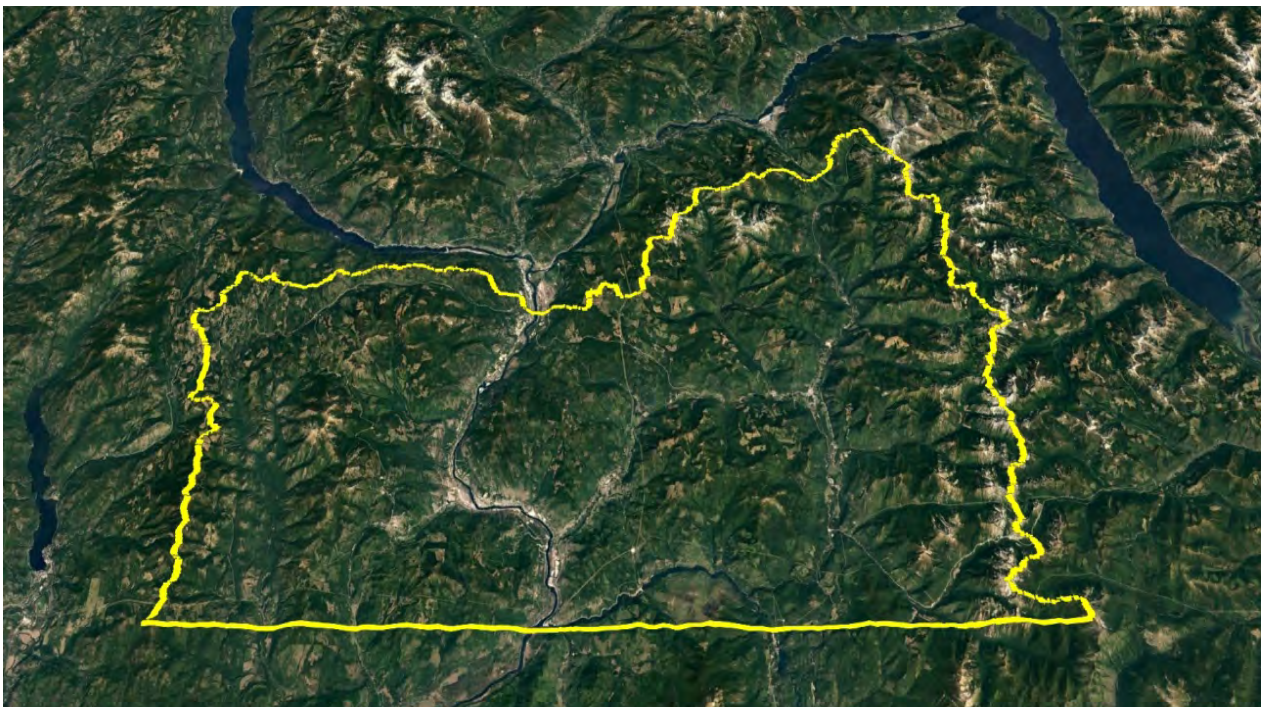


Figure 123. Google Earth view of the South Selkirks-Lower Columbia Corridor as defined by workshop participants. (Source: Kootenay Connect).

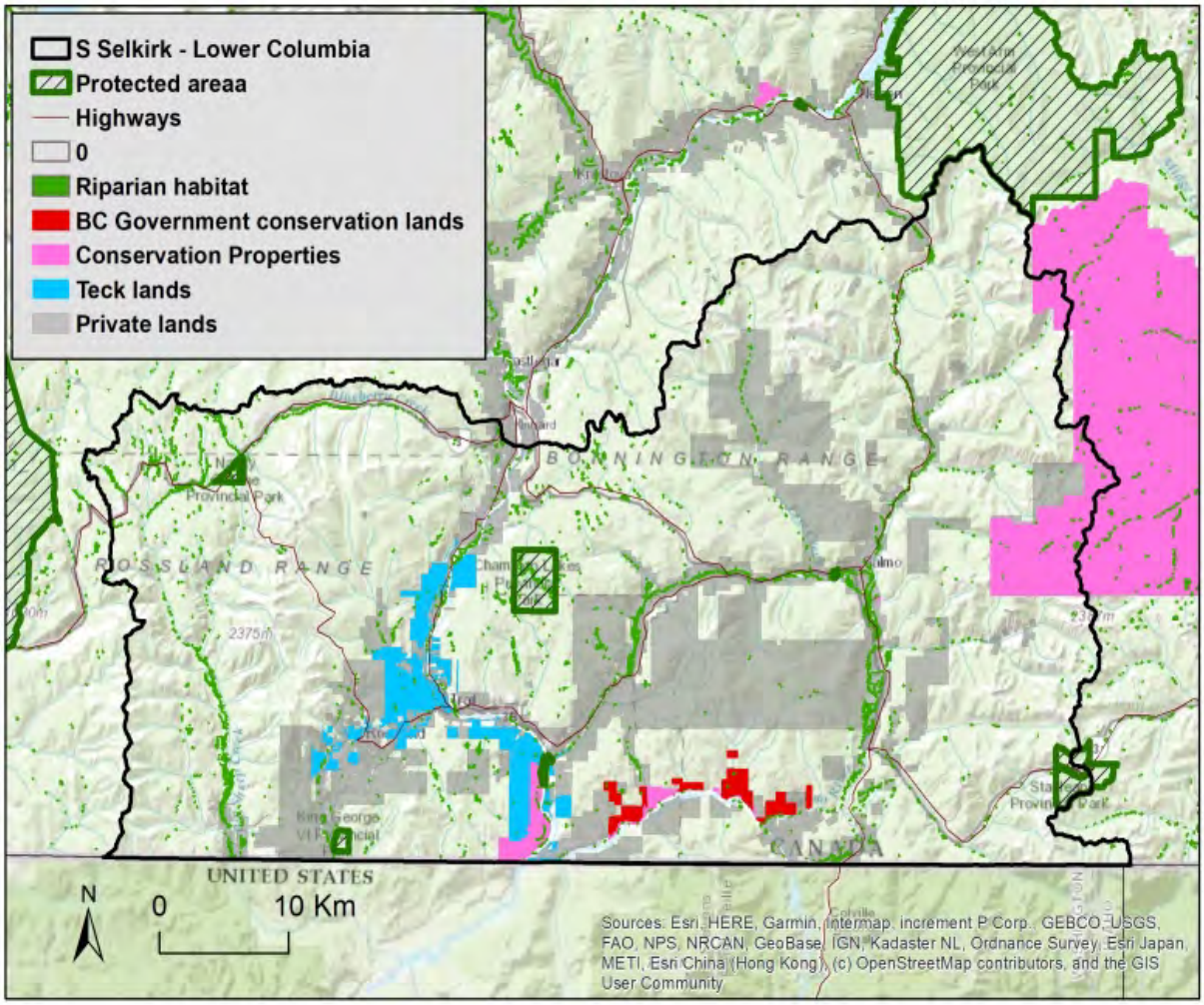


Figure 124. Landownership in the Lower Columbia-Pend d'Oreille is a complex patchwork of different land uses and development. (Source: Central Kootenay Invasive Species Society).

3.13.2 LEADING CONNECTIVITY CONSERVATION GROUPS & ALLIES

Okanagan Nation Alliance (ONA) and the Confederated Tribes of the Colville Reservation have a keen interest and long history stewarding the South Selkirks-Lower Columbia area. The Trail Wildlife Association (TWA) has been actively leading fish and wildlife projects in the area for many years as has the Salmo Watershed Streamkeepers Society, Kootenay Native Plant Society, Central Kootenay Invasive Species Society, and Wildlife Conservation Society Canada's bat conservation program. Independent biologists Marlene Machmer, Jakob Dulisse, and Greg Utzig have also been involved in delivering conservation research and strategy for this area. Land trusts such as, The Land Conservancy of BC, NCC, and NTBC have a long history of conserving private land; and Teck Resources Limited, the major industrial player in the area, has begun making conservation investments.

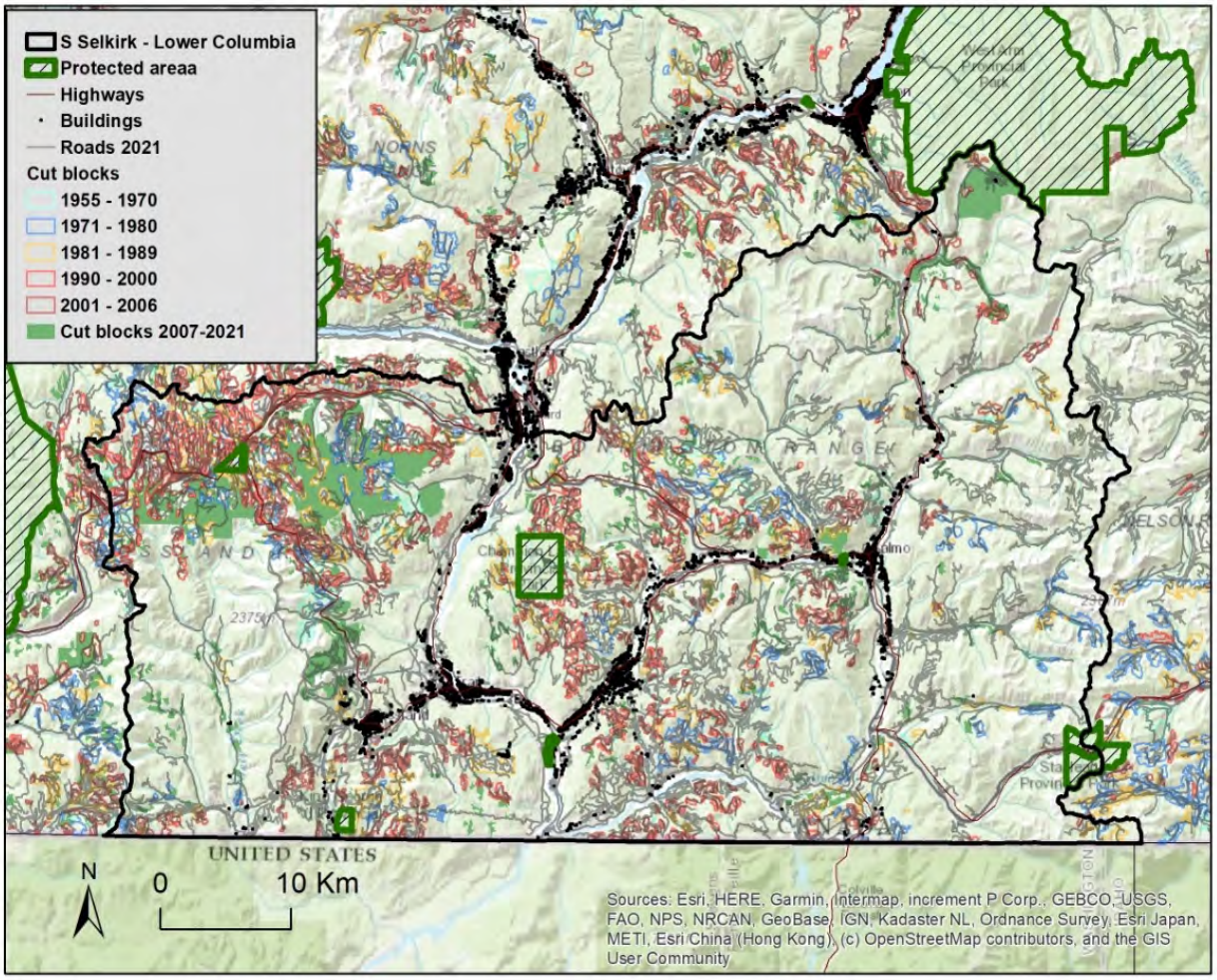


Figure 125. Human footprint, roads, buildings historic and recent logging blocks in the South Selkirk Lower Columbia are of southeast British Columbia. (Source: Kootenay Connect).

3.13.3 SOUTH SELKIRKS-LOWER COLUMBIA CONSERVATION ACTION FORUM AND KOOTENAY CONNECT WORKSHOP

In November 2022, Kootenay Connect co-hosted an in-person Conservation Action Forum with KCP, ONA, and TWA that focused on the South Selkirks-Lower Columbia area. We briefly report on the results here. For more details, refer to *South Selkirks-Lower Columbia Conservation Actions Summary Report* [34].

The Conservation Action Forum was designed to help participants develop on-the-ground solutions to mitigating threats in their local conservation neighbourhood. As a result of the

[34] https://kootenayconservation.ca/wp-content/uploads/2022/12/South-Selkirks-Lower-Columbia-CAF-Summary-Report_FINAL-01Dec2022.pdf

Forum, Kootenay Connect has been encouraging the formation of a corridors steering committee in the South Selkirks-Lower Columbia to champion connectivity in the region. Kootenay Connect will continue to provide strategic support for identifying multi-species wildlife corridors and connectivity as well as data and maps that help inform local, regional, and provincial government decision-making. In addition, we will continue to explore ways to bring species at risk information (Figure 126, 127, 128) into the process of corridor identification as well as encourage a climate change lens to the necessity of connectivity so wildlife and ecosystems can shift with a changing climate.

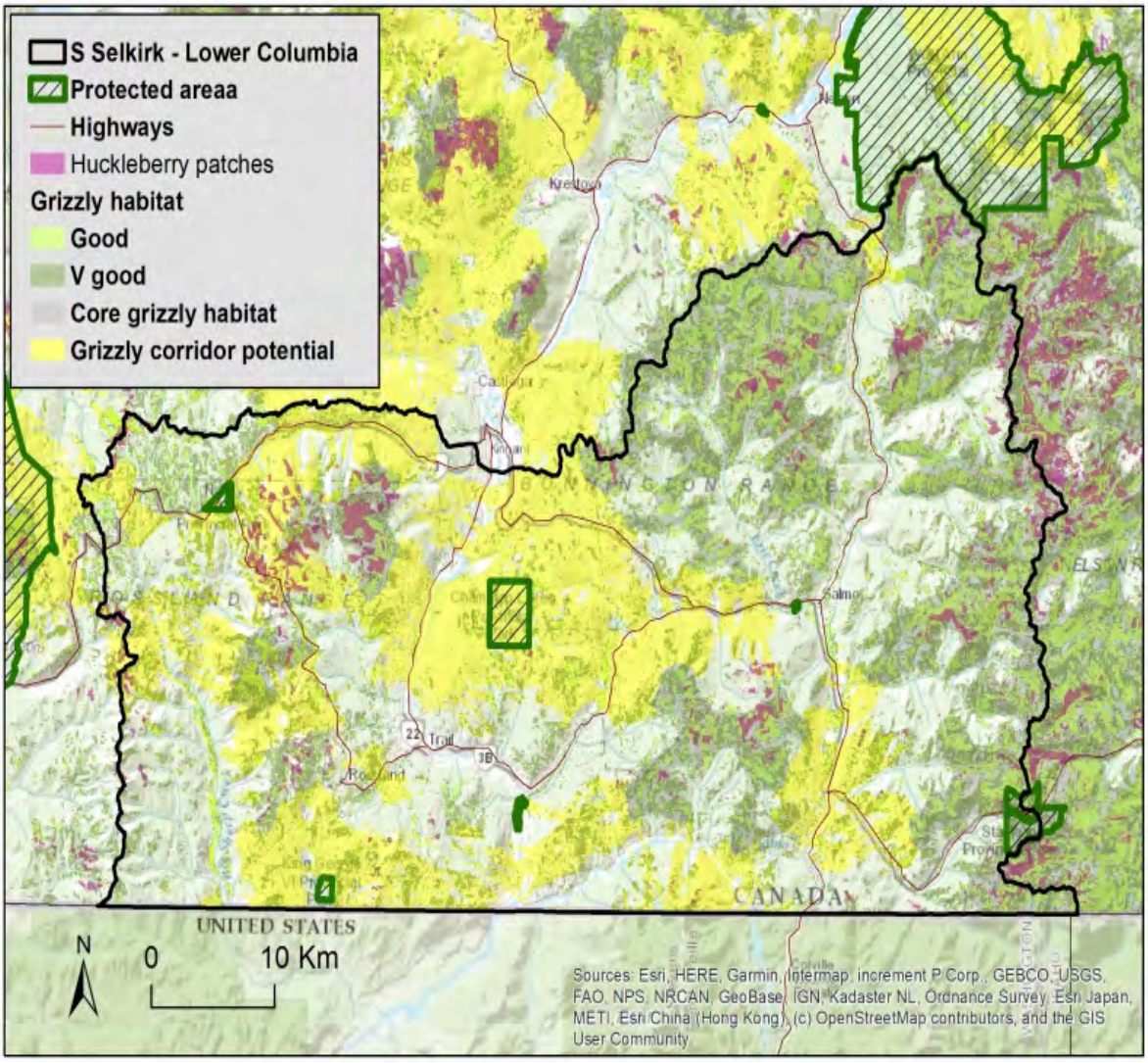


Figure 126. Grizzly bear habitat, huckleberry patches, and potential movement corridors in the South Selkirk Lower Columbia area of southeast British Columbia. (Source: Proctor et al., 2015).

Figure 127. Dens of at risk North American racers frequently occur on private land in the Lower Columbia River-Pend d'Oreille. (Photos: Jakob Dulisse).

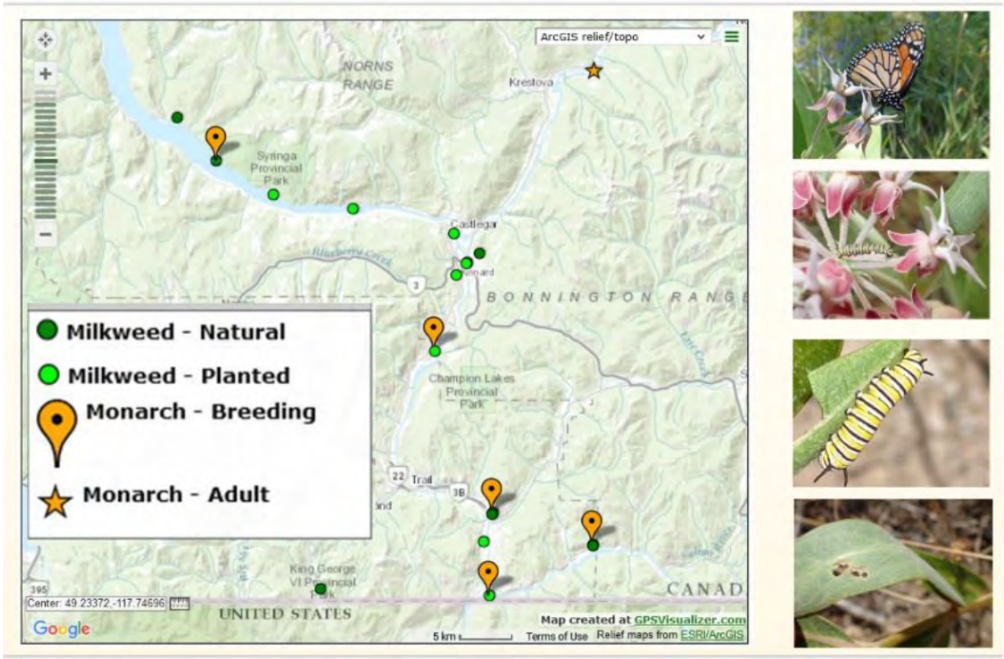


Figure 128. Monarch butterfly breeding sites in natural and planted patches of showy milkweed. Existing populations of which (dark green) need to be connected using new plantings (light green) to create a Monarch-friendly landscape in the Lower Columbia region. (Source: Valerie Huff, Kootenay Native Plant Society).

Predicted Wildlife and Climate Change Corridors

Multiple highways, utility corridors, human settlements, mining operations, dams, reservoirs, and logging have fragmented habitat throughout the South Selkirks-Lower Columbia (Figure 125). Proctor (2022) used an existing habitat model for grizzly bears to propose wildlife corridors with an eye on riparian-wetland complexes in the valley bottoms. Ten possible wildlife corridors were identified for the South Selkirks-Lower Columbia (Figure 129a) that provide a starting place for taking a landscape-level approach to identifying multiple corridors across this region. While all of these corridors are important and open to adjustment through local expertise, three corridors (indicated in red arrows in Figure 129a) should have a higher priority: Apex Creek headwaters – south of Nelson along Highway 6, Fort Shephard – Highway 22A across the Columbia River, and Fruitvale – Park Siding along Highway 3B. Yellow and blue arrows indicate potential corridors of intermediate and lower priority, respectively.

At the Conservation Action Forum, Utzig (2022) provided information on how climate change will disrupt ecosystems in the area and proposed a draft conservation plan that would provide increased climate change resilience by conserving key habitats and increasing linkages across the landscape (Figure 129b). As climate change proceeds, habitat connectivity will be key to allowing species to shift their ranges in response to changing conditions. His connectivity corridors modelling is based on climate models, topography, habitat mapping, wetlands, old growth, intactness, existing conservation lands, protected areas, and species at risk. There are similarities between the proposed wildlife and biodiversity corridors in Figure 129a and the climate corridors in Figure 129b.

3.13.4 PRIORITY CONSERVATION ACTIONS FOR THE SOUTH SELKIRK-LOWER COLUMBIA CORRIDOR

The Conservation Action Forum integrated science and local and traditional knowledge to analyze conservation values and threats and prioritize actions to inform conservation action plans and inspire collaborations. Here we briefly summarize the six conservation priorities generated by workshop participants. The complete list of recommendations from local workshop participants can be viewed in the *South Selkirks-Lower Columbia Conservation Action Forum report*[35]

- Develop and protect native seed sources for focal plant species (e.g., milkweed for Monarch butterflies).

[35] https://kootenayconservation.ca/wp-content/uploads/2022/12/South-Selkirks-Lower-Columbia-CAF-Summary-Report_FINAL-01Dec2022.pdf

- Preserve existing camas fields – culturally important plants for First Nations.
- Identify, protect, and build resiliency for local biodiversity and species at risk (e.g., riparian and wetland areas, mature cottonwood stands).
- Build community support and capacity for prescribed fire and fire management.
- Manage and develop public support for invasive species.
- Take a landscape level approach to ecological connectivity.

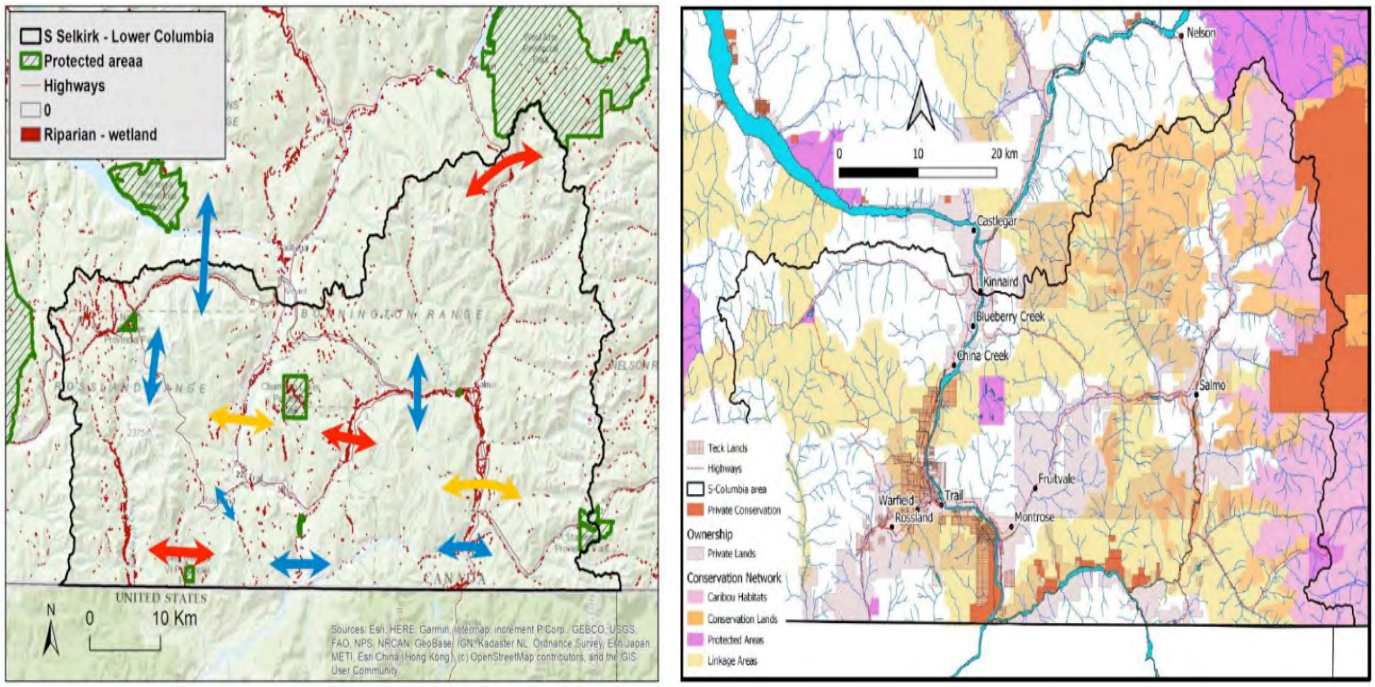


Figure 129.a) Proposed wildlife corridors in the South Selkirks-Lower Columbia area developed from grizzly bear data in relation to riparian-wetland complexes and human settlement patterns (Source: M. Proctor, 2022); and b) potential connectivity corridors that might improve climate change resilience by providing refugia and connectivity for shifting habitats and species ranges. (Source: G. Utzig, 2022).

Kootenay Connect has recommended the South Selkirks-Lower Columbia region create a working group to develop a unified approach and narrative to guide their collective work across multiple jurisdictions and ecosystems for landscape level connectivity and climate resilience.

4 SUMMARY OF OUTCOMES AND RECOMMENDATIONS

4.1.1 KEY CONSERVATION OUTCOMES

To date, Kootenay Connect Community-Nominated Priority Places and our partners have collectively delivered over 50 subprojects. Below are examples of what's been achieved and the conservation impact. For a more comprehensive discussion of the projects within each focal area, see Section 3 Results.

Numerous field studies on species at risk
Annually monitoring North American Bat grid cells in all Kootenay Connect focal corridors for the 13 species of bats found in the region
Field surveys documenting Lewis's woodpecker and osprey nests, western painted turtle sites, and American badger burrows in and adjacent to the Columbia Wetlands
Continuing to add to an extensive species inventory in the Bonanza Biodiversity Corridor of 1,425 unique species being recorded with 55 of them federally listed species at risk
Examining 79 natural levee openings and 359 beaver dams to determine the critical importance of beaver activity for hydrological function of the Columbia Wetlands and its potential to mitigate the impacts from climate change
Key habitat restorations
Enhancing 5 km^2 of wetland & riparian habitat in the Creston Valley Wildlife Management Area that has benefitted the endangered northern leopard frog
Excavating a series of earthen swales to reconnect wetlands across a rail trail berm and installing a recreational walkway to permit water flow and protect vulnerable migrating western toadlets moving underneath
Completing over 90 ha of forest thinning projects to enhance grassland & dry forest habitat to benefit Williamson's sapsucker, Lewis's woodpecker and American badger
Planting over 2,000 native trees and shrubs in wetland and riparian areas
Managing over a dozen invasive plants to improve grasslands and riparian areas

Enhancement of habitat features
Installing 24 western painted turtle basking logs, securing 2 important turtle nesting beds, and constructing beaver dam analogues to retain water in vulnerable wetlands
Creating 29 tree roosts using artificial BrandenBark™ and wildlife tree roosts to mimic old growth and improve nearly 75,000 ha of habitat for bats
Installing 20 km of wildlife-friendly fencing to improve grassland and dry forest habitat
Mapping and assessments to inform project planning
Using LiDAR, Terrestrial Ecosystem Mapping (TEM), orthophotos, and remote sensing to produce some of the first landscape level maps and classified habitat types for the Columbia Wetlands and Bonanza Biodiversity Corridor
Identifying and assessing the hydrology of vulnerable wetlands and the need for enhanced hydrological connection between the Columbia River and Wetlands
Identifying multi-species corridors for six target carnivore and ungulate species
Identifying climate change refugia and corridors for Kootenay Connect's landscapes
Projects achieving important conservation measures
Submitting applications for designating Wildlife Habitat Features to protect mountain goat mineral licks and for registering 790 functioning badger burrows
Submitting applications for designating Wildlife Habitat Areas for great blue heron, American badger, and the rare alkali saltgrass–foxtail barley ecological community
Documenting new active Lewis's woodpecker nests informed our recommendations to expand critical habitat under the federal Species at Risk Act when the recovery strategy is revised
Acquiring 3 conservation properties in Kootenay Connect focal corridors totaling 126 ha by The Nature Trust of BC and Nature Conservancy of Canada

4.1.2 RECOMMENDATIONS MOVING FORWARD

We found there are consistent and similar conservation values and threats within Kootenay Connect's 12 focal corridors (Table A-1 through Table A-5 in Appendix B) yet with just enough variation to illustrate that there is no cookie-cutter approach to address connectivity in the region. Selection of specific tools and who could lead conservation and stewardship activities

must consider both a place-based and regional understanding of threats to successfully address loss of biodiversity and habitat and to mitigate the impacts of climate change if ecosystems in the Kootenays are to become more resilient. In Table 5 we offer a place to start.

Looking across Kootenay Connect's 12 focal corridors at a high level, we recommend:

1. Including local First Nations' knowledge and perspectives into the visioning and planning of landscape level conservation in a manner that respects Indigenous leadership, values, rights, and practices.
2. Improving efforts to inventory species at risk and other locally and culturally important species to capture existing biodiversity.
3. Prioritizing the identification of critical habitats and biodiversity hotspots to increase opportunities for their protection.
4. Utilizing Kootenay Connect's mapping of connectivity areas that link valley bottoms with riparian-wetland areas to upland habitat to guide protection of species whose inter-seasonal and inter-generational life cycles and migrations span the riparian-upland interface, such as western toad, western painted turtle, great blue heron, and western screech-owl.
5. Examining where pinch point locations occur across roadways that could be addressed with wildlife crossing structures and continuing to work with researchers who bring forward new data to optimize locations of wildlife corridors and highway crossing hotspots.
6. Increasing the effectiveness of measures to reduce recreational access and pressures impacting species at risk, high-quality habitats, and connectivity by identifying access management areas in and adjacent to Kootenay Connect's corridors.
7. Assessing landscapes in terms of conservation opportunities for both private and public land, for example, being creative about how land trust acquisitions can complement provincial conservation land designations such as Wildlife Management Areas and Wildlife Habitat Areas that benefit species at risk.
8. Viewing landscape-scale processes such as fire dynamics, forest regeneration, invasive species management, predator-prey cycles, hydrologic fluctuations, and climate change as necessitating the integration of private and public land management solutions.
9. Ensuring all conservation strategies are developed through a climate change adaptation lens so there are a variety of options that will allow management actions to be more adaptive to unpredictable consequences such as catastrophic fires.

10. Enhancing riparian-wetland hydrologic connectivity throughout the region to increase climate resilience and mitigate drought such as, reconnecting wetlands within floodplains, reopening vegetation-choked channels, and beaver enhancement through reintroduction or dam analogues.
11. Identifying and developing, where needed, best management practices for target species in corridors to guide human behaviours and activities that are compatible and support coexistence with wildlife.
12. Developing a communications package that summarizes for the public and politicians the benefits and necessity of establishing Ecological Corridors for the health of ecosystems, biodiversity conservation, and resilience to climate change impacts.
13. **Facilitating dialogues between all levels of government and First Nations to advance a multi-agency landscape approach to connectivity conservation that will secure safe passage for wildlife and enhance climate change resilience.**
14. **Developing a collaborative process to develop a Wildlife and Ecological Corridors Plan that leads to formal designation of Wildlife and Ecological Corridors in landscapes important for connectivity in the Kootenay region.**

Conserving connectivity is critical to maintaining the biological and ecological resilience of the Kootenay region. Our last two recommendations are bolded because based on the past four years of research, workshops, and meetings throughout the Kootenays, we believe it's imperative to begin envisioning a process to formally designate a network of Wildlife and Ecological Corridors with federal, provincial, First Nation, and regional district governments, and land trusts. This type of cooperation is necessary to develop and implement a connectivity conservation strategy and best management practices for the Kootenay region as a model for British Columbia and Canada that will elevate connectivity into legislative, policy, and regulatory arenas for the benefit of nature and humanity.

Table 5. Summary of recommended priority Actions for Kootenay Connect's 12 focal corridors.

These priority actions for Kootenay Connect's (KC) 12 focal corridors were synthesized after extensive consultation with local independent and government biologists, stewardship and conservation organizations, Regional District planners, and First Nations.

Conservation values	Priority actions	Tools	Who
Biodiversity & SAR inventory	SAR critical habitat mapping	Biological assessment	MWLRS, MOF, KC, First Nations
	Identify biodiversity hotspots	Biological assessment	MWLRS, MOF, KC, First Nations
Identify and protect high-quality habitats	Private land - develop farm/ranch biodiversity plans	Conservation values assessment	Farmland Advantage
	Private land purchase of conservation lands	Conservation values assessment	NCC, NTBC, KCP, KC
	Work with RDEK/RDCK to use Development Permit Areas to protect Environmentally Sensitive Areas/Environmental Development Permit Areas (ESAs/EDPAs)	Regional District development permit regulations and Official Community Plans	RDEK, RDCK, KCP, KC
	Provincial lands - restore and/or protect high quality habitats	WMA expansion, WHA WHF designations	MWLRS, KC
	Federal lands - restore and/or protect high quality habitats	Migratory Bird Sanctuaries, Key Biodiversity Areas	CWS, KC
Propose designation for Ecological Corridor status	Cooperatively work towards developing a process and legal designation (if appropriate) for Ecological Corridors with all levels of government	Multi-agency strategic collaborations focused on information and data sharing, landscape scale analysis, and corridor conservation planning	KC, Ktunaxa Nation Council, Shuswap Band, Prov of BC, BC Parks, Parks Canada

Conservation values	Priority actions	Tools	Who
Access management planning in upland corridors	Open dialogue and information sharing with Provincial government regarding access management	Work to develop agreements with recreation and other interest groups and Provincial government during processes to assess access management	Prov of BC, conservation and recreation groups
Manage recreational pressure	Assess important habitats possibly degraded by increasing recreational activities and infrastructure	Work with recreational groups, regional and provincial governments	Local stewardship groups, KC, RDEK, RDCK, Prov of BC
Manage and monitor invasive species to protect sensitive areas	Prevent introduction of new invasive species and contain/ prevent spread of existing ones	Control, inventory and monitor species within Invasive Plant Management Areas	Prov of BC, invasive species organizations
Manage for climate change	Manage for reduced fire severity on lower slopes in climate corridors	Fire interface planning	Prov of BC, First Nations Emergency Services, Ktunaxa Nation Council, Shuswap Band, Regional Districts, NCC, NTBC
	Develop a Climate Change Adaptation Strategy for the Kootenay Region	Expert analysis (e.g., Holt and Utzig)	KC, Kutenai Nature Investigations, CWSP, SLSS, Prov of BC
	Identify and protect wet, cool old-growth patches	Habitat mapping/WHA designation	Prov of BC, NCC, NTBC
Climate change – intra-wetland hydrologic connectivity	Restore hydro connectivity where most needed	Channel dredging; culvert placement; beaver habitat enhancement and reintroduction	CVWMA, Lower Kootenay Band, CWSP, SLSS

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APPENDIX A: KOOTENAY CONNECT PARTNERS

Kootenay Connect engages many partners within a large network of independent and government biologists, stewardship groups, land trusts, First Nations, Regional District planners, and provincial land managers. Our list of collaborators has grown substantially since October 2018 when Kootenay Conservation Program and the Trans-border Grizzly Bear Project sponsored a workshop dedicated to connectivity with a dozen initial partners (*).

Current Partners and Collaborators of Kootenay Connect:

- BC Ministry of Forests, Habitat and Ecosystem Section*
- BC Ministry of Water, Land & Resource Stewardship
- BC Parks
- Calgary Zoo
- Canal Flats Wilderness Club*
- Cirque Environmental
- Columbia Wetlands Stewardship Partners*
- Creston Valley Wildlife Management Area*
- Ducks Unlimited Canada
- East Kootenay Invasive Species Council
- East Kootenay Wildlife Association*
- EcoLogic Consulting, Ltd.
- Elkford Rod and Gun Club
- Farmland Advantage
- Fish & Wildlife Conservation Program
- Goldeneye Ecological Services
- Integrated Ecological Research
- Keefer Ecological Consulting
- Kootenay Centre for Forestry Alternatives
- Kootenay Conservation Program*
- Ktunaxa Nation Council
- Kutenai Nature Investigations*
- Lake Windermere District Rod & Gun Club*
- Living Lakes Canada
- MacDonald Hydrology Consultants, Ltd.
- Momentum Mountain Solutions, Ltd.
- Mountain Station Consultants
- Nature Conservancy of Canada*
- North Kootenay Consulting Services, Ltd.
- Northern Leopard Frog Recovery Team
- Okanagan Nation Alliance
- Pandion Ecological Research, Inc.*
- Parks Canada
- Regional District of Central Kootenay
- Regional District of East Kootenay
- Shuswap Band
- Slocan Lake Stewardship Society
- Slocan River Streamkeepers Society
- Slocan Wetlands Assessment & Monitoring Project
- Sparwood Fish and Wildlife Association
- The Nature Trust of BC*
- Trans-border Grizzly Bear Project*
- University of Lethbridge
- University of Waterloo
- Upstream Ecological Consulting
- Vivid Consulting
- Wetland Restoration and Training, LLC
- Wildlife Conservation Society of Canada
- Wildsight (Regional and Branches: Creston, Elk Valley, Golden, Invermere)
- Yellowstone to Yukon Conservation Initiative

APPENDIX B: SUMMARY TABLES OF CONSERVATION TARGETS & THREATS IN 12 FOCAL CORRIDORS

Table A-1. Species at Risk (SAR) plus ecologically and culturally important species within Kootenay Connect's 12 focal corridors.

This is the result of extensive consultation with local species at risk biologists (independent and government), local stewardship groups, conservation organizations, First Nations, and literature reviews. "●" in the columns indicates that these species are at-risk and locally important, of high conservation value, and therefore deserving attention within the indicated focal corridor.

SAR and Other Important Species	Focal Corridor											
Species Common Name	Creston Valley	Bonanza	Columbia Wetlands	Wycliffe	Duncan Lardeau	Columbia Lake	Golden	Slocan Valley	South Country	South Selkirks-Lower Columbia	Retallack	Elk Valley
Checkered Skipper										●		
Dun Skipper										●		
Gillette's Checkerspot												●
Immaculate Green Hairstreak										●		
Monarch Butterfly										●		
Sagebrush Tiger Beetle										●		
Silver-spotted Skipper										●		
Twelve-spotted Skimmer (dragonfly)										●		
Vivid Dancer (damselfly)						●		●		●		
Western Bumblebee		●						●				
Coeur d'Alene Oregonian Snail	●	●						●		●		
Coeur d'Alene Salamander	●	●			●			●		●		

SAR and Other Important Species	Focal Corridor											
Species Common Name	**Creston Valley**	**Bonanza**	**Columbia Wetlands**	**Wycliffe**	**Duncan Lardeau**	**Columbia Lake**	**Golden**	**Slocan Valley**	**South Country**	**South Selkirks-Lower Columbia**	**Retallack**	**Elk Valley**
Jumping Slug	●											
Magnum Mantleslug										●		
Pale Jumping Slug										●		
Pygmy Slug										●		
Sheathed Slug										●		
Freshwater Mussels									●			
Herrington Fingernailclam										●		
Striated Fingernailclam										●		
Rocky Mountain Ridged Mussel	●			●		●	●					
Columbia Spotted Frog	●	●	●		●	●		●			●	
Northern Alligator Lizard	●	●			●			●	●			
Northern Leopard Frog	●		●	●								
North American Racer										●		
Northern Rubber Boa	●			●		●		●	●	●		
Rocky Mountain Tailed Frog									●			●
Western Toad	●	●	●		●	●		●	●	●	●	●
Western Painted Turtle	●	●	●	●	●	●	●	●	●	●		●
Western Skink	●	●						●		●		
Bull Trout	●	●	●	●	●	●	●	●	●	●		●
Burbot	●	●	●	●		●	●		●			
Umatilla Dace		●								●		

SAR and Other Important Species	Focal Corridors											
Species Common Name	**Creston Valley**	**Bonanza**	**Columbia Wetlands**	**Wycliffe**	**Duncan Lardeau**	**Columbia Lake**	**Golden**	**Slocan Valley**	**South Country**	**South Selkirks-Lower Columbia**	**Retallack**	**Elk Valley**
Kokanee	●	●	●	●	●	●	●	●	●	●		
Gerrard Rainbow Trout					●							
Mountain whitefish									●			
Rainbow trout								●		●		
Salmon reintroduction						●		●				
Columbia Sculpin		●	●					●		●		
Shorthead Sculpin								●		●		
Rocky Mountain Sculpin												●
Sculpin spp.			●	●		●	●	●		●		
Westslope Cutthroat	●	●	●	●		●	●	●	●	●		●
White Sturgeon Columbia R pop								●		●		
White Sturgeon Kootenay R pop	●				●							
American Avocet	●		●						●	●		
American Bittern	●		●	●		●	●			●		●
American Dipper		●			●			●			●	
American White Pelican	●								●			
Bank Swallow	●	●	●	●		●	●	●	●	●		●
Barn Swallow	●	●	●	●	●	●	●	●		●		●
Black Swift		●			●		●	●		●		
Bobolink	●		●	●	●	●	●		●	●		
Clark's Nutcracker		●	●		●	●	●	●	●		●	●
Common Nighthawk	●	●	●	●	●	●	●	●	●	●		

SAR and Other Important Species	Focal Corridors											
Species Common Name	**Creston Valley**	**Bonanza**	**Columbia Wetlands**	**Wycliffe**	**Duncan Lardeau**	**Columbia Lake**	**Golden**	**Slocan River**	**South Country**	**South Selkirks-Lower Columbia**	**Retallack**	**Elk Valley**
Double-crested cormorant	●											
Eared Grebe		●	●			●	●		●	●		
Flammulated Owl			●	●		●			●			
Forster's Tern	●			●								
Goshawk									●	●		●
Great Blue Heron	●	●	●	●	●	●	●	●	●	●	●	●
Great Gray Owl								●				
Horned Grebe			●			●	●			●		
Kingfisher		●						●				
Lewis's Woodpecker			●	●		●		●	●	●		●
Long-billed Curlew	●		●	●		●	●		●			
Olive-sided flycatcher		●			●			●		●		
Osprey		●	●		●			●				
Pacific Wren								●				
Peregrine Falcon *anatum*	●		●			●	●		●			●
Pied-billed Grebe			●			●	●		●			
Pileated woodpecker		●			●							
Sandhill Crane	●		●	●		●	●		●			
Sharp-tailed Grouse						●						
Short-eared Owl	●		●			●	●			●		
Sora									●			
Spotted sandpipers												●
Vaux Swift	●							●				

SAR and Other Important Species	Focal Corridors											
Species Common Name	Creston Valley	Bonanza	Columbia Wetlands	Wycliffe	Duncan Lardeau	Columbia Lake	Golden	Slocan River	South Country	South Selkirks-Lower Columbia	Retallack	Elk Valley
Western Grebe	●	●	●		●	●	●		●	●		
Western Screech-Owl	●		●		●	●		●	●	●		●
Williamson's Sapsucker				●					●			
Yellow-breasted chat										●		
American Badger			●	●		●	●		●	●		●
American Beaver	●	●	●	●	●	●	●	●	●	●	●	●
American Marten		●			●		●	●			●	●
Black bear		●							●		●	●
Big Brown Bat			●	●		●	●	●	●	●		
California Myotis					●							
Canada Lynx												●
Cougar									●			●
Fringed Myotis	●									●		
Grizzly Bear	●	●	●	●	●	●	●	●	●	●	●	●
Hoary Bat							●			●		●
Little Brown Myotis	●	●	●	●	●	●	●		●	●		●
Long-eared Myotis					●		●	●				
Long-legged Myotis					●		●					
Moose		●	●	●	●	●	●		●	●	●	●
Mountain Caribou		●	●		●	●	●			●	●	
Mountain Goat		●	●	●	●	●	●	●		●	●	●
Mule Deer			●	●	●	●	●		●			●
Muskrat			●			●			●		●	
Northern Myotis			●	●	●	●	●					

SAR and Other Important Species	Focal Corridors											
Species Common Name	**Creston Valley**	**Bonanza**	**Columbia Wetlands**	**Wycliffe**	**Duncan Lardeau**	**Columbia Lake**	**Golden**	**Slocan River**	**South Country**	**South Selkirks-Lower Columbia**	**Retallack**	**Elk Valley**
Northern Pocket Gopher	●		●			●			●			
Porcupine			●	●		●	●	●	●	●	●	
Red-tailed Chipmunk	●											
River Otter		●			●			●				
Rocky Mt Bighorn Sheep			●	●		●	●		●			●
Rocky Mt Elk	●	●	●	●		●	●	●	●			●
Silver-haired Bat			●	●		●	●	●	●	●		●
Townsend's Big-eared Bat	●		●	●	●	●	●	●	●	●		
Wolf		●	●	●		●			●			●
Wolverine		●	●		●		●	●		●	●	●
Yuma Myotis			●	●	●	●	●		●	●		
Antelope Bitterbrush				●								
Columbia Quillwort										●		
Dwarf Hesperochiron										●		
Forest Clarkia										●		
Hairy Paintbrush										●		
Least Bladdery Milk-vetch										●		
Long-leaved Aster										●		
Montana Larkspur									●			
Mountain Moonwort		●										
Pinewood Peavine									●			

SAR and Other Important Species	Focal Corridors											
Species Common Name	**Creston Valley**	**Bonanza**	**Columbia Wetlands**	**Wycliffe**	**Duncan Lardeau**	**Columbia Lake**	**Golden**	**Slocan River**	**South Country**	**South Selkirks-Lower Columbia**	**Retallack**	**Elk Valley**
Spalding's Campion									●			
Spurless Touch-me-not										●		
Sweet-marsh Butterweed										●		
Tall Beggarticks										●		
Traditionally important plants (e.g., bitterroot, balsamroot, Camas, elderberry, highbush cranberry, huckleberry, roses, saskatoon, soapberry, wapato)	●	●	●	●	●	●	●	●	●	●	●	●
Western Wallflower										●		
Wild Licorice										●		
Limber Pine			●			●	●					
Ponderosa Pine	●			●					●			
Western Larch				●					●			
Whitebark Pine	●	●	●	●	●	●	●	●			●	●

Table A-2. Important habitat types within Kootenay Connect's 12 focal corridors.

These habitats were identified through extensive consultation with local species at risk biologists (independent and government), local stewardship groups, conservation organizations, First Nations, and literature reviews. "●" in the columns indicates that these habitats are important, and of high conservation value, and therefore deserving attention within the indicated focal corridor. Bolded habitats have high conservation value across all 12 focal corridors.

Important habitats	Creston	Bonanza	Columbia Wetlands	Wycliffe	Duncan Lardeau	Columbia Lake	Golden	Slocan Valley	South Country	South Selkirks-Lower Columbia	Retallack	Elk Valley
Alluvial fans / creek mouths	●	●	●	●	●	●	●	●	●	●	●	●
Alpine & high elevation grasslands		●	●		●	●					●	●
Camas meadows										●		
Fescue grasslands									●	●		
Grassland open forest	●		●	●	●	●	●		●	●		
Ground-surface water interface	●	●	●	●	●	●	●	●	●	●	●	●
Inland temperate rainforest		●					●	●			●	
Interconnected floodplain, wetlands	●	●	●		●	●	●	●				●
Lake foreshore	●	●	●	●	●	●			●		●	

Important habitats	Creston	Bonanza	Columbia Wetlands	Wycliffe	Duncan Lardeau	Columbia Lake	Golden	Slocan Valley	South Country	South Selkirks-Lower Columbia	Retallack	Elk Valley
Low elevation old growth DF, PP, Cedar	●	●	●	●	●	●	●	●	●			●
Mature aspen			●	●		●	●					●
Mature riparian cottonwoods forests	●	●	●	●	●	●	●	●		●		●
Mid elevation/ benchland wetlands		●	●			●						
Milkweed patches										●		
Old growth western larch				●					●			
Ponds & Lakes	●	●	●	●	●	●	●	●	●	●	●	●
Riparian areas	●	●	●	●	●	●	●	●	●	●	●	●
Rivers & streams	●	●	●	●	●	●	●	●	●	●	●	●
Shallow open water	●	●	●		●	●	●	●			●	
Western red cedar-skunk cabbage		●								●		
Wetlands	●	●	●	●	●	●	●	●	●	●	●	●

Table A-3. Important Wildlife Habitat Features within Kootenay Connect's 12 focal corridors.

These wildlife features were identified through extensive consultation with local species at risk biologists (independent and government), local stewardship groups, conservation organizations, First Nations, and literature reviews. "●" in the columns indicates that these features are important, of high conservation value, and therefore deserving attention within the indicated focal corridor. Bolded features are important across all 12 focal corridors.

Habitat features	Creston	Bonanza	Columbia Wetlands	Wycliffe	Duncan Lardeau	Columbia Lake	Golden	Slocan Valley	South Country	South Selkirks-Lower Columbia	Retallack	Elk Valley
Abandoned buildings	●		●		●	●	●	●	●	●		●
Avalanche chutes					●		●				●	
Bat hibernacula	●	●	●	●	●	●	●	●	●	●	●	●
Burrows/denning areas	●	●	●	●	●	●	●	●	●	●	●	●
Calcareous rocks/soils	●	●	●	●	●	●	●	●		●		
Climate change refugia	●	●	●	●	●	●	●	●	●	●	●	●
Climax grasslands	●		●	●		●	●		●	●		●
Cold water sources		●	●		●			●				●
Fish feeding/rearing areas	●	●	●	●	●	●	●	●	●	●		●
Fish spawning beds	●	●	●	●	●	●	●	●	●	●		●
Huckleberry patches	●	●	●	●	●	●	●	●	●	●	●	●
Ice fields / glaciers			●		●	●	●					
Mainstem spawning habitat	●	●	●	●	●	●	●	●	●	●		●

Habitat features	Creston	Bonanza	Columbia Wetlands	Wycliffe	Duncan Lardeau	Columbia Lake	Golden	Slocan Valley	South Country	South Selkirks-Lower Columbia	Retallack	Elk Valley
Migratory stopover sites	●	●	●	●	●	●	●	●	●	●		
Mineral licks	●	●	●	●	●	●	●	●	●	●	●	●
Nesting/roosting sites	●	●	●	●	●	●	●	●	●	●	●	●
Rock caves	●	●	●	●	●	●	●	●	●	●	●	●
Rocky outcrops	●	●	●	●	●	●	●	●	●	●	●	●
Snake hibernacula								●		●		
Steep sided slope clay banks			●	●		●	●		●			
Ungulate winter range	●	●	●	●	●	●	●	●	●	●		●
Wildlife corridors	●	●	●	●	●	●	●	●	●	●	●	●
Wildlife trees	●	●	●	●	●	●	●	●	●	●	●	●

Table A-4. Key ecological processes within Kootenay Connect's 12 focal corridors.

These ecological processes were identified through extensive consultation with local species at risk biologists (independent and government), local stewardship groups, conservation organizations, First Nations, and literature reviews. "●" in the columns indicates that these ecological processes are important, of high conservation value, and therefore deserving attention within the indicated focal corridor. Bolded ecological processes are important across all 12 focal corridors.

Ecological processes	Creston	Bonanza	Columbia Wetlands	Wycliffe	Duncan Lardeau	Columbia Lake	Golden	Slocan Valley	South Country	South Selkirks-Lower Columbia	Retallack	Elk Valley
Beaver wetland creation	●	●	●		●	●	●	●	●	●	●	
Breeding & nesting	●	●	●	●	●	●	●	●	●	●	●	●
Carbon storage	●	●	●	●	●	●	●	●	●	●		
Elevational connectivity, valley bottom to top		●	●		●		●	●			●	●
Fish overwintering	●	●		●	●	●	●	●	●	●		●
Fish passage					●					●		
Fish spawning & rearing	●	●	●	●	●	●	●	●	●	●	●	●
Geomorphic processes, erosion, levees, sedimentation	●	●	●	●	●	●	●	●	●	●		
Hydrologic processes, filtering, recharge, flood control, storage	●	●	●	●	●	●	●	●	●	●	●	●
Natural fire regime	●	●	●	●	●	●	●	●	●	●	●	●
Natural veg succession			●	●		●			●	●		

Ecological processes	Creston	Bonanza	Columbia Wetlands	Wycliffe	Duncan Lardeau	Columbia Lake	Golden	Slocan Valley	South Country	South Selkirks-Lower Columbia	Retallack	Elk Valley
Nutrient dynamics	●	●	●	●	●	●	●	●	●	●	●	●
Pollination	●	●		●	●		●	●		●		
Predator-prey dynamics	●	●	●	●	●	●	●	●	●	●	●	●
Species / wildlife movement	●	●	●	●	●	●	●	●	●	●	●	●

Table A-5. Ecological threats across Kootenay Connect's 12 focal corridors.

These ecological threats were identified through extensive consultation with local species at risk biologists (independent and government), local stewardship groups, landowners, conservation organizations, First Nations, and literature reviews. Coloured cells indicate that these threats are present, of concern, and therefore deserving study and/or management actions to mitigate or alleviate within the indicated focal corridor.

Red cells indicate a significant ecological threat. **Orange cells** indicate a considerable ecological threat.

Threat category	Threat	Creston	Bonanza	Columbia Wetlands	Wycliffe	Duncan Lardeau	Columbia Lake	Golden	Slocan River	South Country	South Selkirks-Lower Columbia	Retallack	Elk Valley
Direct loss or impairment of habitat / species	Agricultural expansion and/ or intensification												
	Coal mining and mining expansion												
	Conifer encroachment on native grassland												
	Declining water quality												
	Declining water availability												
	Exclusionary fencing to wildlife												
	Extensive logging and road building												
	Extreme fire and fire suppression												

Threat category	Threat	Creston	Bonanza	Columbia Wetlands	Wycliffe	Duncan Lardeau	Columbia Lake	Golden	Slocan River	South Country	South Selkirks-Lower Columbia	Retallack	Elk Valley
Direct loss or impairment of habitat / species	**Harvesting and/or falling of wildlife trees**												
	Herbicide/ pesticide run-off												
	Human wildlife conflicts												
	Loss of instream complexity (e.g., woody debris, gravel, sediment)												
	Loss of old structures for bats and barn swallows												
	Loss of river-wetland-floodplain hydrologic connectivity												
	Loss of side channels in river												
	Loss by wildfires												
	Loss of wildlife north-south, east-west connectivity												
	Mine closures (providing bat hibernacula)												
	Mining & gravel extraction												

Threat category	Threat	Creston	Bonanza	Columbia Wetlands	Wycliffe	Duncan Lardeau	Columbia Lake	Golden	Slocan Valley	South Country	South Selkirks-Lower Columbia	Retallack	Elk Valley
Direct loss or impairment of habitat / species	**Natural system modification (e.g., water diversion, diking, railway beds, tailings)**												
	Over-grazing or poor range management												
	Industrial development												
	Heavy metals from smelter emissions												
	Residential development / urban sprawl												
	Stream bank erosion and sedimentation												
	Transportation corridors and hydro lines												
	Baciliius thuringiensis subspecies israelensis (BTI) for mosquito control												
	Unregulated wildcrafting, overhunting												
	Wildlife collisions on transportation corridors												

Threat category	Threat	Creston	Bonanza	Columbia Wetlands	Wycliffe	Duncan Lardeau	Columbia Lake	Golden	Slocan Valley	South Country	South Selkirks-Lower Columbia	Retallack	Elk Valley
Invasive species	American bullfrog												
	chronic wasting disease (CWD)												
	Chytrid fungus												
	creation of linear corridors (increases spread)												
	Domestic sheep diseases (infecting native Bighorn Sheep)												
	Fungus causing white-nose syndrome for bats												
	Invasive plants												
	Non-native fish												
	Invasive plants (e.g., spotted knapweed, dalmatian toadflax, Canada thistle, reed canarygrass, black locust)												
	Whirling disease												
	White pine blister rust												
	Zebra and quagga mussels												

Threat category	Threat	Creston	Bonanza	Columbia Wetlands	Wycliffe	Duncan Lardeau	Columbia Lake	Golden	Slocan River	South Country	South Selkirks-Lower Columbia	Retallack	Elk Valley
Recreational pressure	Dogs off leash												
	Increased access to backcountry and high alpine areas												
	Increased human activity in riparian & wetlands												
	Increased river use (e.g., boaters, tubers, etc.)												
	Increased trail and off-trail usage / damage (e.g., multi-use, non-motorized use)												
	Increased trail building (authorized and unauthorized)												
	Increased motorboat activity in sensitive waterways												
	Increased presence in planes, drones, helicopters												
	Recreation activity causing wildlife increased stress and displacement												

Threat category	Threat	Creston	Bonanza	Columbia Wetlands	Wycliffe	Duncan Lardeau	Columbia Lake	Golden	Slocan River	South Country	South Selkirks-Lower Columbia	Retallack	Elk Valley
Recreational pressure	Increased wildfire risk												
	Increased winter recreation												
Uncertainty of climate change	**Catastrophic wildfire**												
	Changes in nutrient inputs caused by floods and droughts												
	Changing species composition, distribution / shifting habitats												
	Forest pest spread (e.g., mountain pine beetle and other insects)												
	Hydrological changes (causing floods or extreme drought)												
	Increased stream temperature												
	Irrigation depleting water resource during drought												
	Loss of snowpack & cold water creeks												

Threat category	Threat	Creston	Bonanza	Columbia Wetlands	Wycliffe	Duncan Lardeau	Columbia Lake	Golden	Slocan River	South Country	South Selkirks-Lower Columbia	Retallack	Elk Valley
Uncertainty of climate change	Mudslide/ landslide												
	pPant-pollinator phenology mismatch												
	Water impoundments and other water storage affecting hydrology												
	Wildlife disease spread												
Threat category	**Threat**	**Creston**	**Bonanza**	**Columbia Wetlands**	**Wycliffe**	**Duncan Lardeau**	**Columbia Lake**	**Golden**	**Slocan River**	**South Country**	**South Selkirks-Lower Columbia**	**Retallack**	**Elk Valley**
Cumulative effects	**Impacts from multiple threats**												

APPENDIX C: GIS LAYERS & DATABASES FOR KOOTENAY CONNECT

Table A-6. List of GIS layers and databases that underpin Kootenay Connect's analyses and conservation planning. For name of source, refer to DEFINITION OF ACRONYMS.

Layer type	GIS layers	Source
Species layer of interest	Grizzly bear habitat model	TBGBP
	Grizzly bear core habitats model	TBGBP
	Grizzly bear corridor model	TBGBP
	Wolverine density	BC Gov
	Marmot habitat	BC Gov
	Badger habitat model	T. Kinley, N. Newhouse
	Ungulate winter range [2]	BC Gov
	Caribou habitat areas	BC Gov
	Big horn sheep winter & summer range	BC Gov
	Mountain goat winter habitat	BC Gov
	Elk habitat model	Kootenay Connect, K. Mulligan
	Moose habitat	BC Gov
	Mule deer habitat	BC Gov
	Multi-species upland corridor model	Kootenay Connect, M. Proctor
	Species at risk & of concern observations[3]	BC Gov
	Bat hotspots (multiple species)	C. Lausen
	Northern Leopard Frog breeding areas	NLF Recovery Team
Biological	Bird survey data	R. Darvill
	Swan survey data	R. Darvill
	Osprey nest sites	R. Darvill
	Heron nest sites	M. Machmer
	Swallow nest sites	R. Darvill
	Lewis's woodpecker nest sites, critical habitat	R. Darvill
	Western toad breeding ponds	Many sources
	Western painted turtle nesting & basking ponds	R. Darvill
	Amphibian sites	J. Dulisse
	Ecological communities at risk	R. Durand
	Listed Critical Habitats	BC Gov, CWS
	Alkali saltgrass - foxtail barley community	R. Darvill
	Greenness (e.g., deciduous plant productivity)	TBGBP
	Riparian/wetland areas	TBGBP

Layer type	GIS layers	Source
Biological	Vegetation Resources Index (forestry data)	BC Gov
	Grasslands	BC Gov
	Forest cover (dominate tree types)	BC Gov
	Limber pine	BC Gov
	Old growth management areas	BC Gov
	Old growth	G. Utzig, BC Gov
	Cut block history	BC Gov
	Fire history	BC Gov
	Topography (e.g., terrain ruggedness)	BC Gov
	Waterways (e.g., streams, rivers, lakes)	BC Gov
	Ecological productivity	BC Gov
	Land cover (e.g., avalanche, alpine)	BC Gov
	Canopy cover	BC Gov
	Lidar	BC Gov
	Ortho Photos	BC Gov
	Biodiversity Conservation Opportunities	Kootenay Connect, R. Darvill
	BC BEC units	BC Gov
Human influence	Forestry roads	BC Gov
	Road density	TBGBP
	Road closure areas	BC Gov
	Highways	GIS data online
	Human settlement	TBGBP
	Highway roadkill data	BC Gov
	Human development (buildings)	TBGBP, Google Earth
	RDEK Land use designation areas	RDEK
Land ownership and management	First Nations lands	I. Adams
	Private lands	EK/WK Regional Districts
	Protected areas - public	GIS data online
	Protected areas – land trusts	NCC
	Wildlife Management Areas	BC Gov
	Wildlife Habitat Areas	BC Gov
	Wildlife Habitat Features	BC Gov
	Notations of Interest lands (undesignated)	BC Gov
	Canfor High Value Conservation Areas	Canfor
	Greg Utzig Conservation Planning Areas	G. Utzig
	Recreation tenures	BC Gov
	Agricultural Land Reserve	BC Gov
Data gaps	Habitat models for most species	
	Connectivity models for most species	
	Hydrology models	
	Columbia Shuswap Regional District Area A	
	Movement data for wolves, wolverine & badgers	

APPENDIX D: COMPLEMENTARY INITIATIVES

Table A-7. Global, national, provincial and regional initiatives complementary to the purposes of Kootenay Connect.

Initiatives	Purpose	Goal/Objective	Implications
Global Initiatives			
Kunming-Montreal Global Biodiversity Framework Conference of the Parties (CoP-15)	Set global targets for conservation under the United Nations Convention on Biological Diversity. The vision of the Kunming-Montreal Global Biodiversity Framework is a world of living in harmony with nature where "by 2050, biodiversity is valued, conserved, restored and wisely used, maintaining ecosystem services, sustaining a healthy planet and delivering benefits essential for all people."	**Global Goal A:** The integrity, connectivity and resilience of all ecosystems are maintained, enhanced, or restored, substantially increasing the area of natural ecosystems by 2050; Human induced extinction of known threatened species is halted, and, by 2050, extinction rate and risk of all species are reduced tenfold and the abundance of native wild species is increased to healthy and resilient levels; The genetic diversity within populations of wild and domesticated species is maintained, safeguarding their adaptive potential. **Global Goal B:** Biodiversity is sustainably used and managed and nature's contributions to people, including ecosystem functions and services, are valued, maintained and enhanced, with those currently in decline being restored, supporting the achievement of sustainable development for the benefit of present and future generations by 2050.	Targets for biodiversity and connectivity conservation most relevant to Kootenay Connect: ***TARGET 1:*** *Ensure that all areas are under participatory, integrated and biodiversity inclusive spatial planning and/or effective management processes addressing land- and sea-use change, to bring the loss of areas of high biodiversity importance, including ecosystems of high ecological integrity, close to zero by 2030, while respecting the rights of indigenous peoples and local communities.* ***TARGET 2:*** *Ensure that by 2030 at least 30 per cent of areas of degraded terrestrial, inland water, and coastal and marine ecosystems are under effective restoration, in order to enhance biodiversity and ecosystem functions and services, ecological integrity and connectivity.* ***TARGET 3:*** *Ensure and enable that by 2030 at least 30 per cent of terrestrial, inland water, and of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem functions and services, are effectively conserved and managed through ecologically representative, well-connected and equitably governed systems of protected areas and other effective area-based conservation measures, recognizing indigenous and traditional territories, where applicable, and integrated into wider landscapes, seascapes and the ocean, while ensuring that any sustainable use, where appropriate in such areas, is fully consistent with conservation outcomes, recognizing and respecting the rights of indigenous peoples and local communities, including over their traditional territories.* ***TARGET 4:*** *Ensure urgent management actions to halt human induced extinction of known threatened species and for the recovery and conservation of species, in particular threatened species, to significantly reduce extinction risk, as well as to maintain and restore the genetic diversity within and between populations of native, wild and domesticated species to maintain their adaptive potential, including through in situ and ex situ*

			conservation and sustainable management practices, and effectively manage human-wildlife interactions to minimize human-wildlife conflict for coexistence. ***TARGET 12:*** *Significantly increase the area and quality and connectivity of, access to, and benefits from green and blue spaces in urban and densely populated areas sustainably, by mainstreaming the conservation and sustainable use of biodiversity, and ensure biodiversity-inclusive urban planning, enhancing native biodiversity, ecological connectivity and integrity, and improving human health and well-being and connection to nature and contributing to inclusive and sustainable urbanization and the provision of ecosystem functions and services.* ***TARGET 14:*** *Ensure the full integration of biodiversity and its multiple values into policies, regulations, planning and development processes, poverty eradication strategies, strategic environmental assessments, environmental impact assessments and, as appropriate, national accounting, within and across all levels of government and across all sectors, in particular those with significant impacts on biodiversity, progressively aligning all relevant public and private activities, and fiscal and financial flows with the goals and targets of this framework.* https://www.cbd.int/doc/decisions/cop-15/cop-15-dec-04-en.pdf
Post-2020 Global Biodiversity Framework **Preceded and informed the Kunming-Montreal Global Biodiversity Framework (above)*	Galvanize urgent and transformative action by Governments and all of society, including indigenous peoples and local communities, civil society, and businesses, to achieve the outcomes it sets out in its vision, mission, goals and targets, and thereby to contribute to the objectives of the Convention on Biological Diversity and other biodiversity related multilateral agreements, processes and instruments.	**2030 Mission for the framework:** *To take urgent action across society to put biodiversity on a path to recovery for the benefit of planet and people.* **Key long-term goal to achieve 2050 Vision for Biodiversity:** The area, connectivity and integrity of natural ecosystems increased by at least [X%] supporting healthy and resilient populations of all species while reducing the number of species that are threatened by [X%] and maintaining genetic diversity. **2030 Milestones for progress by 2050: Global Goal A** A.1 The area, connectivity and integrity of natural systems increased by at least [5%].	Led by the United Nations' Convention on Biodiversity, the Post-2020 Global Biodiversity Framework builds on the Strategic Plan for Biodiversity 2011-2020 and sets out an ambitious plan to implement broad-based action to bring about a transformation in society's relationship with biodiversity and to ensure that, by 2050, the shared vision of living in harmony with nature is fulfilled. The framework calls for transforming economic, social and financial models so that the trends that have exacerbated biodiversity loss will stabilize in the next 10 years (by 2030) and allow for the recovery of natural ecosystems in the following 20 years, with net improvements by 2050 to achieve the Convention on Biological Diversity's vision of "living in harmony with nature by 2050". https://www.cbd.int/doc/c/3064/749a/0f65ac7f9def86707f4eaefa/post2020-prep-02-01-en.pdf

		A.2 The number of species that are threatened is reduced by [X%] and the abundance of species has increased on average by [X%].	
Key Biodiversity Areas Prepared by the Joint Task Force on Biodiversity and Protected Areas led by the IUCN Species Survival Commission and IUCN World Commission on Protected Areas in association with the IUCN Global Species Programme	Provide a global standard for the identification of sites that contribute significantly to the global persistence of biodiversity in terrestrial, inland water and marine environments.	*Support the strategic expansion of protected area networks by governments and civil society.*	KBA Programme supports the identification, mapping, monitoring and conservation of KBAs to help safeguard the most critical sites for nature on our planet. KBAs can help achieve Global Biodiversity Targets as established by the Convention on Biological Diversity; serve to inform the description or identification of sites under international conventions (such as Ecologically and Biologically Significant Areas described under the Convention on Biological Diversity, wetlands of international importance designated under the Ramsar Convention, and natural World Heritage Sites); inform private sector policies, environmental standards, and certification programs; support conservation planning and priority-setting at national and regional levels; and provide local and Indigenous communities with new opportunities and benefits. https://www.keybiodiversityareas.org/home
Continental Initiatives	**Purpose**	**Goal/Objective**	**Implications**
Yellowstone to Yukon Conservation Initiative	The Yellowstone to Yukon Conservation Initiative (Y2Y) is a joint Canada-US not-for-profit organization that connects and protects habitat from Yellowstone to Yukon so people and nature can thrive.	Y2Y addresses conservation issues at a continental scale to create a web of life-sustaining wildlife habitats linked by movement corridors that extend 2,000 miles (3,200 km) from Yellowstone National Park to the Yukon Territory. Y2Y seeks to reverse fragmentation and to protect and connect habitat in order for wildlife and people to coexist and thrive. Such a protected and connected network creates the best opportunity for wild species to move and adapt to a changing climate.	Yellowstone to Yukon conservation vision took hold in 1993, and currently approximately 450 partner groups have joined forces to connect and protect this landscape. Since Y2Y's inception, protected areas have increased by 80 percent within the Yellowstone to Yukon region; over 120 highway wildlife crossings are keeping people and wildlife safe; and better management practices have improved conservation to help ensure functional wildlife corridors that connect protected areas and allow wildlife to roam. https://y2y.net/

National Initiatives	Purpose	Goal/Objective	Implications
Canada's 2030 National Biodiversity Strategy (*in process) Administered by Environment and Climate Change Canada	Canada's 2030 National Biodiversity Strategy builds upon the 2020 Goals and Targets for Canada. The new strategy will establish a shared vision for halting and reversing biodiversity loss in Canada, reflect Canada's domestic priorities for biodiversity conservation and sustainable use, and guide how Canada implements new global goals and targets in the Kunming-Montreal Global Biodiversity Framework domestically. Set new medium-term goals and targets developed by federal, provincial and territorial governments to achieve long-term biodiversity outcomes.	**National Goal A:** *The integrity, connectivity and resilience of all ecosystems are maintained, enhanced, or restored, substantially increasing the area of natural ecosystems by 2050; Human induced extinction of known threatened species is halted, and, by 2050, the extinction rate and risk of all species are reduced tenfold and the abundance of native wild species is increased to healthy and resilient levels; The genetic diversity within populations of wild and domesticated species, is maintained, safeguarding their adaptive potential.* **National Goal B:** *Biodiversity is sustainably used and managed and nature's contributions to people, including ecosystem functions and services, are valued, maintained and enhanced, with those currently in decline being restored, supporting the achievement of sustainable development for the benefit of present and future generations by 2050.* **Biodiversity target***:* *Ensure that by 2030 at least 30 percent of areas of degraded terrestrial, inland water, and marine and coastal ecosystems are under effective restoration, in order to enhance biodiversity and ecosystem functions and services, ecological integrity and connectivity.*	The Government of Canada, through Environment and Climate Change Canada (ECCC), is responsible for leading the development of the 2030 National Biodiversity Strategy and reporting on Canada's progress to meet the KMGBF targets. ***See TARGETS 1, 2, 3, 4, 12, 14 in Kunming-Montreal Global Biodiversity Framework (above).** https://www.canada.ca/en/services/environment/wildlife-plants-species/biodiversity/2030-biodiversity-strategy-canada.html
Target 1 Challenge Fund of the Canada Nature Fund	Federal government funding available to acquire critical habitats and landscapes in order to increase Canada's protected areas network.	**Biodiversity Goals and Targets for Canada inspired by Kunming-Montreal Global Biodiversity Framework**	The Challenge component of the Canada Nature Fund will provide federal funding of $500 million over five years to support a new approach to the conservation of biodiversity through targeted federal investments that enhance collaboration and partnership on protected and conserved areas and species at risk. In December

Administered by Environment and Climate Change Canada		**Strategic Goal A:** *By 2030, Canada's lands and waters are planned and managed using an ecosystem approach to support biodiversity conservation outcomes at local, regional, and national scales.* **Target 1 Conservation Networks:** *By 2025 and 2030, at least 25% and 30% respectively, of terrestrial areas, inland water, coastal and marine areas are conserved through networks of protected areas and other effective area-based conservation measures.*	2018, the Target 1 Challenge Fund launched an Expression of Interest phase. Since 2019, the first cohort of successful projects has been making progress. https://www.canada.ca/en/environment-climate-change/news/2018/06/canada-nature-fund-special-ministerial-representative-and-national-advisory-committee.html
		Protected areas, IPCAs, and OECMs For activities supported by the Target 1 Challenge, examples of new protected areas could include: • Provincial and territorial government protected areas focused on nature conservation that may be established under designations such as Provincial and Territorial Parks, Wilderness Parks, Wildlife Refuges, Ecological Reserves, Nature Reserves, Biological Reserves, Biodiversity Reserves, Natural Areas, Wilderness Areas, Habitat Protection Areas, Wildlife Management Areas, Conservancies, and Special Management Areas. • In addition to government-owned and managed areas, the Target 1 Challenge may also support collaboratively managed and non-government protected areas including Indigenous Protected and Conserved Areas (IPCAs), privately owned conservation lands, areas protected and conserved through Indigenous land claim agreements and traditional use planning areas, among others. • The Indigenous Circle of Experts (ICE) recommended the concept of IPCAs, which is a spectrum of protected and conserved area approaches led by Indigenous peoples in Canada (including Protected Area, OECMs, and other types of conservation). IPCAs are lands and waters where Indigenous people have a leadership role in protecting and conserving cultures and ecosystems through Indigenous laws, governance, and knowledge systems. • Other effective area-based conservation measures (OECMs): areas that are not recognized as a protected area, and may not have the conservation of biodiversity as the primary goal, yet are geographically defined and managed over the long term in ways that result in the effective and enduring protection of biodiversity.	
Federal Species at Risk Act (SARA)	Designed to meet one of Canada's key commitments under the International Convention on Biological Diversity.	The goal of SARA is to protect endangered or threatened organisms and their habitats. It also manages species which are not yet threatened, but whose existence or habitat is in jeopardy.	The Species at Risk Act designates the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), an independent committee of wildlife experts and scientists, to identify threatened species and assess their conservation status, i.e., federally recognized as special concern, threatened, endangered, extirpated, and extinct in Canada under Schedule I of SARA. COSEWIC reports are influential

			toward the addition of species to the List of Wildlife SAR (Schedule 1) by the Minister of the Environment and Climate Change Canada. SARA describes Critical Habitat as the habitat that is necessary for the survival or recovery of a listed wildlife species, and that is identified as the species' critical habitat in a recovery strategy or in an action plan for the species. Many projects now require screening for critical habitat as part of the impact assessment process. Implementation of SARA depends upon the willingness of the federal government to enforce. https://laws-lois.justice.gc.ca/eng/acts/s-15.3/ https://www.canada.ca/en/environment-climate-change/services/environmental-enforcement/acts-regulations/about-species-at-risk-act.html
Provincial Initiatives	**Purpose**	**Goal/Objective**	**Implications**
Provincial Wildlife Management Plan 2020 BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development **See Together for Wildlife for update*	A broad vision and new strategy for wildlife management and habitat conservation for BC in 2020.	Address some of the challenges currently facing wildlife management and habitat conservation in BC.	Address challenges by: enhancing existing collaboration on wildlife management and habitat conservation with Indigenous peoples; increasing involvement of NGO conservation organizations and a broad range of wildlife and habitat stakeholders; identifying measures that need to be taken to proactively manage wildlife and habitat and prevent wildlife from becoming species at risk; addressing habitat loss, alteration, and fragmentation due to human activity; determining the most effective ways to proactively adapt to the impacts of climate change on wildlife and habitats; acquiring better information on wildlife and habitats to inform management and conservation outcomes and decision-making to achieve robust compliance and enforcement; encouraging prevention and mitigation of human-wildlife conflicts and addressing the underlying causes; providing stable and increasing funding dedicated to wildlife management, habitat conservation, and compliance and enforcement.
Together for Wildlife 2020-2025	To improve wildlife stewardship and habitat conservation in BC by making	**Five Goals of Together for Wildlife Strategy:** 1. All British Columbians have a voice in wildlife stewardship	There are 24 actions that support the goals, including opportunities to: develop inclusive and cooperative governance structures and to make existing engagement

	significant new investments and developing new partnerships to collaboratively deliver wildlife stewardship.	2. Data, information and knowledge drive better decisions 3. Stewardship actions achieve tangible benefits for wildlife and their habitats 4. Accountability and transparency build trust and confidence 5. Collaborative wildlife stewardship advances reconciliation with Indigenous governments	processes more transparent and effective; investing in data collection, cumulative effects assessments, monitoring, innovative population modelling, and information management systems to improve the availability, accessibility, and reliability of wildlife stewardship data for all users; assess existing wildlife stewardship tools (i.e., policies, legislation, financial mechanisms, land designations, or restoration and enhancement activities) for effectiveness and, where needed, develop new tools to respond to changing stewardship needs; and create new opportunities to work collaboratively with Indigenous governments to effectively and efficiently deliver wildlife stewardship through co-management and shared-decisio nmaking. https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/wildlife/together-for-wildlife Together for Wildlife Strategy document: https://www2.gov.bc.ca/assets/gov/environment/plants-animals-and-ecosystems/wildlife-wildlife-habitat/together-for-wildlife/together-for-wildlife-strategy.pdf
Regional Initiatives	**Purpose**	**Goal/Objective**	**Implications**
Fish & Wildlife Compensation Program Action Plans	The FWCP is a partnership between BC Hydro, the Province of BC, Fisheries and Oceans Canada, First Nations and Public Stakeholders to conserve and enhance fish and wildlife in watersheds impacted by existing BC Hydro dams.	**FWCP's Three Strategic Objectives:** 1. Maintain or improve the status of species or ecosystems of concern, and the integrity and productivity of ecosystems and habitats. 2. Maintain or improve opportunities for sustainable use, including harvesting and other uses. Harvesting includes First Nations, recreational, sport, and commercial harvests. Other uses may include cultural, medicinal, or non-consumptive uses. 3. Build and maintain relationships with stakeholders and aboriginal communities to support BC Hydro's social responsibility policy and the Province's shared stewardship objective.	FWCP's Columbia Region Action Plans (revised in 2019) identify priority actions needed to accomplish FWCP objectives for the restoration, conservation, and enhancement of fish and wildlife and their habitats at the basin or watershed-level. The Action Plans guide FWCP investments in projects, track progress toward implementation, set annual priorities and guide decision-making in setting out and approving the Annual Operating Plan. • Reservoirs & Large Lakes Action Plan • Small Lakes Action Plan • Rivers & Riparian Areas Action Plan • Upland & Dryland Action Plan • Wetlands & Riparian Areas Action Plan Kootenay Connect is a synthesis of the focal ecosystems, habitats, and species identified in priority actions within Upland & Dryland and Wetlands & Riparian Areas Action Plans.

Columbia Basin Trust Ecosystems Enhancement Program	The Trust's Ecosystem Enhancement Program aims to identify and support projects in subregions throughout the Kootenay- Columbia region of the Columbia Basin.	The goal is to help maintain and improve ecological health and native biodiversity in a variety of ecosystems, such as wetlands, fish habitat, forests, and grasslands. To maintain and improve ecological health and native biodiversity by supporting large-scale ecosystem enhancement, restoration and conservation projects in the Basin.	The EEP program identifies project opportunities to implement on-the-ground actions to support ecological health at a landscape level. Supported projects by EEP grants focus on enhancement, restoration and conservation with input from community groups, First Nations representatives, and government experts. For the first five years of the program, the Trust focused its EEP funding on two targeted landscapes each year. Currently, the Trust invites proposals through a Basin-wide call for eligible project ideas in any of the subregions. https://ourtrust.org/grants-and-programs-directory/ecosystem-enhancement-program/
Kootenay Conservation Program - Conservation Neighbourhoods	Identify focal areas for both private land securement and stewardship activities within subregions to demonstrate how private land securement and stewardship at the local scale fits into the larger picture of conservation in the Kootenay region.	Identify and strategically support 14 Conservation Neighbourhoods in which groups of partners and stakeholders work together in local landscapes such as watersheds, valleys, and wildlife corridors to develop shared conservation priorities through collaborative action planning and joint stewardship projects to benefit at-risk species, important habitats, hydrologic functions, and connectivity.	To date, five Conservation Neighbourhoods have active partnerships working on common conservation priorities: the Slocan Lake Watershed, upper Columbia Valley, Lower Columbia, Elk Valley, and Creston Valley. https://kootenayconservation.ca/conservation-action-forums/

APPENDIX E: LAND USE DESIGNATIONS, LAWS, & POLICIES TO PROTECT BIODIVERSITY TOOLBOX

The following Tables A-8 and A-9 constitute a conservation toolbox of protections, laws, policies, regulations, and management plans that can be applied to conservation and management of biodiversity areas and wildlife corridors by a variety of jurisdictions.

Table A-8. Land use designation tools to protect biodiversity.[36]

Designation	Legislation (Lead Agency)	Applies to:	Federal Land	Provincial Land	Reg. Distr./Municipal	Private Land	Implemented by:	Effectiveness	Limitations	Who May Be Impacted?
Federal										
Migratory Bird Sanctuaries	Migratory Birds Convention Act (Canadian Wildlife Service, Environment Canada)	Any land in Canada	√	√	√	√	Federal Cabinet	Established in 1917 (updated in 1994). Contains regulations to protect migratory birds, their eggs, and their nests from hunting, trafficking, and possession. Applied extensively in northern Canada. In southern Canada applied more on private lands. Potentially useful designation to protect wetlands where there are nationally significant migratory bird populations.	Primary focus is hunting regulations; poor to no protection for habitat other than nests while active; would not protect wetlands outside of nationally significant migratory bird habitat.	Depends on whether regulations apply only in sanctuaries, or in any areas frequented by migratory birds.

[36] Sources: *A Wetland Action Plan for British Columbia* (2010); Legislation for Species at Risk https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/species-ecosystems-at-risk/legislation

Designation	Legislation (Lead Agency)	Applies to:	Federal Land	Provincial Land	Reg. Distr./Municipal	Private Land	Implemented by:	Effectiveness	Limitations	Who May Be Impacted?
Federal cont.										
National Wildlife Areas (NWAs)	Canada Wildlife Act (Canadian Wildlife Service, Environment and Climate Change Canada)	Land under the administration of the Minister of Environment and Climate Change	√				Federal Minister of Environment and Climate Change	Flexible, open-ended designations for areas required for wildlife conservation; good enforcement provisions for NWAs; less difficult to establish and more flexible than National Park designations.	Regulations do not have habitat focus but prohibit many activities that harm habitat; there is not strong protection for NWAs from outside activity; requirement for federal administration of land requires provincial cooperation (purchase, donation or transfer).	Depends on areas designated NWA.
National Parks	Canada National Parks Act (Parks Canada)	Lands owned by Canada, or agreed to by Province	√				Federal Cabinet	Generally strong protection for species and habitat in national parks, but broad exceptions available; good ecological integrity requirements.	Primary purpose is not protection of biodiversity and habitat – would be of ancillary benefit; low penalty for environmental damage; long process to designate National Parks in legislation.	Potentially the Province and licensees if commercially productive land is removed from the land base.
Indigenous Protected and Conserved Areas	Pathway to Canada Target 1 Initiative (Environment and Climate Change Canada)	Lands and waters where Indigenous governments have the primary authority in protecting and conserving culture heritage and ecosystems	√	√			Federal Minister of Environment and Climate Change	Important new Indigenous-led conservation tool to increase habitat protection on a landscape scale relying on Indigenous laws, governance, and knowledge systems. Secures traditional lands that are critical for the exercise of Treaty and Aboriginal Rights.	IPCAs, like Tribal Parks, conserve traditional lands for traditional activities such as hunting, fishing, and the gathering of medicinal plants crucial to maintaining Indigenous cultural and spiritual identity and connection to the land, while ensuring the stewardship of sensitive ecosystems.	Potentially the Province and licensees if commercially productive land is removed from the land base.

Designation	Legislation (Lead Agency)	Applies to:	Federal Land	Provincial Land	Reg. Distr./Municipal	Private Land	Implemented by:	Effectiveness	Limitations	Who May Be Impacted?
Provincial										
Wildlife Management Areas (WMA) **Critical Wildlife Areas (CWA)** **Wildlife Sanctuaries**	Wildlife Act (Ministry of Environment & Climate Change Strategy)	Land under the administration of the Minister responsible for the Wildlife Act (e.g., Provincial Crown land, or private land leased to Minister)		√		√	Minister with Cabinet's approval	WMAs provide reasonably strong protection, enforceability, and flexibility due to regional manager's authority over all activities in a WMA; strong degree of decision-making by agency responsible for wildlife habitat; example is Columbia Wetlands WMA.	Requires formal act of designation in order for wetlands and other habitat to be protected; requires high-level (Cabinet) consent for Minister's designation decision; may be difficult for agency to acquire administration of land as prerequisite for WMA designation; cannot regulate all activity impacting habitat.	Expanding WMA designations could affect licenced users of the Crown land gaining WMA status; however, some uses could be accommodated depending on the impact.
Provincial Parks	Park Act (Ministry of Environment & Climate Change Strategy)	Provincial Crown land		√			Legislature or Cabinet	Park Act is the strongest protected area designation because many require Act of Legislature to change boundaries. Park, Conservancy and Recreation Area Regulation addresses management and protection of park resources which includes species at risk.	Park Act has strong recreation focus; requires high-level approval to designate; may not be suitable for habitats that require active interventions; not well-suited to designations of small, specific habitat, such as wetlands.	New Provincial Park designations would affect licenced users of the Crown land.

Designation	Legislation (Lead Agency)	Applies to:	Federal Land	Provincial Land	Reg. Distr. /Municipal	Private Land	Implemented by:	Effectiveness	Limitations	Who May Be Impacted?
Provincial cont.										
Ecological Reserves	Ecological Reserves Act (Ministry of Environment & Climate Change Strategy)	Provincial Crown land		√			Cabinet (some require the Legislature to modify boundaries)	Strong legislation for protection of ecosystems; takes priority over all other legislation. Ecological Reserves are created for many reasons, including protection of at-risk species or their habitat. They are established by inclusion to the schedules of the Protected Areas of British Columbia Act or by order-in-council under the Ecological Reserves Act. The Park, Conservancy and Recreation Area Regulation under the Park Act applies to ecological reserves as if they were parks. The Ecological Reserve Regulations address additional restrictions in ecological reserves to ensure protection of the resources in an ecological reserve.	Science-based research and education focus; good for many lands, but not for those that require active management. No provisions in associated regulations target species at risk or their habitat.	New Ecological Reserve designations would affect licenced users of the Crown land.

Designation	Legislation (Lead Agency)	Applies to:	Federal Land	Provincial Land	Reg. Distr./Municipal	Private Land	Implemented by:	Effectiveness	Limitations	Who May Be Impacted?
Provincial cont.										
Ad Hoc designations	Environment and Land Use Act	All land in BC		√	√	√	Cabinet	Good, flexible legislation that can be tailor-made to special circumstances, where other tools are a poor fit; prevails over other legislation.	Protection and enforcement depend on the order-in-council (OIC) that is passed by Cabinet in a given situation. Past enforcement problems were addressed under **s.6** of the Park Act (might not fit every situation).	Depends on the Cabinet OIC – potentially anyone.
Wildlife Habitat Areas (WHAs)	Forest and Range Practices Act (Government Actions, Forest Planning and Practices, Range and Woodlots Regulations)	Crown forest land, range land, and private land in a Tree Farm Licence area, Community Forest Area, or Wildlife Management Area		√		√	Minister of Environment (delegated to Deputy Minister of Environment)	The purpose of WHAs is to conserve those habitats considered most limiting to a given Identified Wildlife element. WHAs are mapped areas that are necessary to meet the habitat requirements of an Identified Wildlife element; designate critical habitats in which activities are managed to limit their impact on the Identified Wildlife element for which the area was established. WHAs can be put into WMAs.	WHAs only apply to identified wildlife; depends on strength of general wildlife measure for the identified wildlife; not very flexible; implementation is highly constrained by occurrences of species and land use impacts.	Would mostly affect forest or range licensees carrying out forest or range practices.

Designation	Legislation (Lead Agency)	Applies to:	Federal Land	Provincial Land	Reg. Distr./Municipal	Private Land	Implemented by:	Effectiveness	Limitations	Who May Be Impacted?
Provincial cont.										
Wildlife Habitat Features (WHFs)	Forest and Range Practices Act (Government Actions, Forest Planning and Practices, Range and Woodlots Regulations)	Crown forest land, range land, and private land in a Tree Farm Licence area, Community Forest Area, or Wildlife Management Area		√		√	Minister of Environment (delegated to Deputy Minister of Environment)	WHFs may provide additional protection to WMAs or WHAs, e.g., for ecosystem elements used by wildlife to meet one or more of their important habitat requirements. WHFs are a possibility where the MoE Deputy Minister could identify specific localized features to protect a species at risk. Practices requirement for a WHF, once established, is "must not damage or render ineffective."	WHFs are generally small areas, spatially defined, and probably of limited use in conserving large areas of habitat. Examples include a significant mineral lick or wallow, a nest used by a bird, bat hibernaculum, or a burrow or den used by a mammal.	Would mostly affect forest or range licensees carrying out forest or range practices.
Reserves, notations, and transfers	Land Act ss.15, 16, 17	Crown Land Reserves can be referred to as wildlife habitat management areas, natural environment areas, recreation conservation management areas.		√			Ministry of Forests and Range – Integrated Land Management Bureau (ILMB)	Effective in withdrawing Crown land from disposition; could be important tool in implementing a provincial policy in which important Crown lands for wildlife are not sold.	Not necessarily effective in protecting habitat from land use practices, because there are no enforceable measures to protect habitat per se; seen more as an interim designation to preserve conservation opportunity until more appropriate designation is made.	Potentially interested users or purchasers of Crown land.

Designation	Legislation (Lead Agency)	Applies to:	Federal Land	Provincial Land	Reg. Distr./Municipal	Private Land	Implemented by:	Effectiveness	Limitations	Who May Be Impacted?
Local Government										
Environmentally Sensitive Areas/ Environmental Development Permit Areas (ESAs/EDPAs)	Local Government Act	Potentially any land in a municipality or Regional District jurisdiction			√	√	Municipal councils and Regional District boards	Local governments have the capacity to declare important habitat as ESAs in Official Community Plans and regional growth strategies, and to restrict use of these areas, such as wetlands, through zoning bylaws and Development Permit Areas.	Enabling only with no provincial direction, policy or model to guide local governments; potential for wide discrepancy in results.	Owners of properties with important habitat, such as wetlands, deciduous riparian forest, and old-growth conifer forest.
Development Permit Areas (DPAs) **Environmental DPAs**	Local Government Act	Private and public land within a municipality			√	√	Municipal councils and Regional District boards	Attempts to control the form and character of development to preserve, protect, restore or enhance natural values. DPAs provide an implementation option, for example, for the Riparian Areas Regulation (RAR).	Depends on local government willingness to designate DPAs, and quality of requirements in each development permit.	Local governments; property owners.

Table A-9. Legislation and regulation of land & water Uues and activities that affect biodiversity.[37]

Legislation (Lead Agency)	Mechanism/ Activity	Federal Land	Provincial Land	Reg. Distr./Municipal	Private Land	Tools	Effectiveness	Limitations	Who Is Impacted?
Federal									
Species at Risk Act (SARA) (Ministry of Environment)	Prevent wildlife species in Canada from disappearing; provide for the recovery of wildlife species that are extirpated (no longer exist in the wild in Canada), endangered, or threatened as a result of human activity; and manage species of special concern to prevent them from becoming endangered or threatened.	√	√			SARA includes species at risk listing and reporting processes through COSEWIC. SARA helps protect Critical Habitat – the habitat necessary for the survival or recovery of a listed wildlife species (Schedule 1), and that is identified as the species' critical habitat in a recovery strategy or in an action plan for the species. Many projects now require screening for critical habitat as part of the impact assessment process.	Depends on the federal government's willingness to implement and enforce. Many species listed under SARA have continued to decline after SARA was enacted in 2002. COSEWIC process provides scientific evidence but listing decisions for many vulnerable species are delayed. In some cases, protections are withheld for certain species because of economic interests. SARA does have a "safety net" clause that would force the provinces to protect SARA listed species, but it has never been used.	The legislation itself may not be the problem but how it's being implemented by the federal government is not stopping populations from declining or helping species recovery; focuses on individual species rather than ecosystems; developing recovery strategies can be challenging and time-consuming which delays protection.	Commercial and industrial interests on the land and in freshwater and marine environments where vulnerable species live or where harvesting occurs.

[37] Sources: A Wetland Action Plan for British Columbia (2010); Legislation for Species at Risk https://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/species-ecosystems-at-risk/legislation

Legislation (Lead Agency)	Mechanism/ Activity	Federal Land	Provincial Land	Reg. Distr./Municipal	Private Land	Tools	Effectiveness	Limitations	Who Is Impacted?
Federal cont.									
Canadian Environmental Assessment Act – Bill 38 (Canadian Environmental Assessment Agency)	Coordinated impact assessment of proposed major development in BC where federal government has authority.	√	√	√?	√?	Certain types of proposed projects must undergo environmental impact assessment and obtain an EA certificate in order to proceed.	The Reviewable Projects Regulation defines the types and sizes of projects that are automatically subject to EAA process. The Minister has power to designate a project as reviewable even though it is not included in Reviewable Projects Regulation. Casts a broad net over many of the potential ways that the federal government can affect species and habitat; the primary means of implementing the Federal Policy on Wetland Conservation.	Act's application is discretionary; increased threshold for review; no guaranteed participation for communities, First Nations, local governments, or the public; government may decide that economic interests prevail over environmental protection.	Major project proponents.
Fisheries Act (Fisheries & Oceans Canada)	Prohibitions on activities that cause harmful alteration, disruption or destruction to fish habitat and/or cause deposit of deleterious (polluting) substances in any Canadian freshwater and marine fisheries waters.	√	√	√	√	Habitat Protection and Pollution Prevention Provisions of the Act outline obligations (of owners, operators, developers and project proponents) and enforcement.	Federal laws that may help protect fish habitat and can apply to conserving wetlands and riparian areas associated with fish habitat; enforcement provides deterrent, and sentencing may require remediation.	Reactive and rarely applied.	Industrial and commercial interests.

Legislation (Lead Agency)	Mechanism/ Activity	Federal Land	Provincial Land	Reg. Distr./Municipal	Private Land	Tools	Effectiveness	Limitations	Who Is Impacted?
Federal cont.									
International Boundary Waters Treaty Act (International Joint Commission – Canada Ministry of Foreign Affairs)	Protection of international boundary waters.	√				Treat Act created in 1909 with a focus on the Great Lakes. Boundary waters are bodies of fresh water that flow through the US-Canada international border.	The Act enables an International Joint Commission and mechanisms for addressing conflicts and rights arising between the two countries over the use of any waters that cross the borders of the two countries, in particular pollution and dams or other structures.	Doesn't include transboundary rivers, although the treaty has provisions related to such rivers, e.g., dams.	
Canadian Environmental Protection Act (Environment Canada)	Regulation of toxic wastes & substances.	√	√	√	√		Provides indirect benefits to land and water by regulating release of toxic substances, pollutants, and wastes into the environment.		

Legislation (Lead Agency)	Mechanism/ Activity	Federal Land	Provincial Land	Reg. Distr./Municipal	Private Land	Tools	Effectiveness	Limitations	Who Is Impacted?
Provincial									
Forest and Range Practices Act (FRPA)	Forest practices (including forestry, range, some oil & gas activities) on Crown forest and range land, and some private land within tenures.		√			Allows designation of Wildlife Habitat Areas and Wildlife Habitat Features. Riparian classification includes management area, management reserve zone, and management zones with varying restrictions and buffers with well-developed discretionary management guidelines.	Effective because protects habitat features important to wildlife for breeding, spawning, nesting, hibernating, etc. It also requires classification of all wetlands with associated restrictions and buffers on wetlands as small as 0.25 ha in specific biogeoclimatic zones. Also provides restrictions and buffers for smaller wetlands within 60 m of each other with a combined size of 5 ha or larger.	Restrictions and buffers do not apply to all small wetlands some of which may have high habitat values. Restrictions and buffers are discretionary and only apply in the absence of an approved Forest Stewardship Plan that does not include a result or strategy to meet the objective for water, fish, wildlife, and biodiversity set out in the Forest Planning and Practices Regulation.	Forest and range tenure holders.

Legislation (Lead Agency)	Mechanism/ Activity	Federal Land	Provincial Land	Reg. Distr./Municipal	Private Land	Tools	Effectiveness	Limitations	Who Is Impacted?
Provincial cont.									
Private Managed Forest Land Act and Regulations	Managed Forest Land Class is a BC Assessment property classification established to encourage private landowners in BC to manage their lands for long-term forest production in accordance with the Private Managed Forest Land Act and associated regulations.				√	A regulatory approach that requires forest owners to protect key public environmental values such as water quality and fish habitat, soils conservation, critical wildlife habitat, and reforestation.	Regulations specify management requirements for timber harvesting, silviculture, and road-related activities. The Managed Forest Council ensures compliance and makes determinations which may be followed by other steps including: Reconsideration of Council Decision, and Appeal to the Forest Appeals Commission. Offers little in regard to enforceable regulation to protect habitat.	A voluntary tax exemption program that has limited protection. Anyone who intends to cut trees on lands covered by FRPA is required to have a cutting licence and must comply with FRPA and associated regulations, or in the case of the oil and gas industry requires a master licence to cut and the provision of the Forest Practices Code applies.	Owners of private forest reserve land.

Legislation (Lead Agency)	Mechanism/ Activity	Federal Land	Provincial Land	Reg. Distr./Municipal	Private Land	Tools	Effectiveness	Limitations	Who Is Impacted?
Provincial cont.									
Wildlife Act (Ministry of Environment and Climate Change Strategy)	Regulation of hunting Access Management Areas		√	√	√	Protects all vertebrate species from direct harm, except as allowed by regulation (e.g., hunting or trapping). Protections can be enabled for endangered or threatened species and their habitats can be protected as Critical Wildlife Habitats in Wildlife Management Areas. Ministry of Environment manages access through two sections of the Wildlife Act. Wildlife Act provides FLNRORD with the ability to manage access within sensitive areas or areas of high fish and wildlife habitat value.	Limited ability to help species through hunting regulations, **s.9** (beaver dams) and **s.34** protection for birds, eggs, and some nests; ability to designate threatened and endangered species and provide for critical wildlife areas within Wildlife Management Areas. **S.108** allows MoE to place restrictions on the use of motorized vehicles for the purpose of hunting or fishing. This section is useful for the protection of populations from over-harvest. **S.109** allows MoE to place restrictions on the use of all motorized vehicles within a specified area for the purpose of wildlife management including the protection of fish and/or wildlife habitat and ecosystems. This restriction applies to all motorized use.	Focus on "take" regulation is a limiting means of managing wildlife; habitat provisions are limited, usually requiring formal designation, but available; threatened & endangered provisions underutilized. Limited reporting and enforcement of violations.	Depends on approach taken. Presently, affects mainly hunters, some farmers, and motorized recreationists.

Legislation (Lead Agency)	Mechanism/ Activity	Federal Land	Provincial Land	Reg. Distr./Municipal	Private Land	Tools	Effectiveness	Limitations	Who Is Impacted?
Provincial cont.									
Fish Protection Act (Ministry of Environment & Climate Change Strategy)	Protection of fish & fish habitat.		√	√	√	Currently in force are sections dealing with designation of sensitive streams, recovery plans, and no new dams on specified rivers.	Sections not yet in force provide for: issuance of stream flow protection licences; orders for temporary reduction in water use in case of drought; identify fish & habitat considerations in water management plans; authorize reduction of water rights in accordance with water management plans. **Sec. 9** in force for orders for temporary reduction in water use in case of drought to protect threatened fish populations.	Not yet in force: **s.5** - fish and fish habitat considerations in licencing decisions; **s.8** - streamflow protection licences; **s.10** - fish and fish habitat considerations in water management plans; **s.11** - reduction of water rights in accordance with plan; and, **s.36 -** transitional pending Water Act applications.	Local governments, landowners, water licence applicants & holders, developers, industry.

Legislation (Lead Agency)	Mechanism/ Activity	Federal Land	Provincial Land	Reg. Distr./Municipal	Private Land	Tools	Effectiveness	Limitations	Who Is Impacted?
Provincial cont.									
Fish Protection Act - Section 12 (Ministry of Environment & Climate Change Strategy) (Local Government)	Riparian Areas Regulation and Sensitive Stream Designation. Focuses on four major objectives: ensuring sufficient water for fish; protecting and restoring fish habitat; improved riparian protection and enhancement; and stronger local government powers in environmental planning.		√	√	√	Provides legislative authority for water managers to consider impacts on fish and fish habitat before approving new licences, amendments to licences, or issuing approvals for work in or near streams.	Directives will help fish-associated habitat, especially if they are critical to maintaining mean annual discharge (MAD) and base-flow requirements under a recovery plan; wetlands expressly addressed in regulations; provides provincial guidance for local governments; regulations incorporate no net loss approach; restricts licencing under Water Act; Sensitive Stream designation allows for recovery plans that may help protect associated habitat. Some local governments have failed to implement as required by the Regulation.	Fish-stream focused; limited ability to address agricultural impacts to riparian areas and wetlands; local governments must establish streamside protection and enhancement areas within 5 years of the Regulation being proclaimed. Only applies to urbanized areas of the province.	Local governments, landowners, some water licence applicants, developers, industry.

Legislation (Lead Agency)	Mechanism/ Activity	Federal Land	Provincial Land	Reg. Distr./Municipal	Private Land	Tools	Effectiveness	Limitations	Who Is Impacted?
Provincial cont.									
Land Act	Integrated Land Management Bureau (ILMB) Ministry of Environment for habitat acquired under **s.106.**		√			Governs the sale and granting of rights to use Crown land.	Has provisions that could help conserve habitat by: • withdrawing wetlands from disposition, • requiring reservations and conservation covenants on Crown land sold; requiring environmental assessment on Crown land before sale, • regulating activity in designated areas, • enforcing against trespass on Crown lands, • allowing for land exchanges (e.g., Crown land for important private land), • allowing any ministry to acquire and manage land.	When it comes to the extraction of natural resources, the Province normally retains ownership of the land, and grants resource extraction rights through other legislation.	Possibly forest and range tenure holders, mining forestry, and other industrial and commercial activities occurring on Crown land.

Legislation (Lead Agency)	Mechanism/ Activity	Federal Land	Provincial Land	Reg. Distr./Municipal	Private Land	Tools	Effectiveness	Limitations	Who Is Impacted?
Provincial cont.									
Land Title Act (LTA)	Land Title Office (LTO); Agricultural Land Commission; Approving Officers under LTA (e.g., local government, Islands Trust, Ministry of Transportation officials).			√	√	Allows registration of **s.219** conservation covenants on land title; specifies terms for subdivision approval.	Good tool for protecting habitat values through encumbrances (rather than outright ownership) on titles that survive ownership changes; allows approving officers discretion to refuse or impose conditions on subdivision of land.	LTO policy requires approval of Agricultural Land Commission for ALR land (but not for FLR). This raises issues about weakness of ALC Act regarding wetlands values. Enforcement is problematic; cost issues (e.g., survey for LTO, affordability for NGOs); discretion re subdivision approvals is adequate.	Property owners, and conservation agencies seeking to negotiate and register conservation covenants.
Protection of Crown Lands (BC Ministry of Environment and Climate Change Strategy)	Orders-in-council		√	√	√	Orders-in-council can be made respecting the environment or land use.	Government has used this provision to establish 81 protected areas. Environment and Land Use Committee of Cabinet has broad powers to ensure that all aspects of the preservation and maintenance of the natural environment are fully considered in the administration of land use and resource development.	Management direction for protected areas is provided by any special conditions included in the establishing order-in-council and specified provisions of the Park Act and Park and Recreation Area Regulation as identified in the order-in-council.	Possibly forest and range tenure holders, mining forestry, and other industrial and commercial activities occurring on Crown land.

Legislation (Lead Agency)	Mechanism/ Activity	Federal Land	Provincial Land	Reg. Distr./Municipal	Private Land	Tools	Effectiveness	Limitations	Who Is Impacted?
Provincial cont.									
Water Protection Act (Ministry of Environment and Climate Change Strategy)	Prohibitions on bulk water removal.		√	√	√		Confirms provincial ownership of Crown surface water and groundwater. Province has right to ensure its protection and sustainable use. Prohibits bulk water removal from BC, and diversion of water between major watersheds within BC.		Water licence applicants, developers.
Water Act (Ministry of Environment & Climate Change Strategy)	Ministry of Environment - Water Stewardship Division		√	√	√	Water Use Planning; Water Use Plans (WUPs)	WUPs define daily operating parameters applied at all BC Hydro hydroelectric facilities; recognize multiple water use objectives; and balance competing uses, such as domestic water supply, fish and wildlife, recreation, heritage, and electrical power needs. Once a WUP is accepted by the Comptroller of Water Rights, operational changes, monitoring studies, and physical works outlined in the plan are implemented through orders under the Water Act.		BC Hydro, other water stakeholders.

Legislation (Lead Agency)	Mechanism/ Activity	Federal Land	Provincial Land	Reg. Distr./Municipal	Private Land	Tools	Effectiveness	Limitations	Who Is Impacted?
Provincial cont.									
Water Act **Groundwater Protection Regulation** (Ministry of Environment & Climate Change Strategy)	Land and Water BC Inc. (for dispositions) Ministry of Environment - groundwater technical standards and water management planning		√	√	√	Issuance of water licences Groundwater protection	Water Act requires provincial approval for diverting or storing water, or changes in and about a stream (definition includes wetlands to some extent). Groundwater regulations (Part 5 of Water Act) protect wells/aquifers from contamination and thus afford some protection for wetlands that are groundwater-fed. Part 4 of Water Act provides for legally binding water management plans tailored to address local issues.	Wetland conservation issues are not effectively addressed in Water Act; important wetlands may be harmed by licence approvals. Groundwater consumption is not regulated which could result in wetlands connected to groundwater going dry. Definition of stream is limited in that it may not be interpreted to include all wetlands.	Water Licence applicants/holders. With respect to groundwater, well owners, drillers, and pump installers are impacted. Consultants may also be impacted in that they may be required to make alternate specifications for well installations.
Drainage, Ditch and Dike Act (Part 1 of Act repealed by Bill 8, 2002) **Dike Maintenance Act**	Dike construction and maintenance		√	√	√	None – but **s.63** requires compliance with Water Act.	Establishes authority for activities that can impact wetlands, but does not impose accountability for wetlands impacts.	May have considerable impact on wetlands, yet does not address wetlands at all. Most diking is historic; new diking is undertaken by local government or Ministry of Transportation.	Local governments, Ministry of Transportation and Infrastructure.

Legislation (Lead Agency)	Mechanism/ Activity	Federal Land	Provincial Land	Reg. Distr./Municipal	Private Land	Tools	Effectiveness	Limitations	Who Is Impacted?
Provincial cont.									
Agriculture Land Commission Act **Agricultural Land Reserve Use, Subdivision and Procedure Regulation**	Agricultural land practices			√	√	Regulates use of agricultural land, soil removal and fill in ALR. Brownfield Removal Strategy.	Variable. Allows for ecological reserves and wildlife habitat uses of agricultural land if surface is not subject to substantial works; very limited allowance for considering environmental values (**ss. 43.1, 44**), but always subordinate to farm use.	Strong priority given to agriculture; no consideration of environmental impacts such as loss of wetlands for most decisions; assumes agricultural land is more scarce than wetlands; could impede ability to implement mitigation measures.	Private landowners in Agricultural Land Reserve (ALR).
Weed Control Act	Invasive species		√	√	√	The BC Weed Control Act imposes a duty on all land occupiers to control designated noxious plants.	Works for designated species that have an impact on agriculture.	Designated species list may not reflect invasive species that are impacting non-agricultural lands.	Crown land and private landowners.

Legislation	Lead Agency	Federal Land	Provincial Land	Reg. Distr./Municipal	Private Land	Relevance	Effectiveness	Limitations	Who Is Impacted?
Provincial cont.									
Local Government Act (LGA) **Community Charter (CC)**	Local governments Ministry of Community and Rural Development			√	√	Zoning and bylaw actions affect land use.	In addition to Environmentally Sensitive Areas (ESAs) and Development Permit Areas (DPAs) designations, local governments have delegated authority to identify land use zones and pass bylaws affecting land use that could impact wetlands, for both public and private land. This can have both a positive and negative effect on wetlands. Wetland areas prone to flooding can be protected by bylaw (**s.910 LGA**). Forested wetlands could be protected from tree cutting by bylaw (**s.50 CC**).	Recognizes that a purpose of local government is to foster the "current and future economic, social, and environmental well-being of a community." Does not provide a definition of "environment," and protection of wetland environments, wetland habitats, and wetland species including species at risk is discretionary rather than mandated ("may" instead of "must"). Local governments are constrained by some provincial legislation, e.g., Farm Practices Protection (Right to Farm) Act, in their desire to protect wetlands as the highest use for a property.	Local governments, landowners, and constituents.

Legislation	Lead Agency	Federal Land	Provincial Land	Reg. Distr./Municipal	Private Land	Relevance	Effectiveness	Limitations	Who Is Impacted?
Provincial cont.									
Official Community Plans (OCPs) - Bylaw				√	√	Official Community Plans support a sustainable community, and serve to preserve and enhance the local economy, and the health and well-being of its residents and property owners as well as the natural environment. OCPs must encourage environmental stewardship for land, water, and air.	OCPs are enacted as bylaws with an overarching goal to support healthy, clean, and sustainable communities by ensuring that environmental integrity and diversity are maintained in land use decisions. Broad environmental goals can include: protecting the natural environment; ensuring development does not adversely harm or detract from identified wildlife corridors and areas with high wildlife and fisheries habitat value; protecting the quantity and quality of water resources and waterways; ensuring development is managed along with the physical nature and natural limitations of the land base.	Refers to resource and land use based on forestry, mining, and commercial, residential, and recreation development and activities relative to sustainability. Strong OCPs can have resource objectives such as protecting the local forest land base and large areas of un-fragmented forest habitat for its aesthetic and recreational value and importance to natural ecological functioning; and protecting riparian zones, sensitive ecosystems, watersheds, and biodiversity.	Private landowners, developers, industrial and commercial interests.