Kootenay Connect: Riparian Wildlife Corridors for Climate Change

Year 2 Annual Report

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

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DEFINITION OF ACRONYMS

ALR	Agricultural Land Reserve
BBC	Bonanza Biodiversity Corridor
BCO	Biodiversity Conservation Opportunity
BMP	Best Management Practices
CBT	Columbia Basin Trust
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
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
FLA	Farmland Advantage
FRPA	BC Forest and Range Protection 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
FLNRORD	Ministry of Forests, Lands, Natural Resource Operations and Rural Development
NCC	Nature Conservancy of Canada
NGO	Non-governmental Organization
NTBC	The Nature Trust of British Columbia
OCP	Official Community Plan
OCEM	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
SLSS	Slocan Lake Stewardship Society
SWAMP	Slocan Wetlands Assessment & Monitoring Project
TBGBP	Trans-Border Grizzly Bear Project
WC	Wycliffe Corridor
WHA	Wildlife Habitat Area
WHF	Wildlife Habitat Feature
WNS	White-nose Syndrome
WMA	Wildlife Management Area

EXECUTIVE SUMMARY

Riparian and wetland systems are biodiversity hotspots and climate refugia that also act as wildlife linkages across human-settled valleys. In the Kootenay region of BC, protecting riparian-wetland complexes is also the best opportunity for re-establishing fragmented grizzly bear populations and potentially other wildlife species. A new initiative called "Kootenay Connect" integrates large carnivores, ungulates, and other wildlife and species at risk occurrence data with large riparian-wetland complexes mapped in Geographic Information Systems (GIS) to identify critical habitats and connectivity corridors at a regional scale.

Our vision for Kootenay Connect is to add the landscape-scale connectivity dimension to conserving biodiversity; integrate conservation and management efforts across ecosystems and jurisdictions to promote climate change resilience; and help kick-start connectivity conservation collaboratives in the Kootenays where they are not yet occurring.

The four goals of Kootenay Connect are to:

- Blend science and community-based approaches to large landscape conservation by identifying connectivity areas throughout the East and West Kootenays focused on wildlife corridors, biodiversity hotspots, and climate change refugia.
- Integrate climate modelling to identify the highest priority areas in which to retain landscape connectivity as habitats shift over time.
- Assess conservation threats, and opportunities for addressing them, through strategies that will enhance the ability of ecological networks to connect different landscape elements and elevational gradients for all species.
- Initiate governmental and public recognition of Kootenay Connect'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, Wildlife Management Areas, Wildlife Habitat Areas, private land trust acquisitions, private land habitat restoration, and appropriate regional and provincial government land use regulations.

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

This report of Kootenay Connect's Year 2 activities and results updates (and replaces) our Preliminary Report and annual Year 1 Report (Proctor and Mahr 2019, 2020). Briefly, this initiative evolved from a decade of work by the Trans-border Grizzly Bear Project (TBGBP) that identified grizzly bear fragmentation patterns (Proctor et al. 2012) and potential corridors across the region's human-settled valleys of southeastern BC (Proctor et al. 2015); and detailed how a decade of targeted connectivity management resulted in enhanced grizzly bear connectivity across the Creston Valley that also protected strategic endangered northern leopard frog breeding habitats (Proctor et al. 2018).

This body of work highlighting the Creston Valley Frog Bear corridor became the springboard and proof of concept for Kootenay Connect to investigate the role of riparian-wetland complexes throughout the Kootenay region to provide at a regional scale 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 example are that science research can help confirm the most important locations for conservation measures across landscapes, inform specific solutions and actions, and monitor their effectiveness. Using this paradigm, 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 conservation.

Kootenay Connect builds on the growing capacity of conservation collaboratives that 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 stakeholders with a common interest in developing place-based solutions for local landscapes. We are working with the Kootenay Conservation Program, a network of 80+ partners, and other key stakeholders within 12 corridors to develop a mosaic of conservation activities, strategies, and solutions that

include private and public lands in order to improve management across wildlife corridors and landscape connectivity areas throughout the East and West Kootenays.

As regional funders such as the Fish & Wildlife Compensation Program (FWCP) and Columbia Basin Trust (CBT) direct more support to landscape-level conservation and restoration, and federal and global initiatives encourage increasing protected areas and connectivity areas, the time is right for Kootenay Connect to help identify where conservation values are highest, capacity is strongest, and collaborative efforts are valued. Thus, there are many ongoing conservation opportunities and initiatives that are complementary to the purposes of Kootenay Connect within which we can contribute an integrated high-level perspective to stitch together habitats and ecosystems that ecologically depend upon each other as an integrated whole.

Kootenay Connect is being developed over three years between 2019–2022. In Year 1 (2019–2020), our project focused on Four Focal Corridors: Creston Valley and Bonanza Biodiversity Corridor in the West Kootenay, and the Columbia Wetlands and Wycliffe Wildlife Corridor in the East Kootenay. In Year 2 (2020–2021), we focused on the Lardeau Duncan area 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 Year 3 (2021–2022), we will focus on the Koocanusa Reservoir area and Elk River Valley to the south and east of Cranbrook in the East Kootenay, and the Retallack area at the mountain pass on Highway 31A between Kaslo and New Denver and Salmo River Valley south of Nelson in the West Kootenay (Fig. 1).

In Year 2, Kootenay Connect focused on the four focal corridors mentioned above by working closely with stewardship groups, First Nations, and local and provincial biologists, land planners, and natural resource managers to implement corridor-specific conservation strategies. This included identifying areas for strategic private land acquisitions; conservation easements and farm stewardship plans; enhancements to Wildlife Management Areas; and possible expansions to Wildlife Management Areas and BC's protected areas system. We 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. We intend that this Kootenay Connect annual report will provide a framework, mechanisms and tools for scaling up local conservation efforts to provide solutions for large-scale conservation.

The following activities were pursued in Year 2 of Kootenay Connect:

1. **Mapping**. We developed an extensive GIS database to help us map carnivore/wildlife/species at risk (SAR)/riparian/climate change corridors to be considered for enhanced

protection and connectivity management. Our GIS data includes 14 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 and bighorn sheep occurrence data; 7) ungulate winter range; 8) all available SAR spatial data including a thorough species at risk review in the Columbia Wetlands; 9) ecological and geophysical GIS layers; 10) regional ecological climate-response modelling; 11) high conservation value forest delineations used by the timber industry; 12) human-related land use layers; 13) jurisdictional land use designations, private and public protected lands, land ownership; and 14) information gathered from several regional wildlife and habitat experts.

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 threats and conservation opportunities.
3. **Identified private land conservation opportunities**. We assessed private lands within and adjacent to riparian-wetland complexes within our Eight Focal Corridors for their potential conservation by the 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).
4. **Produced detailed GIS maps for each of the Year 2 Four Focal Corridors.** We have mapped the Lardeau Duncan, Columbia Lake, Golden, and Slocan River Corridors with the above attributes to inform conservation planning.
5. **Worked with champions in Year 2's Four Focal Corridors.** We used our experiences from Year 1 workshops to refine and improve our approach to designing our Year 2 workshops in the Four Focal Corridors: Lardeau Duncan (July 17, 2020), Columbia Lake (October 14, 2020), Golden (November 25, 2020), and Slocan River (March 5, 2021). For each workshop we consulted with local stewardship groups; First Nations; local, regional, and provincial land managers; and other regional experts to review maps and identify corridor-specific threats and conservation opportunities available in both the public and private sectors.
6. **Analyzed case studies.** We worked in Year 2's Focal Corridors applying our framework of data-gathering, interpretation, and mapping to inform identification, prioritization, and implementation of conservation actions.

7. **Compiled existing resources.** We researched and packaged the best available information and resources for each of the Year 2 Focal Corridors, such as data layers, maps, conservation targets and threats tables, and relevant journal articles and reports.
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 2 Annual Report.* The purpose of this report is to showcase the initiative and is our blueprint for future conservation efforts across the region. We developed a matrix of Kootenay Connect corridor-specific needs, efforts, and conservation tools to guide the approach we are applying to corridors in Year 3 (2021–2022).

Over the past two years (2019–2021), Kootenay Connect and our partners have carried out conservation-oriented workshops in eight focal corridors across the Kootenay Connect region. Here we summarize, by focal corridor, our downstream conservation activities and results of our collective efforts. For more details about each of these projects see Part V.

Creston Valley

- Restored otherwise vegetation-choked water channels to enhance northern leopard frog breeding ponds and connectivity routes, which resulted in a significant increase in egg masses produced in both years since the restoration work, enough to allow a portion to be translocated to a reintroduction site near Brisco in the Columbia Wetlands.
- Developed a climate change assessment that identified a transboundary climate corridor along the Kootenay River from Bonner's Ferry through the Creston Valley and along the east shore of Kootenay Lake.
- Upgraded a water control mechanism that will allow better water access to improve wetland function to > 300ha.
- Initiated and contributed to the design of a Connectivity Management Plan for the area that spans the east–west extent of the northern portion of the valley, capturing the "Frog Bear Conservation Corridor" and predicted climate corridors to be managed as an ecological corridor for northern leopard frogs, grizzly bears, bats, and more to be implemented in 2021–2023.

Bonanza Biodiversity Corridor

- Completed assessment and restoration at Hunter Siding Wetland to increase connectivity within the Bonanza Creek floodplain; to provide opportunities for increasing the rare ecological community of western cedar-skunk cabbage swamp; and to conserve key amphibian breeding areas.

- Developed restoration plans for Upper Bonanza Creek and Summit Lake wetlands to improve hydrologic connectivity to be implemented in 2021–2022.
- Conducted fisheries surveys that assessed how wetland/riparian enhancement sites could also benefit instream kokanee and rainbow trout habitat and passage along Bonanza Creek and Summit Lake.
- Carried out field inventory and mapping of all current and historic beaver activity, lodges, dams, and channels throughout the 15-km corridor to estimate occupied and unoccupied habitats in the Bonanza Corridor to develop a plan for beaver restoration as part of wetland enhancement projects.
- Completed ecosystem mapping and field ground-truthing that identified remaining old-growth western red cedar-western hemlock forests in the corridor to create a current GIS layer of Old Growth Management Areas (OGMAs).
- Conducted biodiversity and species at risk (SAR) field surveys with approximately 1,000 species identified including several hundred not previously known to the area and 25 species with provincial and/or federal conservation status.
- Developed a climate change assessment that identified a regional climate corridor moving north along the Valhalla Range on the west side of the Slocan River Valley and Slocan Lake through the Bonanza Corridor and continuing northward along the south side of Summit Lake towards Nakusp.

Wycliffe Corridor

- Conducted field assessments to inform ecosystem-based restoration prescriptions to improve critical habitat for endangered Williamson's sapsucker and Lewis's woodpecker on suitable forested sites in the 1,109-hectare Wycliffe Conservation Complex, to be implemented in 2021–2022.
- Assessed grassland health to inform and prioritize 2021–2022 restoration work.
- Surveyed invasive species and did initial treatment of several high-priority areas to support native grassland restoration activities in 2021–2022.

Columbia Wetlands

- Performed SAR data search and literature review (2020), which identified 65 SAR and 21 ecological communities at risk within the 180-kilometre-long Columbia Wetlands.
- Conducted field SAR surveys focusing on Lewis's woodpecker, western painted turtle, osprey, mountain goat licks, and the rare alkali saltgrass–foxtail barley ecological community.

- Identified 10 additional (only two were previously known) important western painted turtle sites, with plans to be implemented in 2021–2022 to reduce western painted turtle nest site mortality on roads and improve basking habitat through log placement.
- Applied for two provincial Wildlife Habitat Areas (WHA) to protect rare alkali saltgrass–foxtail barley ecosystem on Crown land in the Canal Flats area. In 2021–2022, third site will be applied for a WHA designation.
- A Wildlife Habitat Area for a great blue heron rookery on Crown land linking mature upland forest and the wetlands was submitted to the province to help abate a Kootenay-wide decline in successful heron nest sites.
- Successful applications were submitted to the provincial government to designate two Wildlife Habitat Features to protect identified mountain goat mineral licks upland from the wetlands.
- Completed the first ecosystem mapping of the Columbia Wetlands using lidar and Terrestrial Ecosystem Mapping to highlight important areas such as remaining cottonwood forest galleries.
- Applied a new Elk Habitat Model developed by a research scientist at the University of Alberta across the entire Columbia Wetland area to predict high-value habitat for this culturally important species.
- Combined grizzly bear, wolverine, mountain goat, American badger, and elk data to identify potential multi-species cross-valley upland corridors linking the Rocky Mountains–Columbia Wetlands–Purcell Mountains.
- Identification of 126 specific biodiversity conservation opportunities relative to SAR and multi-species upland corridors to guide future Wildlife Management Area prescriptions and expansion areas, new land trust acquisitions, private land restoration activities, and more.
- Completed the first-ever hydrological studies assessing wetland health and vulnerability due to water level changes over time in order to identify at-risk wetlands that might lose their ability to retain water during dry conditions from climate change.
- Bat researchers erected two (of 10 planned) artificial old-growth bat roosts in the northern portion of the Columbia Wetlands to mitigate loss of old-growth forest until it is replenished. Roosts will benefit northern myotis and other old-growth-dependent species, to be expanded in 2021–2023.

In Kootenay Connect's new Year 2 Focal Corridors, priority actions were identified during workshops. Many of the following activities will be implemented in subsequent years.

Lardeau

- Work to establish a cross-valley corridor linking the Purcell and Selkirk ranges and the Purcell Wilderness Conservancy and Goat Range Park
- Identify additional private lands of high conservation value as candidates for acquisition
- Consider conservation tools and designations to protect conservation values, such as Wildlife Management Area, Section 16, and Environmentally Sensitive Areas
- Enhance Crown land conservation status on selected undesignated Crown lands
- 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

Columbia Lake

South end of Columbia Lake

- Encourage the Village of Canal Flats to create a buffer around the WMA
- Manage human access to the trails through the wetlands and lakeshore
- Extend conservation management along the WMA to the east to Sabine-Desmet area

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
- Evaluate stewardship and conservation opportunities for the Columbia River and Wetlands corridor between Fairmont and Lake Windermere to enhance bird habitat a north–south flyway
- Integrate activities on the east side of the Columbia River with the Ktunaxa and Aksiq'nuk

Golden

Five action plans were developed to guide activities.

- Combine science and Indigenous Knowledge to protect SAR habitat and biodiversity in the Columbia Wetlands (5 activities)
- Identify and prioritize for conservation of multi-jurisdictional, multi-species wildlife corridors linking valley bottom wetlands and uplands (10 activities)
- Reduce Intensity of human disturbance in backcountry, sensitive areas and wildlife corridors (24 activities)
- Mitigate recreational impacts by incorporating recreation and ecological data to inform land use decisions (9 activities)
- Build climate adaptation and mitigation thinking into all conservation activities (7 activities)

Slocan River

Lemon Creek Corridor

- Identify conservation targets to fit into a larger corridor-based project
- Work to reduce motorized access on Crown land to improve habitat security for grizzly bears, wolverine, and other species
- Investigate non-motorized designation on Slocan River from Slocan Lake to Lemon Creek
- Initiate a second phase of Sensitive Ecosystem Inventory to improve and prioritize cottonwood forests and rare floodplain communities
- Evaluate cottonwood galleries for western screech-owl conservation and assess options for habitat protections
- 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 including bird and bat boxes
- Continue SAR inventories through the Slocan Valley Biodiversity Project

Passmore Corridor

- Support habitat restoration and enhancement on the lower Little Slocan River to protect channels and shorelines, create and restore fish habitat, and enhance wildlife movement corridors
- Continue efforts to protect Perry Ridge[1] 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

We found consistent and similar conservation targets and threats across Year 2's Eight Focal Corridors, yet with just enough variation to reinforce that there is no cookie-cutter approach that will address connectivity throughout the Kootenay region. This local, community-based approach was reflected in the articulation of priority actions and recommendations for conservation. Specific tools and who might address these activities are detailed in Table 4 in the Recommendations section.

We recommend these actions occur Kootenay-wide:

- Improving efforts to inventory SAR to capture existing biodiversity
- Prioritizing the identification of critical habitats and biodiversity hotspots and opportunities for protection

[1] https://www.perryridge.org/

- Integrating Kootenay Connect's mapping of connectivity areas that link valley bottom riparian and wetland areas to upland habitat to guide protection of species whose inter-seasonal and inter-generational life cycles span the riparian-upland interface (e.g., western toads, western painted turtles, great blue herons, western screech-owls)
- Increasing the effectiveness of measures to reduce recreational access and pressures impacting species at risk and connectivity habitats, i.e., access management practices should be initiated in these corridors and the areas adjacent to them
- Assessing landscapes in terms of conservation opportunities for both private and public land, for example, being creative about how land trust acquisitions can complement WHA designations for key species at risk
- Detecting, preventing, managing and monitoring invasive terrestrial and aquatic species
- Viewing landscape-scale processes such as fire dynamics, forest regeneration, invasive species management, predator-prey cycles, hydrologic fluctuations, and climate change as necessarily requiring private and Crown land management solutions
- 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 (e.g., catastrophic fires)
- Enhancing intra-wetland hydrologic connectivity throughout the region to increase climate resilience and mitigate drought
- Using Kootenay Connect's data and maps to underpin and inform efforts by its partners and all levels of government to pursue official designation and establishment of "Wildlife and Ecological Corridor" status for identified areas to integrate connectivity conservation within and in addition to the existing system of protected areas including BC Parks and Parks Canada, Wildlife Management Areas, and private conservation lands managed by land trusts (e.g., NCC, NTBC)
- Evaluating how an integrated Kootenay-wide ecological network that connected valleys to uplands and protected areas like federal and provincial parks could increase our region's climate resilience while at the same time addressing the loss of biodiversity and old-growth forest that many listed species depend upon for survival

Kootenay Connect is a deliberate synthesis of FWCP's Action Plan focal ecosystems, habitats and species encapsulated by priority actions in Upland & Dryland and Wetlands & Riparian Areas Action Plans. Our project is designed to maintain and re-establish landscape-level connectivity through our human-settled valleys through rich, biodiverse wetland-riparian complexes and in the process overlaps with many identified FWCP Priority Actions encompassing research, land securement, habitat-based actions and monitoring detailed below. Kootenay Connect works to sew together upland habitats with wetland-riparian habitats for the benefit of several recovery species and species of interest and their habitats.

Kootenay Connect: Corridors with Champions

Kootenay Connect's 12 target corridors based on:

- high ecological value
- intact grizzly bear habitat
- riparian-wetland areas
- local champions

★ Year 1 (2019-2020)
★ Year 2 (2020-2021)
★ Year 3 (2021-2022)

In all corridors, Kootenay Connect is working with stewardship groups, land trusts, local, provincial and federal government, and First Nations to identify potential collaborators.

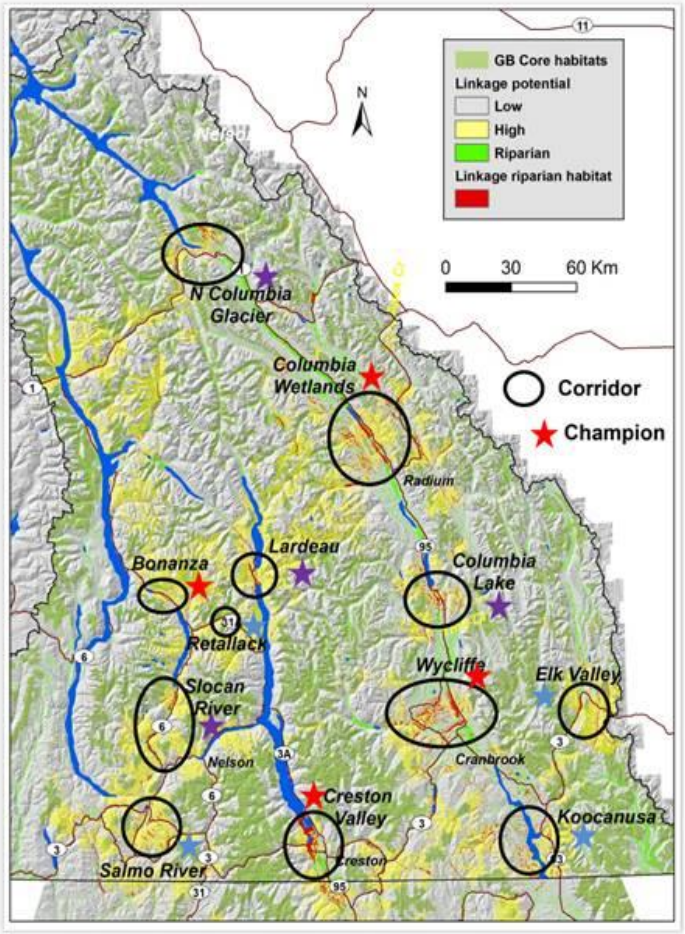


Figure 1. Kootenay Connect's 12 Focal Corridors represented as cohorts in Years 1 through 3 with local champions identified (colour-coded stars). Year 2 Focal Corridors of Lardeau Duncan, Slocan River Valley, Columbia Lake, and Golden area are denoted in purple.

OVERVIEW

This report of Kootenay Connect's Year 2 activities and results updates (and replaces) our Preliminary and Year 1 Reports (Proctor and Mahr 2019, 2020). It provides background, justification, and realized and anticipated conservation benefits of initiating Kootenay Connect to assess and call attention to ecological connectivity throughout the Kootenay region. In our Year 1 Report we summarized our Preliminary Report and presented new information and results from our analysis, maps, and workshops in "Four Focal Corridors" of Creston Valley, Bonanza Biodiversity Corridor, Columbia Wetlands, and Wycliffe Wildlife Corridor. In this Year 2 Report we build upon the findings of our Year 1 Report and increase our scope to "Eight Focal Corridors" including Lardeau Duncan, Slocan River Valley, Columbia Lake, and Golden (Fig. 2).

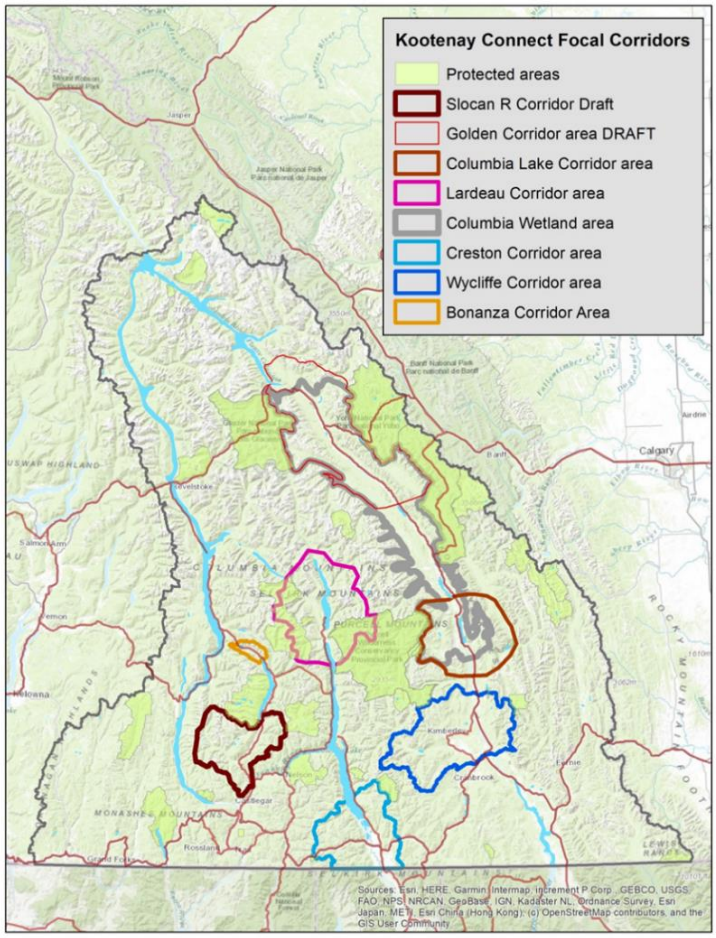


Figure 2. Eight Focal Corridors across the Kootenay region within Kootenay Connect Years 1 and 2 efforts encompassing 18,000 km^2.

Our vision for Kootenay Connect is to add the landscape-scale connectivity dimension to conserving biodiversity; integrate conservation and management efforts across ecosystems and jurisdictions to promote climate change resilience; and help kick-start connectivity conservation collaboratives in the Kootenays where they are not yet occurring.

The premise behind Kootenay Connect is that landscape linkages focusing on large riparian-wetland complexes are essential for conserving biodiversity, wildlife movement corridors, and ecological functions over time. Given this, the goals of Kootenay Connect are:

- To blend science and community-based approaches to large landscape conservation by identifying connectivity areas throughout the East and West Kootenays focused on wildlife corridors, biodiversity hotspots, and climate change refugia.
- To integrate climate modelling to identify the highest priority areas in which to retain landscape connectivity as habitats shift over time.
- To assess conservation threats, and opportunities for addressing them, through strategies that will enhance the ability of ecological networks to connect different landscape elements and elevational gradients for all species.

In Year 2, we added a fourth goal:

- To initiate governmental and public recognition of Kootenay Connect'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, Wildlife Management Areas, Wildlife Habitat Areas, private land trust acquisitions, and appropriate regional and provincial government land use regulations.

Throughout this document we refer to "ecological connectivity"[2] 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 destruction and fragmentation of habitats and loss of species and is a key approach 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.

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

KOOTENAY CONNECT AND FWCP ACTION PLANS AND PRIORITY ACTIONS

Our project is an intentional synthesis of the Fish & Wildlife Compensation Program's (FWCP) focal ecosystems, habitats, and species encapsulated by priority actions in Upland & Dryland and Wetlands & Riparian Areas Action Plans. Given that Kootenay Connect is designed to maintain and re-establish landscape-level connectivity through human-settled valleys that have rich, biodiverse wetland-riparian complexes, our project overlaps with many identified FWCP Priority Actions encompassing research, land securement, habitat-based actions, and monitoring detailed below.

Kootenay Connect's large landscape approach sews together upland habitats with wetland-riparian habitats for the benefit of 31 federal species at risk (SARA 2002) and 35 provincial species of special concern and interest (see Table 5 in Appendix A for a Summary of Species at Risk across Kootenay Connect). Many of these species are "recovery species" mentioned in the FWCP's Action Plans such as, northern leopard frog, western painted turtle, western screech-owl, Lewis's woodpecker, northern myotis, American badger, and grizzly bear. Kootenay Connect is designed to benefit 35 species of provincial special concern and interest, such as bull trout, kokanee, great blue heron, osprey, mountain goat, and American beaver.

As a result of our workshops and mapping in Years 1 and 2 we have increased local appreciation for the ecological significance of wetland and riparian habitats and provided strategic guidance on community-based stewardship and conservation activities. An early example of Kootenay Connect's conservation impact was securing a $2 million 4-year grant (2019–2023) from Environment and Climate Change Canada's Nature Fund for "Kootenay Connect Priority Places," for our Year 1 cohort of Four Focal Corridors (Fig. 1).

Kootenay Connect overlaps well with many of the global priority actions applicable to all focal areas identified in FWCP's Upland & Dryland and Wetland & Riparian Areas Action Plans detailed below. The area-specific actions also overlap with Kootenay Connect's goals and objectives (see Part V for results of Years 1 and 2).

FWCP UPLAND & DRYLAND ACTION PLAN

Kootenay Connect aligns well with the priorities of FWCP's Upland & Dryland Action Plan.

Under Land Securement there are several relevant Priority Actions where Kootenay Connect is making important contributions, including:

- Protecting connectivity corridors for carnivores and ungulates in the Creston Valley – Kootenay Connect is advising and funding through our ECCC grant (see Part V)

restoration and enhancement projects to benefit multiple species within the Frog Bear Conservation Corridor linking the South Purcell and South Selkirk Mountains.

- Securing important connectivity habitat for carnivores and ungulates in the Elk Valley and Columbia Valley – In Year 2 of Kootenay Connect ECCC-funded work, Kootenay Connect has gathered available multi-species data and identified corridors that will receive conservation attention in Years 3 and 4 (2021–2023) of that grant.
- Identifying opportunities to secure priority upland/dryland habitats in the Columbia Basin – Kootenay Connect is working directly with the Nature Conservancy of Canada and the Nature Trust of BC to facilitate achieving this goal, particularly in the Columbia Wetlands, Columbia Lake, and Wycliffe corridors.
- Contributing to land acquisition opportunities as they arise adjacent to conservation properties and Wildlife Management Areas for recovery of focal species and the habitats they depend upon now and into the future – Kootenay Connect has produced a database, maps, and report identifying conservation opportunity areas that have been shared with the Kootenay Conservation Program's Securement Committee.
- Protecting upland grassland and open forests in the Columbia Valley – Kootenay Connect is encouraging, and funding, though our ECCC grant, grassland restoration in the Columbia Valley as well as the Wycliffe Corridor. Enhancing habitat through wildlife tree recruitment (primarily for Lewis's woodpecker), grassland, and open forest ecosystem restoration activities in the East Kootenay – Kootenay Connect's financial support of projects in the Wycliffe Focal Area also includes restoration of Williamson's sapsucker and American badger habitat.

FWCP WETLANDS & RIPARIAN AREAS ACTION PLAN

Kootenay Connect aligns well with the priorities of FWCP's Wetlands & Riparian Action Plan.

Under Research and Information Acquisition, Kootenay Connect is:

- Mapping the abundance and distribution of riparian habitats by focal area including detailed wetland mapping in the Bonanza Corridor and Columbia Wetlands Focal Areas.
- Reviewing available species inventories in order to identify changes, trends and information gaps, as well as generating new data on species at risk, such as western painted turtle nesting locations in the Columbia Wetlands.

Under Habitat-based Actions, Kootenay Connect is:

- Engaging in on-the-ground projects to restore and create wetland and riparian area habitat in Kootenay Connect's Bonanza and Creston Valley Focal Corridors.

- Exploring options to collaborate with partners, in order to conserve and enhance wetland and riparian areas in the Lardeau Duncan and Slocan River valleys.

Under Land Securement, Kootenay Connect is:

- Identifying threats to habitat connectivity and supporting opportunities for land securement to permanently protect and steward values for wetland and riparian areas in all Kootenay Connect focal corridors.

Under Monitoring and Evaluation, Kootenay Connect is:

- Compiling, assessing, and documenting effectiveness of completed wetland and riparian restoration projects in Kootenay Connect's Four Focal Corridors funded by ECCC.

HOW THIS REPORT IS ORGANIZED

This Year 2 Report is organized into two main parts: Background and Results.

BACKGROUND

1. Part I explores the intellectual and conservation rationale for the concept of Kootenay Connect, and has been updated from previous reports.
2. Part II 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.
3. Part III 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.
4. Part IV 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

5. Part V provides results of our Year 1 and 2 activities in Eight Focal Corridors, introduces additional focal areas to be considered in Year 3, and proposes a framework for identifying, prioritizing, and implementing conservation actions.
6. Part VI identifies next steps beyond this report to effectively deliver Kootenay Connect.

BACKGROUND

NOTE TO READER: This multi-year, geographically broad project has accumulated many results over the past two 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 sections relevant to their interests.

PART I. WHY KOOTENAY CONNECT?

The impetus for developing the new initiative of "Kootenay Connect" is based on ecological principles, with downstream social, political, and economic implications. The Trans-border Grizzly Bear Project (TBGBP) has identified corridors for grizzly bears across most human-settled valleys with major highways across the Kootenay region (Proctor et al. 2015) in response to evidence of extensive population-level fragmentation (Proctor et al. 2012). Based on this research and corridor identification, the TBGBP focused connectivity management on the Creston Valley and over a decade or more, successfully re-established connectivity between the South Selkirk and South Purcell Mountains in that area (Proctor et al. 2018). The main linkage area was the northern end of the Creston Valley, which is dominated by the Creston Valley Wildlife Management Area (CVWMA) – a large world-class riparian-wetland complex that is also a regional biodiversity hotspot[3] (Fig. 3). That special area was given the moniker the "Frog Bear Conservation Corridor"[4] to highlight the fact that the endangered northern leopard frog is also staging a comeback in shallow open water wetlands exactly where grizzly bears are traversing the valley.

Soon after, and with this frog-bear species overlap in mind, 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 areas throughout the Kootenay region. These findings have led us to consider other important regional linkage areas and develop a large landscape approach through Kootenay Connect. This initiative is designed to build on conservation success in the Creston Valley to establish and enhance connectivity areas that provide benefits at a regional scale for multiple species at risk, sensitive habitats, movement corridors, and ecological functions, and apply them across several landscapes within the Kootenays.

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

[4] https://www.natureconservancy.ca/en/where-we-work/british-columbia/featured-projects/west-kootenay/frog-bear-conservation-corridor.html

Figure 3 illustrates the diversity of land ownership that may necessitate a mosaic of conservation strategies respective of private and public landownership. The Trans-border Grizzly Bear Project has been working with a network of organizations to apply a mosaic of conservation strategies within the Creston Valley for over a decade, which has resulted in the re-establishment of inter-mountain connectivity of grizzly bears (Proctor et al. 2018) and expanded the conservation utility of the Creston Wildlife Management Area in an east–west dimension to foster wildlife connectivity.

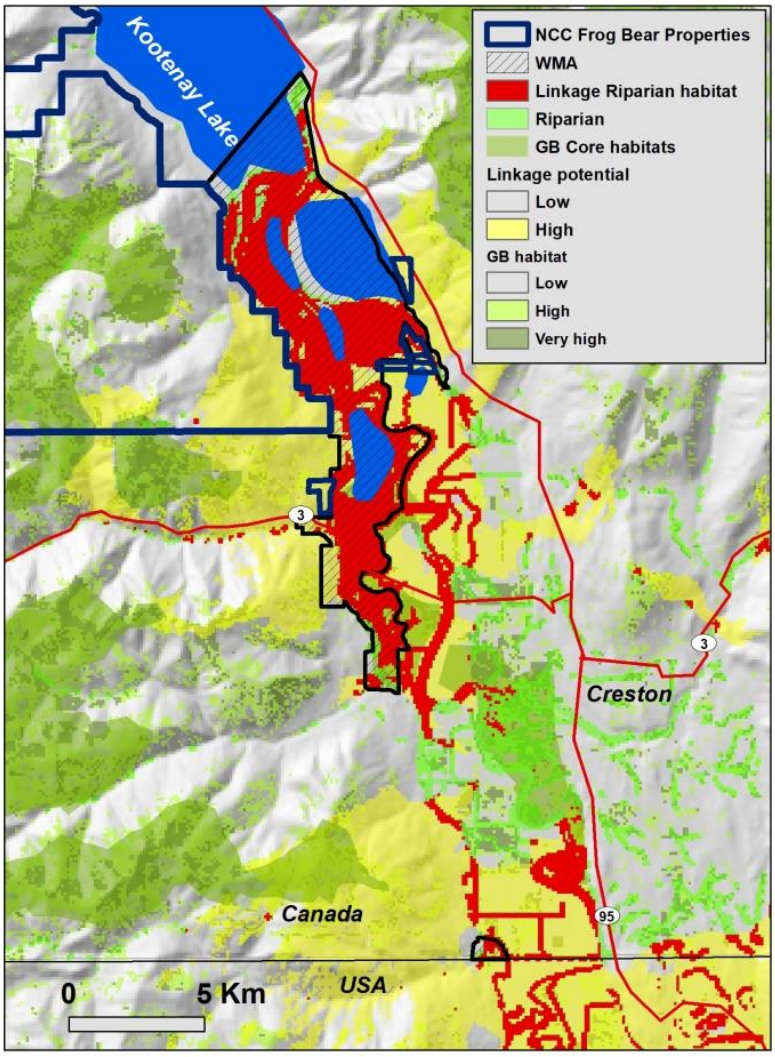


Figure 3. Close-up of the overlap of riparian-wetland habitats and grizzly bear linkages (red) in the Creston Valley that reveals the mosaic of land ownership (provincial, Creston Valley Wildlife Management Area, and private land conservation properties owned by Nature Conservancy of Canada).

SCIENCE RATIONALE

We know that riparian-wetland areas often have higher species richness and abundance than adjacent upland habitats (Klein et al. 2009, Kinley & 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 mentioned above and the region's grizzly bears (Proctor et al. 2012, 2015). It has also been suggested that to effectively manage for biological diversity (including ecological processes or ecological diversity) a landscape perspective is required (Naiman et al. 1993) that integrates adjacent upland habitats as well as adjacent agricultural lands (Harvey et al. 2008).

Considering the entire landscape (Fig. 4), 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. 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. Both suitable habitats and connectivity need to occur across a large-scale grizzly bear metapopulation, but this is fragmented in the Kootenay region (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 funds) 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.

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

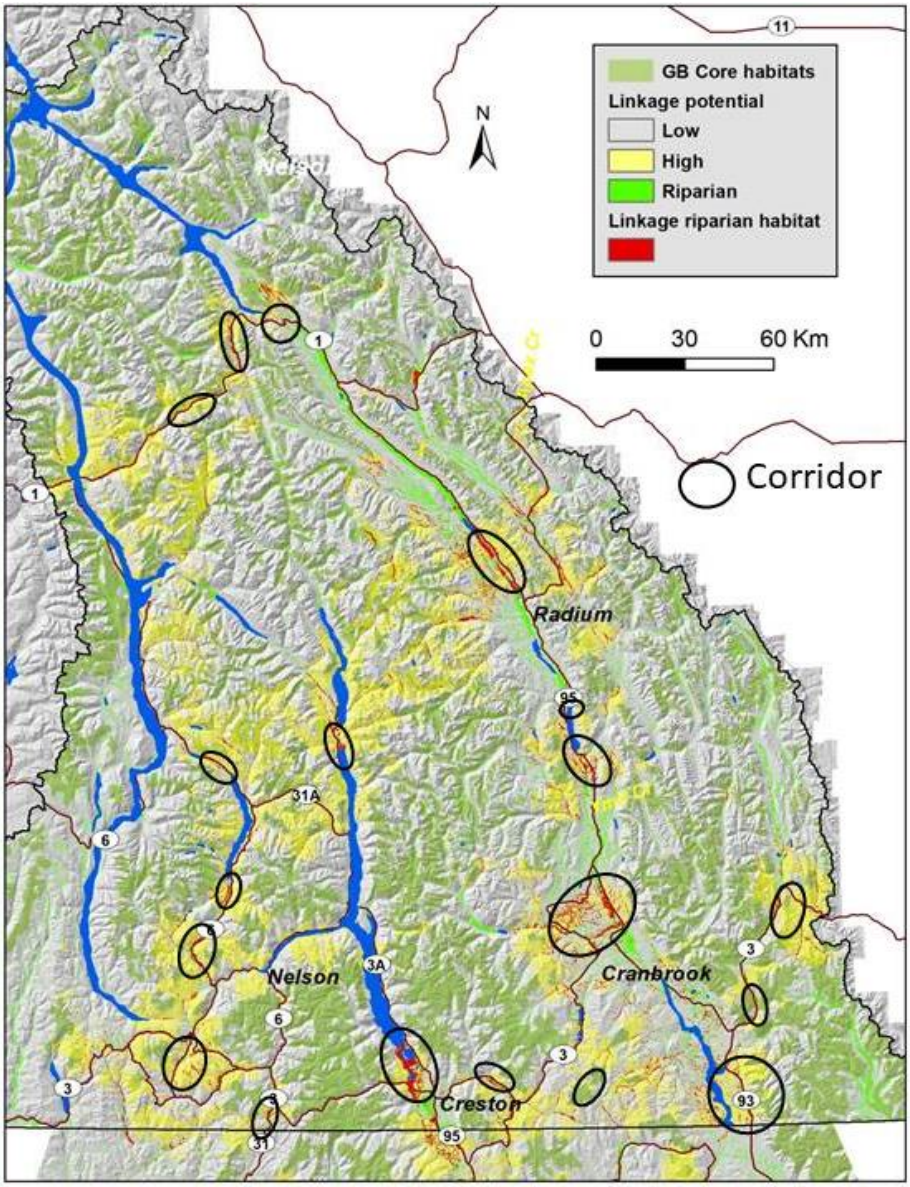


Figure 4. Map of the Kootenay region that illustrates the overlap between predicted grizzly bear linkages and riparian habitat that are potential focal corridors for Kootenay Connect.

Figure 4 shows overlap areas (red) between predicted grizzly bear linkages (yellow) and riparian (lime green) habitat. Red areas with ovals are preliminary riparian-wetland biodiversity hotspot corridors that are candidates for conservation within Kootenay Connect.

One example of connectivity management is the partial protection of key private land that dominates the valley bottom. Key forest and agricultural lands were purchased by the Nature Conservancy of Canada to enhance and expand the conservation benefits of the CVWMA in an east–west direction (Fig. 5). When you add together the benefits to wildlife provided by

protected Crown land (CVWMA), land trust conservation properties, and conservation practices adopted on adjacent private farm and ranch lands, these collaborative actions have measurably improved grizzly bear connectivity between the South Selkirk and South Purcell Mountains (Proctor et al. 2018) while also helping to secure a critical breeding area for endangered northern leopard frogs.

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

Thinking how best to advance Kootenay Connect beyond grizzly bears, we have expanded this concept of landscape connectivity management by identifying other important places where diverse partners might work together to protect areas of high biological diversity and establish recognized wildlife corridors across the Kootenays (Hilty and Merenlender 2004, Todd et al. 2009). 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 jurisdictional landscape across the Kootenays (Gallo et al. 2008, Miller and Hobbs 2002, Miller et al. 2003). 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, targeted education and landowner assistance for stewardship to improve private land management, fundraising for specific actions, and more. (See Part IV and Appendix D for more information on conservation tools.) In Year 2, we began introducing the idea that BC begin recognizing corridor habitats that currently connect isolated protected areas by a) expanding the use of an existing legal designation (e.g., Wildlife Management Area, Wildlife Habitat Area) or b) creating a new designation of "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 (Hilty et al. 2020, Strahlberg et al. 2020).

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 associated with habitats of higher biodiversity, in species number, richness (different types), and 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 & 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). Protecting riparian-wetland areas is considered good insurance for sustaining refugia of current biodiversity. In addition, our research suggests they are also important areas for landscape-level wildlife connectivity, along and across riparian corridors that link mountain ranges in our region where extensive hydrological developments (dams) have transformed many of our valley bottoms (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 (Kootenay, Slocan, Arrow, Columbia, Windermere). These hydrologic systems have steered human settlement into theses 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 help validate our proposed corridor sites and complement our corridor selections where appropriate. 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.

THE TIME IS RIGHT FOR KOOTENAY CONNECT

Kootenay Connect is a project whose time has come and is in line with many recent efforts across the globe to interconnect ecosystems. For example, Kootenay Connect is a real-world example that is implementing guidelines for preserving connectivity 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 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-scale conservation challenges. There is growing interest in participating in

connectivity conservation from a broad range of organizations, as demonstrated at our well-attended eight Kootenay Connect workshops, as well as the Kootenay Conservation Program's Fall Gatherings 2017–2019, and KCP co-sponsored Conservation Action Forums[5].

In conjunction with the scientific rationale described above, the timing of Kootenay Connect allows this initiative to build upon the growing capacity of conservation collaboratives that are emerging across the Kootenays. For example, new conservation collaboratives are being created with our leadership addressing ecological connectivity and influence of climate change within KCP's subregions – referred to as "Conservation Neighbourhoods" (Fig. 6), which focus on a specific local landscape or geography, such as a watershed or valley. 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 Neighbourhoods), emphasizing the importance of landscape connectivity and cross-boundary collaboration from multiple partners and stakeholders. Kootenay Connect has created unique teams in our region that are essential to addressing the mosaic of land ownership and management objectives inherent in landscape-scale conservation within and between subregions.

An objective 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 problems 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, partnerships, and resources.

In Years 1 and 2 of Kootenay Connect, Kootenay Connect coordinated delivery and co-hosted workshops with KCP when advantageous. For example, of the eight corridors workshops that Kootenay Connect has held in the region from 2019–2021, Kootenay Connect and KCP have teamed up on two Forums, i.e., Creston Valley (January 2020) and Golden (November 2020). In

[5] https://kootenayconservation.ca/conservation-action-forums/

each of these Forums, new scientific information and maps of local corridors and connectivity areas were shared and Kootenay Connect facilitated a corridors and connectivity action group.

In Part V, the priority actions resulting from KCP-sponsored Conservation Action Forums in the Conservation Neighbourhoods of Golden, Creston Valley, Slocan Lake Watershed, and upper Columbia Valley are summarized in terms of their contributions to Kootenay Connect. Common within all of these areas are these eight conservation priorities:

1. Conserve populations of species of concern
2. Protect existing high-quality habitats
3. Enhance landscape connectivity and corridors
4. Enhance and restore degraded ecosystems
5. Advance climate change resilience
6. Prevent and control invasive species
7. Reduce human-wildlife conflict and recreational pressure
8. Address cumulative effects

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 partnerships, we have been engaging key stakeholders with interests in private and public lands within each landscape corridor to develop a mosaic of conservation activities, strategies, and solutions that are informing how Kootenay Connect's science will result in conservation on the ground. By combining our efforts, Kootenay Connect and KCP have synergistically strengthened collaborative conservation in the Kootenays.

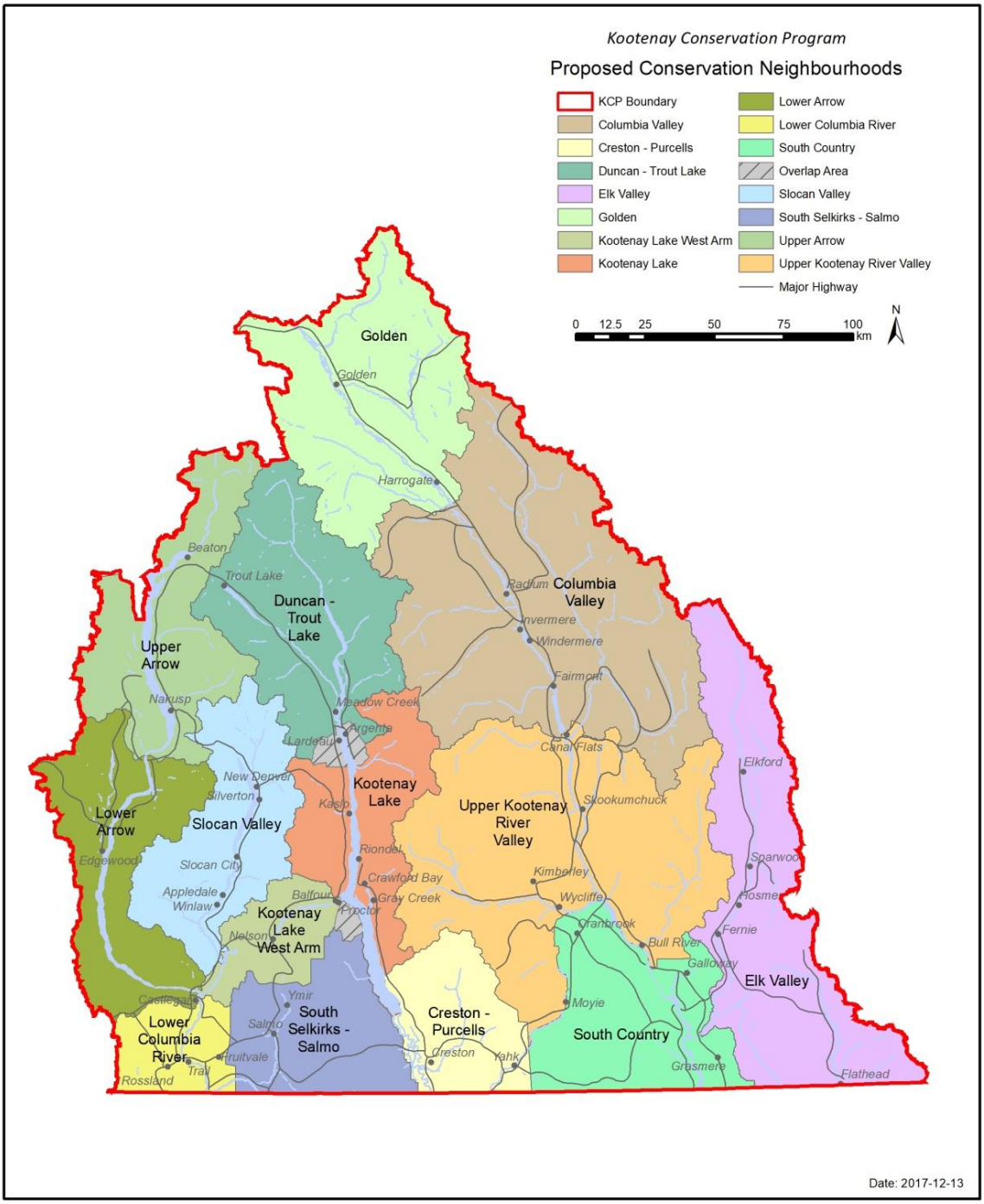


Figure 6. Kootenay Connect is addressing corridors and connectivity within and between the Kootenay Conservation Program's 14 Conservation Neighbourhoods in the East and West Kootenays. (Source: KCP.)

PROJECT DESCRIPTION

The goal of Kootenay Connect is to identify, assess, and initiate establishment of regionally and provincially recognized wildlife connectivity areas across the human-settled valleys within the East and West Kootenays. Recent analyses suggest that there is significant overlap between grizzly bear connectivity areas and riparian-wetland complexes in most of our major valleys. These riparian-wetland complexes are also excellent biodiversity hotspots and potential refugia from the impacts of climate change (Capon et al. 2013, Davies 2010).

Kootenay Connect is being developed over three years (2019–2022). In Year 1 (2019/20), 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 (Fig. 4). Also in Year 1, we focused on four connectivity areas to identify conservation targets, ecological threats, and conservation opportunities, as well as local champions who are already working to develop initial conservation management frameworks. These areas are case studies to research local, regional, and provincial resource agencies and stewardship groups (e.g., partners of the Kootenay Conservation Program) to develop a mosaic of strategies that will encompass both private and public lands. (See Part V for more information on developing and applying case studies.)

This Year 2 Report updates our Preliminary and Year 1 Reports (Proctor and Mahr 2019, 2020) and highlights the results of scientific analysis, mapping, and local engagement we have accomplished to advance connectivity conservation in the eight focal connectivity areas. It also incorporates on-the-ground conservation actions accomplished with our Canada Nature Fund Community-Nominated Priority Places grant administered by Environment and Climate Change Canada (ECCC, see below), which was a direct result of Kootenay Connect and now in Year 2 provides an excellent example of the realization of Kootenay Connect's impact on conservation. In Year 3, we will expand on our approach from Years 1 and 2, plus take our lessons learned, and form local corridor initiatives in the remaining four corridors where they do not yet exist, i.e., Koocanusa, Elk Valley, Retallack-Hwy. 31A, and Salmo. (See Part VI for more information on next steps.)

From the enthusiastic response of diverse stakeholders who have attended our eight corridor workshops, there is great interested in contributing to our roll-up and integration of 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 functioning to inform on-the-ground conservation action.

PART II. CRESTON VALLEY CASE STUDY

In 2005, TBGBP researchers 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 Creston Valley off a ridge at the north end of the valley, just south of Duck Lake. Each evening he would cross 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. He was using a very well-used wildlife trail and using a remote camera TBGBP documented that the trail was also being used by most other large mammal species in the area, sharing time between the rich productive valley-bottom habitat and the adjacent upland habitats. This male bear's movements inspired TBGBP to include the Creston Valley and the 7,000-hectare (17,000-acre) CVWMA – originally established in 1968 for wildlife and waterfowl conservation and flood control – as integral to the transboundary grizzly bear research program.

Fast-forward and a decade later, TBGBP had ample evidence that the riparian-wetland habitats of the CVWMA (which covers 41% of the valley-bottom flats between Kootenay Lake and the US border, Fig. 4) were both 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 with its extensive riparian-wetland habitat 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?*

The management activities in the Creston Valley by TBGBP (between 2005 and 2017) were centred on grizzly bear connectivity with the idea that grizzlies might be a useful umbrella species. Therefore, one of our primary activities has been to focus on expanding 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 trans-border 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.

With data and maps of actual and predicted grizzly bear movement in hand, in 2009 TBGBP started working with the Nature Conservancy of Canada (NCC) and Yellowstone to Yukon Conservation Initiative to purchase strategic land in fee simple and establish conservation covenants with willing landowners that would enhance ecological connectivity in the east–west dimension across the human-settled valley bottom. Because some of the properties that were purchased 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 agricultural activities to be "wildlife friendly." Currently, these purchased lands are managed for wildlife connectivity and northern leopard frog conservation.

a) b)

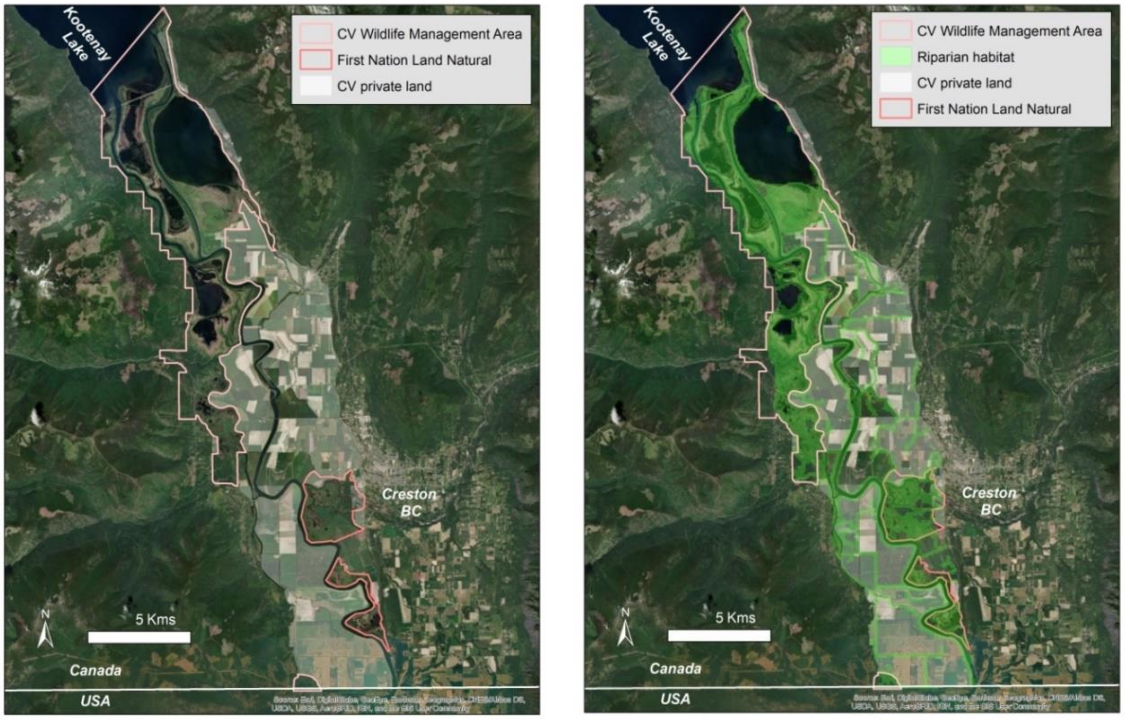


Figure 7. a) The Creston Valley matrix of private lands and farms and the Creston Valley Wildlife Management Area; and b) same landscape with the extensive riparian-wetland habitats indicated in lighter green.

To support local efforts to coexist 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 which then ultimately results 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). This overall effort is a work in progress, as there is still more to be done with respect to private land conservation and documenting the benefits to other important species.

The lesson learned from the Creston Valley Frog Bear example: Science research can help confirm the most important locations for conservation measures across landscapes, inform specific solutions and actions, and monitor their effectiveness. Using this knowledge, 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 conservation.

In the case of the Creston Valley connectivity area, TBGBP and partners integrated 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 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.

PART III. COMPLEMENTARY INITIATIVES

There are many ongoing conservation opportunities and initiatives globally, nationally, provincially, and regionally that are complementary to the purposes of Kootenay Connect and within which Kootenay Connect can contribute conservation outcomes that will result in more protected land strategically located across the Kootenays (Appendix C).

We anticipate Kootenay Connect will contribute to reaching some of the various goals and targets of these complementary initiatives. 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 (Fig. 8). 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

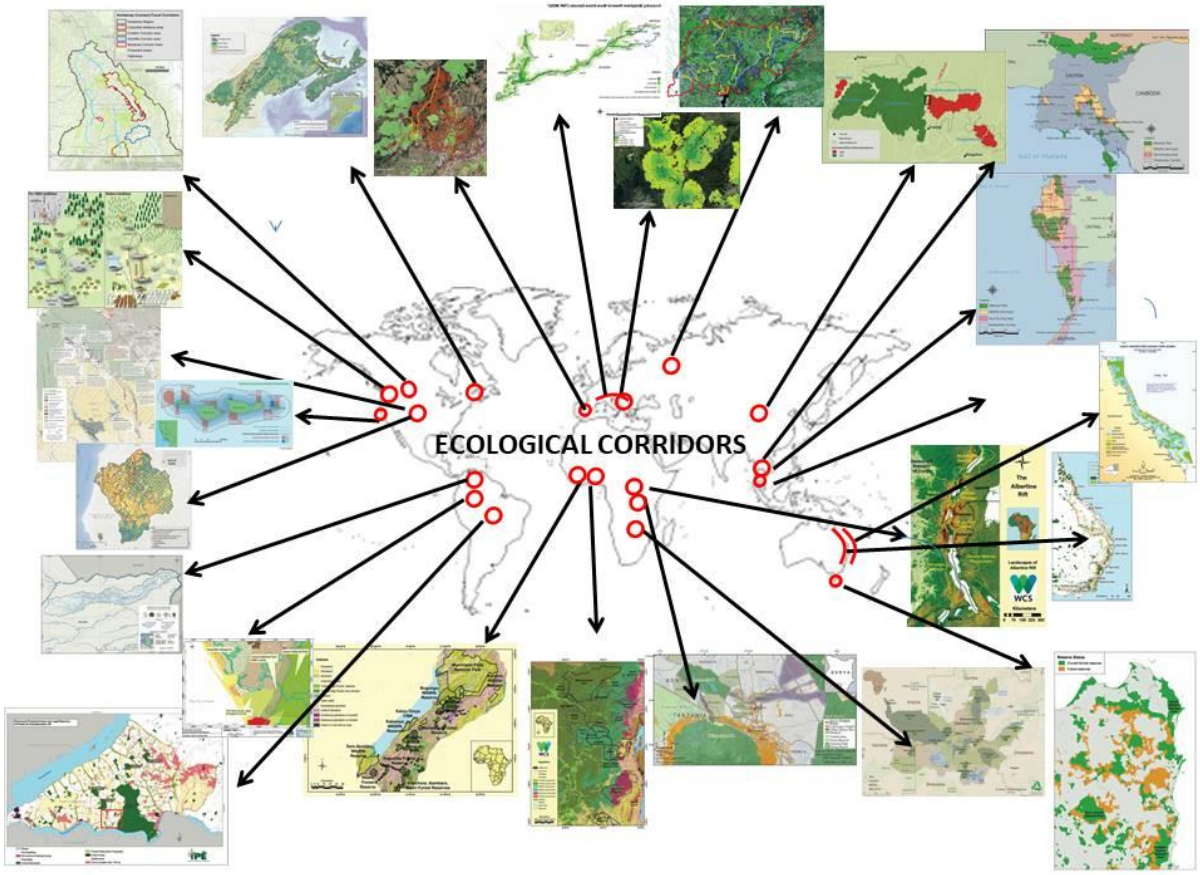


Figure 8. Ecological Corridors being established across the globe as detailed in Hilty et al. (2020) and including Kootenay Connect in western Canada.

2009, Dinerstein et al. 2017, 2020, Pollock et al. 2017, WWF 2018, 2020, Morelli et al. 2016, Theobald, et al. 2020). These calls have filtered through to global institutions (e.g., IUCN) and federal and provincial governments within Canada. For example, global initiatives include the United Nations Convention on Biodiversity Aichi Biodiversity Target 11[6] which was recently updated in a *Post-2020 Biodiversity Framework*[7] with goals set for 2030 and 2050, and designation of Key Biodiversity Areas[8]. Nationally, the 2020 Biodiversity Goals and Targets for Canada[9] has led to the Target 1 Challenge Fund of the Canada Nature Fund.

[6] https://www.cbd.int/sp/targets/rationale/target-11/

[7] https://www.cbd.int/doc/c/3064/749a/0f65ac7f9def86707f4eaefa/post2020-prep-02-01-en.pdf

[8] http://www.keybiodiversityareas.org/about-kbas

[9] https://www.canada.ca/en/parks-canada/news/2016/12/2020-biodiversity-goals-targets-canada.html

Canada and the United States[10] are currently taking inspiration from the *Post-2020 Global Biodiversity Framework* and a 60-nation summit on global conservation designed to implement that Framework[11]. Canada's current Liberal government platform has integrated this idea as evidenced on their 2020 website[12] 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.*

The BC Provincial Wildlife Management Plan 2020 is an opportunity that will guide provincial priorities in the coming years. One of the priority mandates[13] for the newly elected 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 British Columbia:

> *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*[14]*.*

By our calculations, the Kootenay region currently has approximately 10% protected lands with 4% Provincial, 5% Federal, and 1% private. Establishing "Wildlife and Ecological Corridors" across the Kootenays would be a strategic addition to the protected area system and help

[10] https://www.wri.org/news/statement-biden-administration-commits-protect-30-us-land-and-ocean-2030
[11] https://www.hacfornatureandpeople.org/
[12] https://liberal.ca/our-platform/more-conservation/
[13] https://www2.gov.bc.ca/assets/gov/government/ministries-organizations/premier-cabinet-mlas/minister-letter/heyman_mandate_2020.pdf
[14] http://www.env.gov.bc.ca/soe/indicators/land/protected-lands-and-waters.html

Canada and BC reach their global and national commitments for protected and connected ecosystems.

Regionally, the Fish & Wildlife Compensation Program (FWCP)-Columbia Region Action Plans, the Columbia Basin Trust's Ecosystem Enhancement Program, and the Conservation Neighbourhoods approach developed by the Kootenay Conservation Program all work towards some portion of Kootenay Connect's overall goal of conserving connectivity areas with high biodiversity.

CANADA NATURE FUND'S SUPPORT FOR KOOTENAY CONNECT PRIORITY PLACES

Due to the increasing global imperative for interconnected ecosystems and protected areas described above, in 2019 Kootenay Connect proved to be a good fit for Environment and Climate Change Canada's (ECCC) Canada Nature Fund Community-Nominated Priority Places program. Four of Kootenay Connect's 12 focal corridors were the centrepiece of a successful $2 million 4-year grant with ECCC for the Kootenay Connect Priority Places project [15]. These "Four Focal Corridors" included the Creston Valley, Bonanza Biodiversity Corridor in the north Slocan Valley, Columbia Wetlands, and Wycliffe Wildlife Corridor between Cranbrook and Kimberley. At the start of Kootenay Connect, we believed these four landscapes were the most promising connectivity areas for conservation action to focus our efforts in Year 1. These areas had local champions who were already working collaboratively to advance conservation at a landscape scale. (These Four Focal Corridors are discussed in detail in Part V.)

Kootenay Connect Priority Places includes 25 partners and specialists in the East and West Kootenays and over 50 subprojects that are contributing to national and global goals to protect biodiversity, improve habitats for species at risk, and increase inter-ecosystem connectivity. This important component of Kootenay Connect is a direct consequence of the vision and timing of Kootenay Connect made possible by FWCP funding of our initiative. Currently, Kootenay Connect's collective on-the-ground conservation and management actions are working to hemp Canada achieve its conservation goal of 25% by 2025 of connected and protected lands mentioned above.

To address potential confusion, the schematic below (Fig. 9) shows how Kootenay Connect Priority Places fit into the larger concept of Kootenay Connect that we are reporting on here. Kootenay Connect provides an umbrella for both FWCP- and ECCC-funded projects. Whereas the original concept of Kootenay Connect funded by the FWCP was proposed as a three-year regional initiative to provide a scientific and mapping foundation for collaborative conservation

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

planning and implementation across 12 connectivity areas, Kootenay Connect Priority Places is a four-year program focusing on the four corridors that were identified in Year 1 of the FWCP-funded project.

In our first year of Kootenay Connect (funded by FWCP) and Kootenay Connect Priority Places (funded by ECCC), the four corridors of both projects overlapped in purpose and geography; however in subsequent years Kootenay Connect (FWCP) is focusing on eight other corridors in the Kootenay region beyond those four that will continue to be funded by ECCC's Canada Nature Fund.

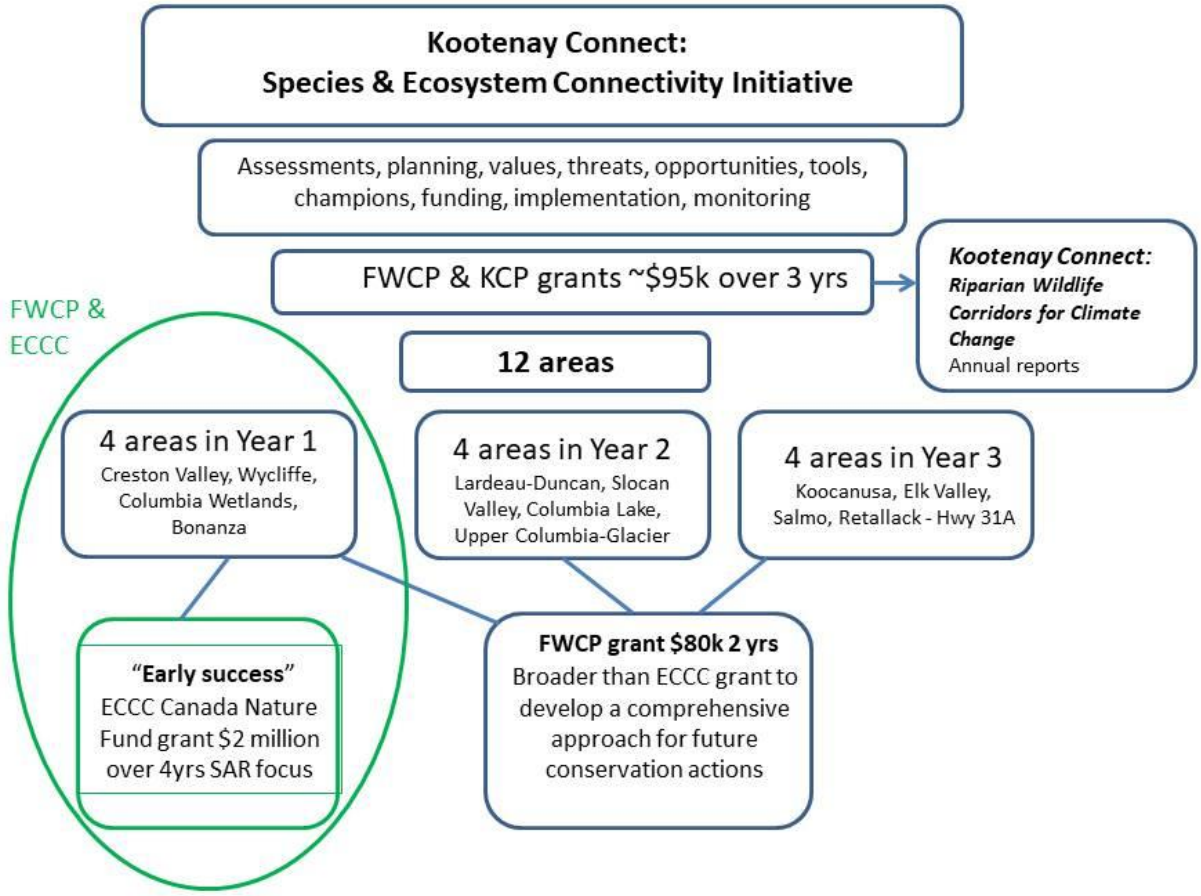


Figure 9. Diagram of how Kootenay Connect provides an umbrella for projects funded both by FWCP and by Environment and Climate Change Canada's Community-Nominated Priority Places.

PART IV. POTENTIAL CONSERVATION TOOLS

Once high-priority regions on the landscape are identified to increase conservation protection and actions, it is important to know what mechanisms or tools are available in the conservation toolbox that can be applied to a mosaic of land ownerships and multiple jurisdictions. To increase our collective knowledge of appropriate tools (i.e., land designations, legislation, policies, and regulations), we put together the *Land Use Designations, Laws, and Policies to Protect Biodiversity Toolbox* (Tables 13 and 14 in Appendix D) 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 as Kootenay Connect and local stakeholders begin assessing how best to designate new lands for conservation, and influence government management plans and practices that protect species at risk 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 would integrate and expand on existing complementary initiatives discussed above and in Appendix C, and utilize various tools that we have summarized in the Toolbox in Appendix D.

For example, it may be appropriate to apply for an expansion of existing (or creation of new) Wildlife Management Areas on crown lands that are important riparian-wetland habitats; or directly purchase in fee simple (or place under conservation covenant) through a land trust private lands that are adjacent to an important riparian area as connectivity habitat to adjacent upland habitats; or embark on wetland restoration on private lands to reclaim degraded habitat; or help develop guidelines for wildlife corridors and connectivity in Environmentally Sensitive Development Permit Areas designated by Regional Districts[16]. The RDCK designates Environmental Development Permit Areas (EDPAs) and 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 the 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.

[16] A *Development Permit Area* 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. In the case of environmentally sensitive areas, the purpose of the development permit is protection of the natural environment, its ecosystems and biological diversity. An *Environmentally Sensitive Area* is an area that because of its unique characteristics plays a critical role in supporting productive and diverse plant and animal populations.

PART V. APPLICATION ACROSS THE KOOTENAY REGION

The Kootenay region has seen substantial conservation effort around our regional wetland complexes, but with minimal emphasis on connectivity with adjacent upland habitats. There are considerable protected areas across the upper Columbia Basin, which were created with minimal emphasis on connecting Wildlife Management Areas and 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 is essential to realizing ecological integrity and supporting nature's ability to adapt to climate change.

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 other species of interest (Olson et al. 2007). We endeavour to integrate each realm into a composite effort that bridges jurisdictional, protection, and management priorities and results in connecting suites of species and ecological processes that require multiple habitat types currently and into the foreseeable future under 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 Columbia Wetland Stewardship Partners, Slocan Lake Stewardship Society, Slocan River Streamkeepers, Creston Valley Wildlife Management Area, Columbia Lake Stewardship Partners, Farmland Advantage, Wildsight Golden, Nature Conservancy of Canada, Nature Trust of BC, Okanagan Nation Alliance, Ktunaxa Nation, and Shuswap Indian 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.

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

RESULTS: YEARS 1 AND 2 IN FOUR KOOTENAY CONNECT CORRIDORS

Four Focal Corridors

Between September 2019 and March 2020, we held Kootenay Connect workshops in each of our Four Focal Corridors: Wycliffe Wildlife Corridor (Cranbrook, September 2019), Columbia Wetlands Corridor (Radium Hot Springs, November 2019), Creston Valley Corridor (Creston, January 2020), and Bonanza Biodiversity Corridor (Silverton, March 2020). Workshop 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.

Of the four Kootenay Connect workshops held in Year 1, three were organized and delivered by Kootenay Connect with a local co-sponsoring group. The Creston workshop, however, was co-hosted with KCP as a Conservation Action Forum. As discussed above in Part I, 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. This conservation action planning approach had not yet been offered in Creston, thus the opportunity for Kootenay Connect to team up with KCP proved both advantageous and successful.

Kootenay Connect Workshop for the Bonanza Biodiversity Corridor co-sponsored by the Slocan Lake Stewardship Society including independent and government biologists and other experts, local conservation groups, land trusts, regional district staff, and First Nations with the purpose of identifying important conservation values and threats to the BBC, as well as opportunities for collaborative conservation. 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 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 ultimate goal of each workshop was to develop specific conservation strategies for each area and encourage collaboration for local stewardship and management actions.

A series of Tables 6–10 in Appendix A summarizes focal corridor-specific ecological values including species of interest, important habitats and habitat features, important ecological processes and the ecological threats each area faces. These data are summarized from our extensive data gathering from local experts at workshops; in consultations with regional researchers; and GIS database development of biological, ecological, and human-influence layers, described above. As these Year 1 Four Focal Corridors were centred on important low-elevation, wetland-riparian areas, there is significant similarity in the conservation values across the four corridors.

Conservation targets were defined as species at risk and of cultural importance, important habitat types, wildlife habitat features, special landscape elements, and ecological processes that are targets 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.

Threats were 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 stresses. Cumulative impacts are difficult to quantify and even more difficult to predict. Therefore, a precautionary approach to management and further development will be important in order 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 is 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, 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 spatial layers and maps developed for each of the Four Focal Corridors that includes 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 Four Focal Corridors is found in Appendix B. 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 results of those Year 1 Kootenay Connect workshops, and the realized downstream conservation actions resulting from our Kootenay Connect Priority Places ECCC-funded projects in both Years 1 and 2 (2019-2021).

CRESTON VALLEY

Geographic Description

The Creston Valley connects a portion of the South Selkirk and South Purcell Mountains and holds the Creston Valley Wildlife Management Area (CVWMA) which covers ~41% of the valley bottom. Details are also provided above in Part II. The CVWMA has 19 SARA-listed species, 34 Committee on the Status of Endangered Wildlife in Canada (COSEWIC)-listed species and 43 BC-listed species (Tables 5), including the grizzly bear a species of special concern (Fig. 10) and endangered northern leopard frog (Figs. 12 & 13).

Leading Connectivity Conservation Groups

Groups engaged in conserving and managing biodiversity and habitat connectivity in the Creston Valley include: Trans-border Grizzly Bear Project, Creston Valley Wildlife Management Area, Nature Conservancy of Canada, Lower Kootenay Band, Farmland Advantage, Northern Leopard Frog Recovery Team, FLNRORD, Kootenay Conservation Program, Wildsight-Creston, and Yellowstone to Yukon Conservation Initiative. The centrepiece of the Creston Valley Corridor is the Creston Valley Wildlife Management Area, and considerable effort has been made to link the riparian-wetland valley bottom to adjacent upland habitats (as discussed above in Part II, Creston Valley Case Study). The Nature Conservancy of Canada (with fundraising help from the Yellowstone to Yukon Conservation Initiative) has already purchased

several strategic lands for grizzly bears and northern leopard frogs that also benefit other species at risk.

Through the Creston Conservation Action Forum and Kootenay Connect Workshop, we identified there is more work to be done to ensure both inter-mountain connectivity across this valley and longitudinal connectivity north to south for seasonal migrants and south to north for species with shifting ranges due to climate change (Fig. 11). A diverse group of partners are motivated to continue collaborating on conservation land acquisitions and restoration projects that will contribute to realizing Kootenay Connect in the Creston Valley.

Creston Valley Wildlife Management Area and northern leopard frog. (Photo: CVWMA)

a

b

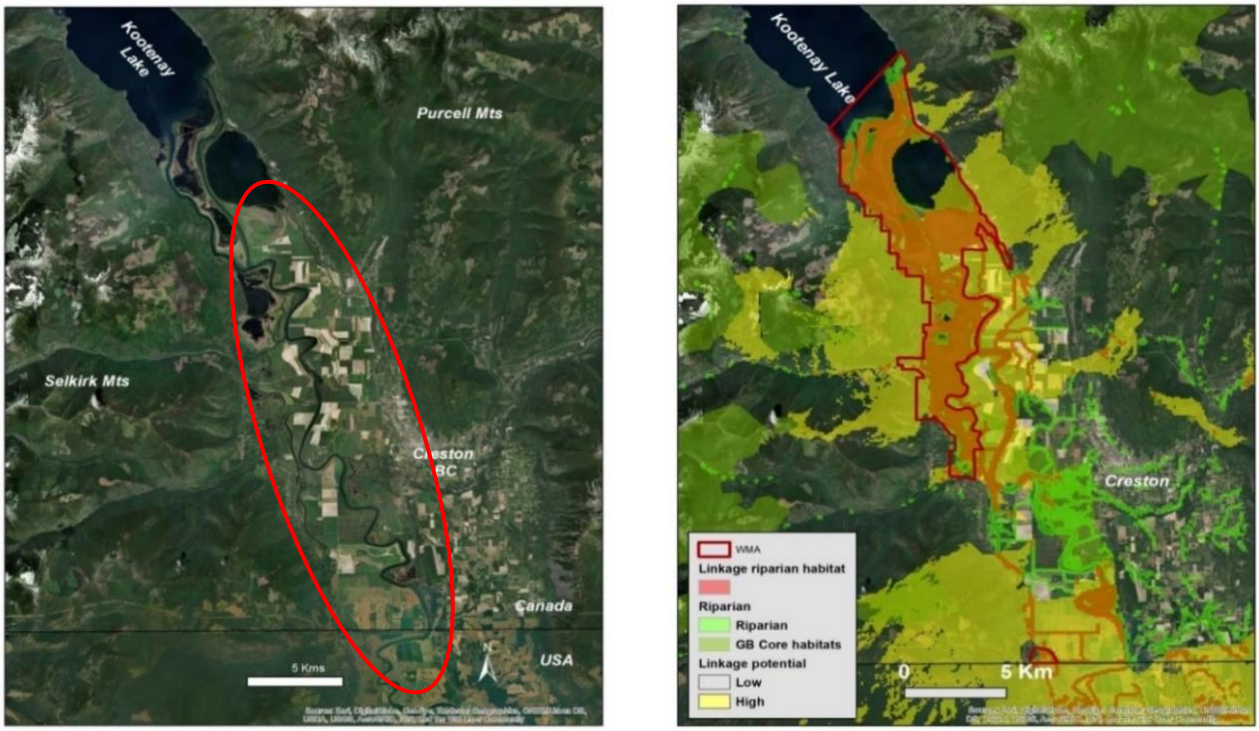


Figure 10. a) Google Earth image of the Creston Valley Corridor (red oval) connecting the Purcell and Selkirk Mountains along BC Highway 3A north of Creston, BC; and b) the same area with grizzly bear core (green) and linkage (yellow) habitats overlaid with riparian habitats (orange) in the valley bottom.

Creston Valley Conservation Action Forum & Kootenay Connect Workshop

In January 2020, Kootenay Connect co-hosted a Conservation Action Forum in conjunction with KCP and the Creston Valley Wildlife Management Area (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[17].

The Forum also provided an important opportunity for further integrating private lands into the conservation and management of connected habitat in the Creston Valley by engaging

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

Farmland Advantage, Creston Beef Growers Association, Yaqan Nu?kiy (Lower Kootenay Band), CVWMA, and Regional District of Central Kootenay (RDCK).

During this event, scientific recommendations led to identifying *conservation targets* (including species at risk Tables 5 and 6; habitat types Table 7; habitat features Table 8; ecological process Table 9); and *ecological threats* (Table 10) in Appendix A. 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.

Of the many recommendations, five of these became priorities that were developed into action plans that proposed positive conservation solutions and activities. They included:

1. Develop a Landscape-scale Ecosystem-based Inventory of Biodiversity
2. Enhance Landscape Connectivity and Corridors Through a Climate Change Lens
3. Expand Stewardship Opportunities to Protect High-quality Habitats
4. Restore Floodplain Connectivity of the Kootenay/Kootenai River System
5. Perform Fire-maintained Ecosystem Restoration

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 for Creston were:

1. 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.
2. To protect the north–south climate corridor connecting with 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 just south of Duck Lake (Fig. 11).
3. To restore inter-wetland and river floodplain connectivity to enhance the water storage function of the wetlands and floodplains through the dry summer months.
4. Identify and protect tributaries that have the potential to deliver cold water throughout the summer through their high-elevation reach and snowmelt potential.
5. To identify and protect wet, cool old-growth patches throughout the area as fire-resistant patches that may act as climate refugia.

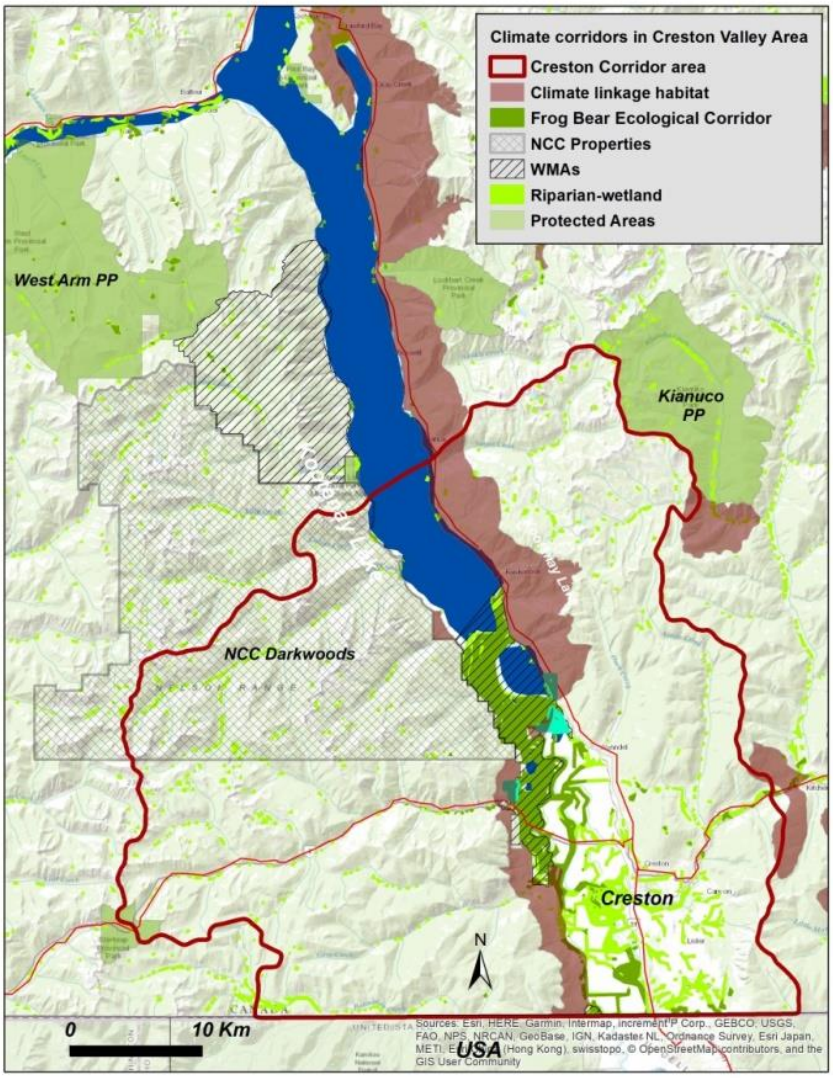


Figure 11. Proposed "climate corridor" (brown) north and south of Creston Valley (Utzig 2020) connected by the Frog Bear Conservation Corridor (dark green) that runs east–west across the Creston Valley just south of Duck Lake.

Kootenay Connect Priority Places Projects

As mentioned in Part III above, Creston was also part of the Kootenay Connect Priority Places project funded by Environment and Climate Change Canada's Canada Nature Fund. The lead partner in this corridor is the Creston Valley Wildlife Management Area. Here we report results from Years 1 and 2 of that project since these on-the-ground conservation efforts are a result of Kootenay Connect and overlap with the two years funded by FWCP.

In Fall 2019 of Kootenay Connect Priority Places, shovel-ready subprojects led by CVWMA occurred at the Duck Lake Nesting Area, Six Mile Slough, and Corn Creek Marsh that benefited northern leopard frog and western painted turtle as well as addressing Priority 3 from the Creston workshop, "To restore inter-wetland and river floodplain connectivity to enhance the water storage function of the wetlands and floodplains through the dry summer months."

A subproject in the Creston Valley Duck Lake area worked to remove encroaching emergent vegetation to increase intra-wetland hydrologic connectivity – in other words, increased shallow open water breeding habitat – and re-established the flow of water between components of the Duck Lake wetland complex that were being choked out by vegetation (Fig. 12). Northern leopard frog population recovery work occurred in conjunction with the provincial Northern Leopard Frog Recovery Team. The restoration activities targeting northern leopard frog 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.

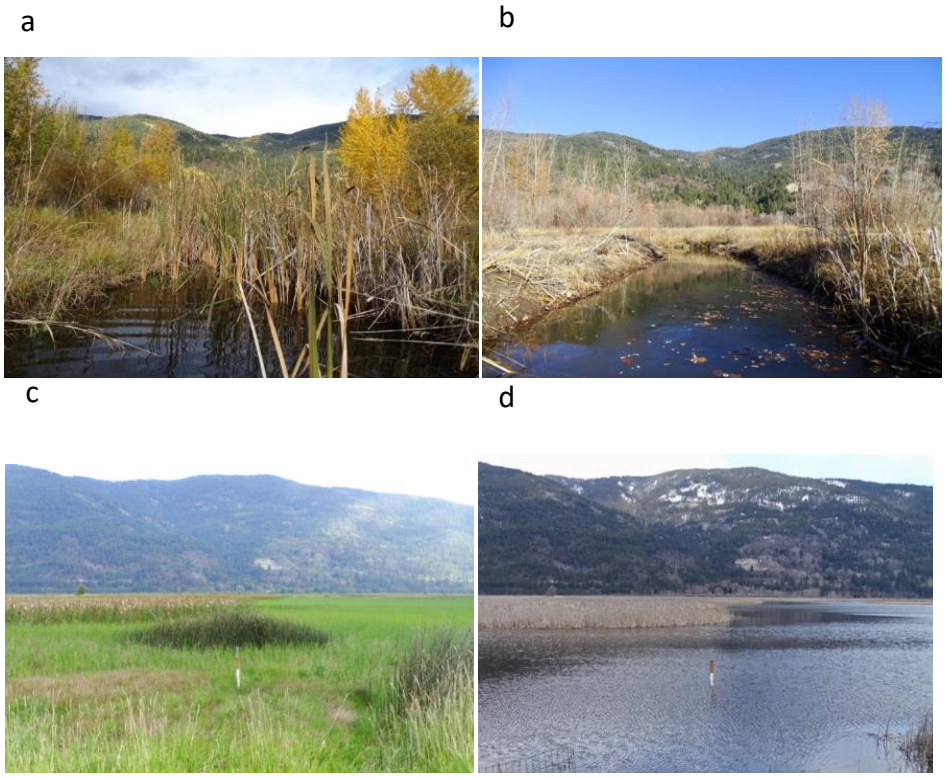


Figure 12. Before and after photos of restoration of northern leopard frog habitat in the Creston Valley: a) vegetation-choked channel; b) same channel with vegetation cleared for better hydrological connectivity; c) target frog breeding area; and d) newly created shallow open water pond.

>13 NLF egg masses counted in spring 2020 in restored area – some used for reintroduction at Brisco site in Columbia Wetlands

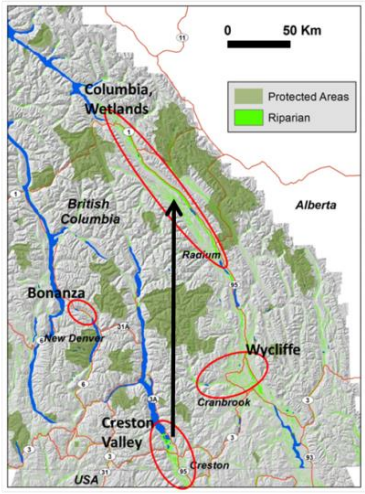


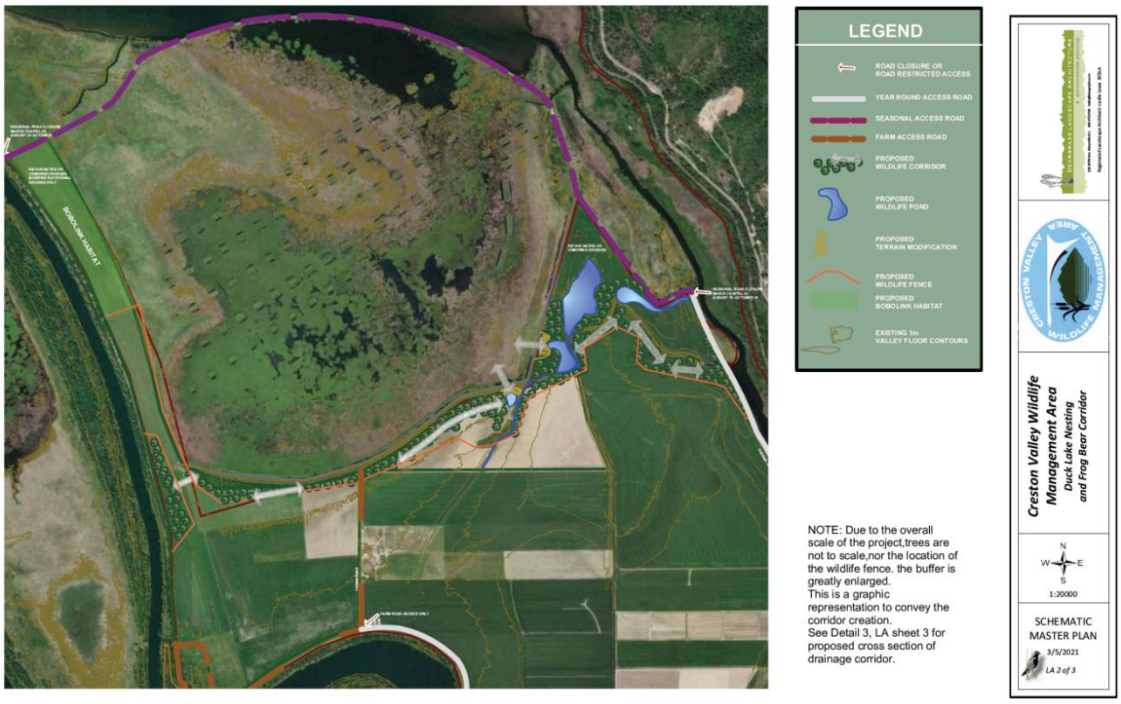
Figure 13. Intra-wetland hydrologic connectivity work supported by Kootenay Connect Priority Place's ECCC funding to the Creston Valley Management Area to improve northern leopard frog foraging, breeding, and overwintering habitat, and connectivity routes between seasonally important habitats.

In Year 2 (2020–2021) in the Creston Valley, a works to improve water control at the Duck Lake Nesting Area resulted in replacement of aging infrastructure in order to enhance overall hydrologic flow in the northern portion of the valley, ultimately to benefit 300 hectares (67%) of the overall 450-hectare Duck Lake Nesting Area. Concurrently, the CVWMA led a planning exercise to restore cross-valley connectivity for large and small mammals also in the northern portion of the valley that includes development of a habitat buffer strip of aquatic, woodland, and open upland vegetation along the south side of the Duck Lake Nesting Area. Figure 14 contains several landscape designs for on-the-ground restoration activities to be carried out in Years 3 and 4 (2021–2022). This cross-valley connectivity area overlaps the northern leopard frog habitat enhancement projects that enhance their seasonal movement between breeding, foraging, and overwintering habitats.

a


GRAZED UPLAND AREA CONFLICTS WITH BOBOLINK NESTING
BOBOLINK HABITAT
RIPARIAN MATRIX
FRAGMENT DOGWOOD THICKETS
ROAD LINEAR CORRIDOR
RIPARIAN EDGE DEGRADED BY CATTLE
FRAGMENT BLACK COTTONWOOD FOREST UNDERSTORY REMOVED BY CATTLE
DIKE, LINEAR CORRIDOR BARRIER BETWEEN WETLANDS AND UPLAND HABITAT
FRAGMENT BLACK COTTONWOOD FOREST, UNDERSTORY REMOVED BY CATTLE
CHANNELIZED STEEP BANKED DRAINAGE DITCHES
FOREST MATRIX
RURAL DEVELOPMENT
RIPARIAN CORRIDOR
FARMLAND MATRIX
ROAD LINEAR CORRIDOR
RIPARIAN MATRIX
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 1m 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

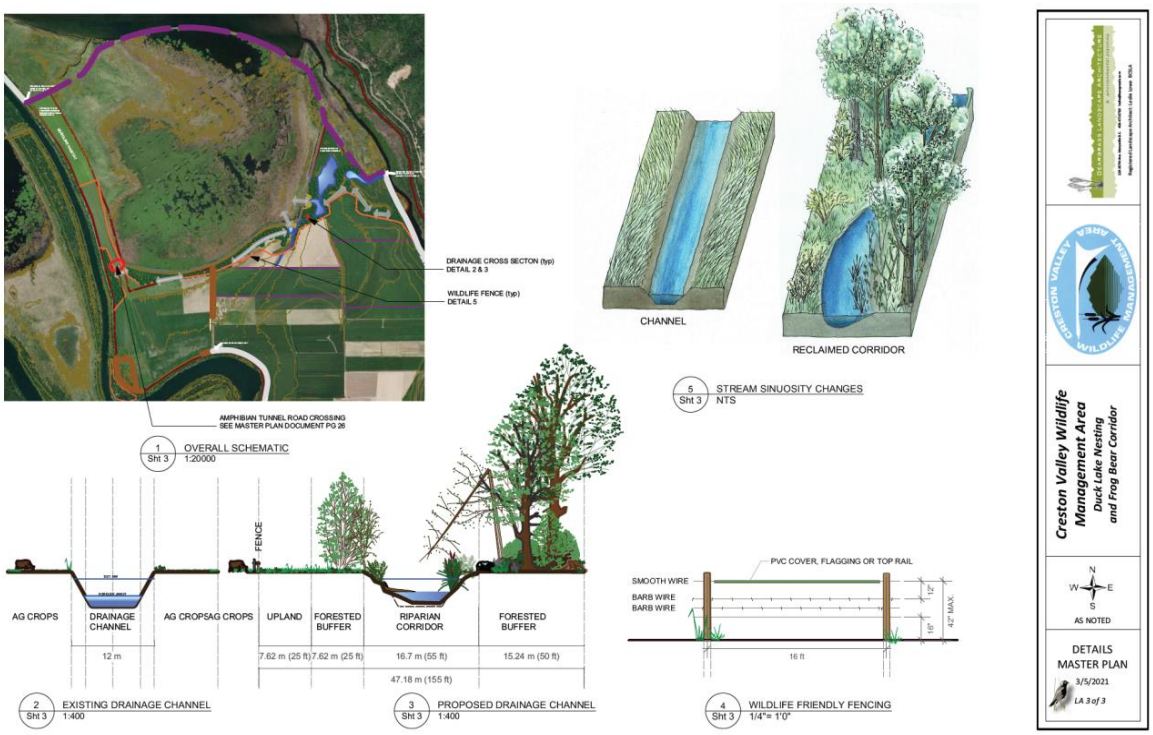


Figure 14. Creston Valley Year 2 large mammal and species at risk landscape connectivity habitat restoration maps a-c developed by Beargrass Landscape Architecture for Kootenay Connect.

BONANZA BIODIVERSITY CORRIDOR

Geographic Description

The 140 km^2 Bonanza Biodiversity Corridor (BBC) encompasses an area of 12,865 hectares that link Slocan and Summit Lakes within the upper Slocan Lake Watershed (Fig. 15). At the landscape scale, the BBC has great potential to be a significant Wildlife and Ecological Corridor connecting the Valhalla and Central Selkirk Mountains, 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.

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)

a b

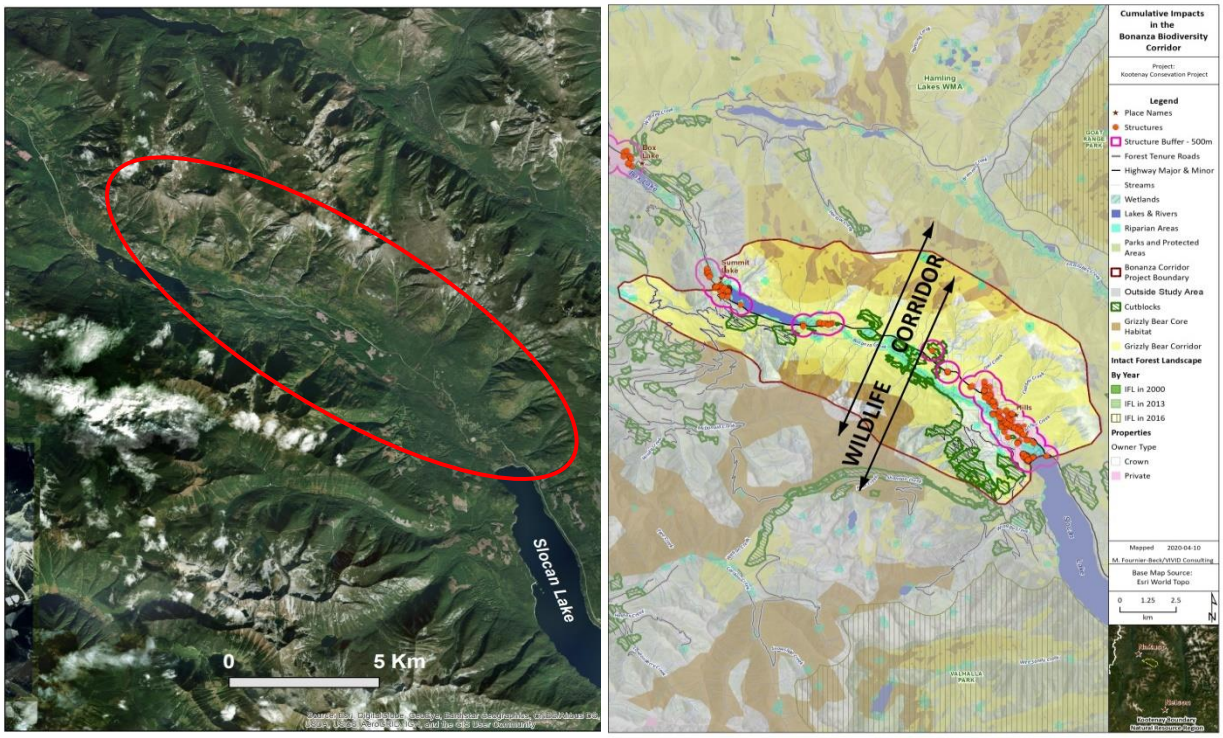


Figure 15. a) Google Earth image of the BBC (red oval) extending along BC Highway 6 between Slocan and Summit Lakes connecting the Valhalla and Central Selkirk Mountain ranges, and b) same area with grizzly bear core (tan) and linkage (yellow) habitats as identified by the Trans-border Grizzly Bear Project (Proctor et al. 2015), overlaid with cumulative impacts relative to preliminary upland wildlife corridors.

The upland corridors maps in Figure 15 were developed in Year 1 of Kootenay Connect Priority Places and have been updated with cumulative SAR and other species data collected in Year 2 as described below.

Leading Connectivity Conservation Groups

Groups engaged in conserving and managing biodiversity and habitat connectivity in the Bonanza Biodiversity Corridor include the Slocan Lake Stewardship Society (SLSS), Slocan Wetlands Assessment & Monitoring Project (SWAMP), Summit Lake Western Toad Project, Valhalla Foundation for Ecology, Valhalla Wilderness Society, and Okanagan Nation Alliance.

SLSS is a non-profit advocacy organization that is dedicated to retaining the ecological integrity of the Slocan Lake Watershed through applied scientific research and education. At the 2017 Conservation Action Forum co-hosted by SLSS and KCP, the Bonanza Biodiversity Corridor was recognized as a unique ecosystem in need of conservation (Mahr 2017a and b). The BBC was also identified as a grizzly bear corridor (Proctor et al. 2015), and recently a radio-collared bear

used this area to move across the valley between the two mountain ranges. KCP (Mahr 2018b) 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 Rainforest. In addition, SWAMP has 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.

The Valhalla Foundation for Ecology's acquisition of a 14-hectare (35-acre) portion of Bonanza Marsh, referred to as Snk'mip Nature Preserve, provides a conservation anchor at the southern end of the BBC at the head of Slocan Lake. VFE is currently restoring hydrologic connectivity to reclaim areas impacted by human disturbance and enhancing the diversity of wetland types surrounding the core of shallow open water. At the northern end of the corridor is Summit Lake, which has possibly BC's largest breeding hotspot for the endangered western toad.

Kootenay Connect – Bonanza Biodiversity Corridor Workshop

Back in February 2017, SLSS and KCP co-hosted a Conservation Action Forum that used a Conservation Neighbourhood approach to identifying ecological threats, conservation opportunities, and collaborative strategies for the Slocan Lake Watershed (Mahr 2017b). We briefly report on the results here[18]. After declaring the area between Summit and Slocan Lakes the "Bonanza Biodiversity Corridor," scientific recommendations led to identifying conservation targets (including species Tables 5 and 6, habitat types Table 7, habitat features Table 8, and ecological process Table 9); and ecological threats (Table 10) in Appendix A.

As a corollary to this Forum, Kootenay Connect held a workshop in March 2020 for the Bonanza Biodiversity Corridor to continue the work started in 2017. Twenty-six participants included local species at risk experts and recovery team members, independent and government biologists, conservation land trusts, regional planners, and conservation organizations (e.g., Slocan Lake Stewardship Society, Slocan River Streamkeepers, Yellowstone to Yukon Conservation Initiative), and First Nations (Okanagan Nation Alliance, Sinixt).

During this workshop participants reviewed and updated results from the Forum by adding new ecological threats, conservation opportunities, and collaborative strategies (summarized in Appendix A). The workshop highlighted projects that were addressing priorities identified in 2017, such as the Bonanza Wetland Enhancement Project (a Kootenay Connect Priority Places

[18] For more details visit https://kootenayconservation.ca/wp-content/uploads/Slocan-Lake-Watershed-Forum-14Mar2017.pdf

project), which is enhancing and restoring three valley-bottom wetlands (Fig. 16), in addition to assessing beaver habitat, and mapping and ground-truthing species at risk, habitat types, and old growth to enhance habitat connectivity along elevation gradients.

For this workshop we engaged climate change modeller and landscape ecologist Greg Utzig of Kutenai Nature Investigations to pilot a process for meaningfully incorporating climate change impacts into assessments of habitat connectivity. Employing a climate change lens to the BBC allowed us to explore new connectivity needs for climate-induced shifts in species ranges in the area and the key role of the distribution of water in determining existing and future cool, wet climate refugia (Utzig and Holt 2015b).

Climate adaptation recommendations being incorporated into Kootenay Connect

- Identify cool, wet, old-growth refugia and protect 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 connectivity to hold water longer
- Build in wetland redundancy – protect 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.

Priority Conservation Actions for the Bonanza Biodiversity Corridor

- Fire suppression preparation to help resist catastrophic fire – encourage Fire Smart practices around private land in the corridor
- Protect areas around important old-growth patches that lived through past fires
- Explore OGMA protection system in the corridor and ground-truth for accuracy
- Initiate baseline data collection for water monitoring
- 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 for using Development Permit Areas in Environmentally Sensitive Areas on private lands and work with RDCK
- Establish a citizen science road watch (App) to monitor roadkill and identify mortality hotspots for potential management

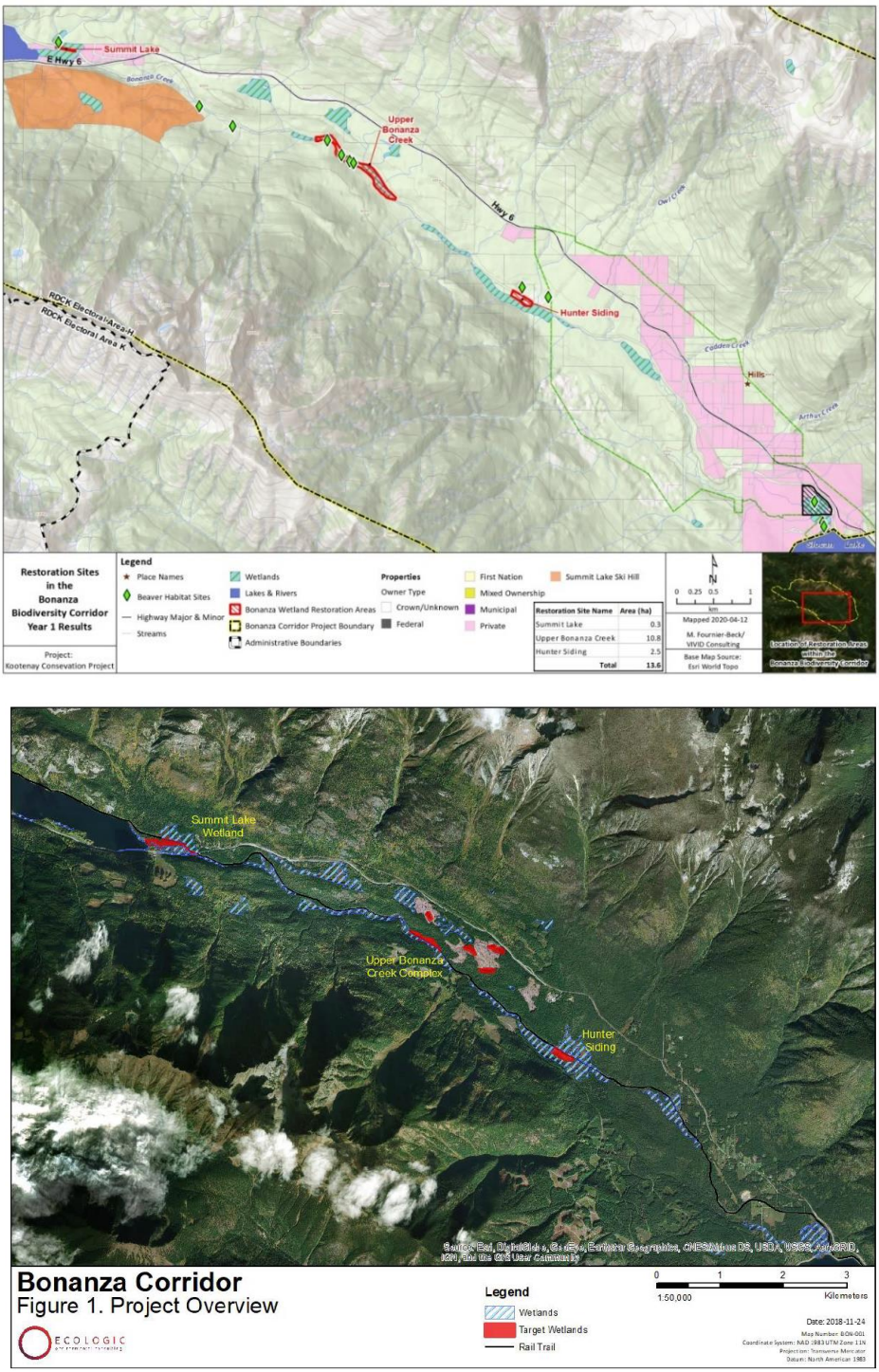


Figure 16. Wetland restoration work in three wetland sites at Summit Lake, Upper Bonanza Creek, and Hunter Siding supported by Kootenay Connect Priority Places for the Slocan Lake Stewardship Society in the Bonanza Biodiversity Corridor.

Kootenay Connect Priority Places Project

As mentioned in Part III above, the Bonanza Biodiversity Corridor is part of the Kootenay Connect Priority Places project. The lead organization in this corridor is the Slocan Lake Stewardship Society. Projects funded by the ECCC were a direct result of Kootenay Connect's priority actions previously identified in the Slocan Lake Forum. Here we report results from Years 1 and 2 of that project since they are a result of Kootenay Connect and overlap with the two years funded by FWCP.

The Bonanza Biodiversity Corridor activities include five primary subprojects:

- restoring three wetland sites along Bonanza Creek and Summit Lake (Fig. 16)
- mapping habitat types and remaining old growth using lidar remote sensing and Terrestrial Ecosystem Mapping (TEM)
- updated old-growth maps are used to propose new Old Growth Management Areas (OGMAs)
- assessing beaver habitat and estimating beaver population
- conducting complete species and species at risk inventory

In Year 2 of Kootenay Connect's Priority Places, wetland restoration at Hunter Siding was completed to encourage the sedge and willow-dominated wetlands to respond positively to additional water and remain healthy during the summer season. Also, a fish habitat assessment for kokanee and rainbow trout was conducted in preparation for restoration of Upper Bonanza Creek and Summit Lake Wetland sites during Year 3 (Fig. 17).

Year 2 also saw the completion of a beaver survey assessment (Fig. 18) with active, potential, and historic beaver habitat identified (Fig. 19). Active search targets included the following evidence of use: vegetation cutting, scent mounds, dams, soil excavation, 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 to be potential beaver habitat. Finding of significant beaver activity, providing natural channelling and hydrologic flows throughout the corridor, were identified. These habitat categories were mapped as Active Use, Potential Use, Historic Use, Not Suitable (Figure 19a). The habitat assessment suggests that active beaver populations occupy 47.2% (65.3 ha) of the suitable habitat in the BBC. Restoration of selected sites will occur in Years 3 and 4.

We used wildlife cameras installed throughout the BBC at beaver lodges and dams to determine if the structures were active in an attempt to capture images of live individuals. Based on the number of lodges found in the BBC, the current population of beavers is

approximately 25. The colony-based population estimate indicates that 40 beavers may inhabit the BBC. Habitat-based analysis predicts the potential carrying capacity of the BBC for a population of 85 beavers inhabiting 17 distinct colonies.

a

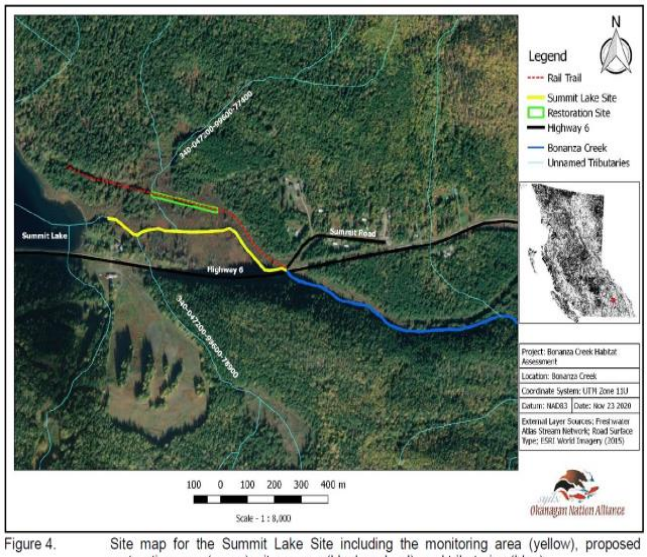


Figure 4. Site map for the Summit Lake Site including the monitoring area (yellow), proposed restoration area (green), site access (black and red), and tributaries (blue).

b

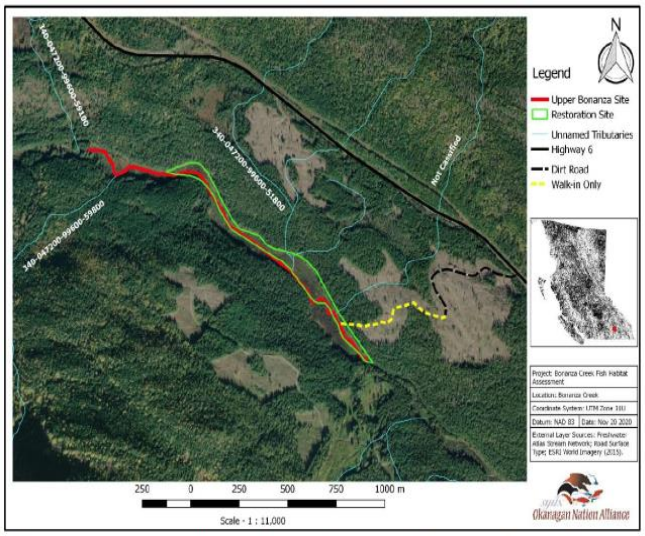


Figure 3. Site map for the Upper Bonanza Site including the monitoring area (red), proposed restoration area (green), site access (black and yellow), and tributaries (blue).

Figure 17. Fisheries habitat restoration planning for a) Summit Lake site; and b) Upper Bonanza Creek site (ONA, 2020).

a

b

Figure 18. Photos of a) beaver lodge near Summit Lake that was active in 2019 and then inactive in 2020 due to trapping; and b) large active functioning dam on Bonanza Creek at the Upper Bonanza restoration site.

a

b

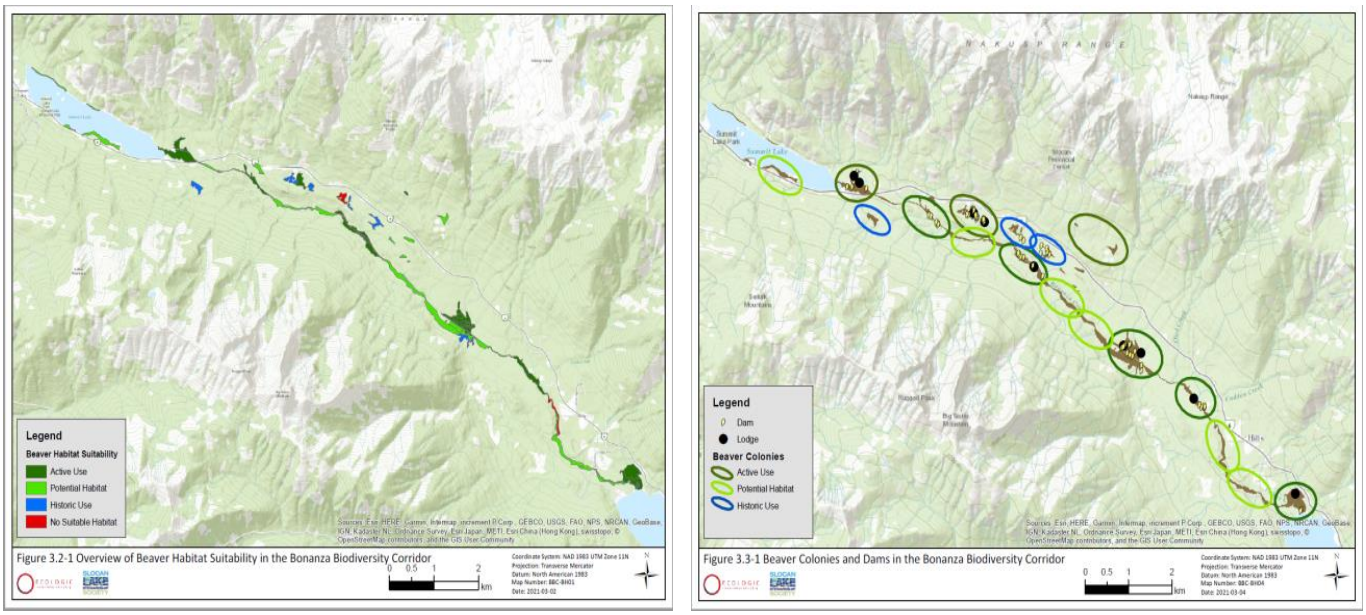


Figure 19. a) Beaver habitat suitability, active, potential, and historic; and b) beaver colony status (Durand and Peyton 2021).

In Year 2, an extensive Biodiversity and Species at Risk Assessment was initiated that relied upon a variety of sources that documented 994 unique species (Table 1) and affirmed the aptly named Bonanza "Biodiversity" Corridor. A total of 25 species that have provincial and/or federal conservation ranks were identified in the BBC including: 3 Endangered, 8 Threatened, and 4 Special Concern species from the federal Species at Risk Act (SARA); 3 Endangered, 11 Threatened, and 2 Special Concern species from the federal Committee on the Status of Endangered Wildlife in Canada (COSEWIC); and one Red, 18 Blue, and 409 Yellow species tracked by the British Columbia Conservation Data Centre. This species data will guide 2021 field surveys to focus on under-studied taxonomic groups (e.g., lichens), specific habitat types that have a high potential to support SAR that are known to occur, those 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. All conservation ranks are current as of March 5, 2021. (Durand and Ehlers 2021).

			Species with Conservation Ranking*					
Lifeform	**No. of Taxa***		**BC List**	**No. taxa**	**COSEWIC**	**No. taxa**	**SARA**	**No. taxa**
Amphibian	4		Red	1	Endangered	3	Endangered	3
Arthropod	82		Blue	18	Threatened	11	Threatened	8
Bird	154		Yellow	409	Special Concern	2	Special Concern	4
Fish	16		Accidental	1	Not at Risk	14		
Fungus	203		Exotic	28				
Lichen	7		No Status	99				
Mammal	28		Unknown	5				
Mollusc	21							
Myxomycete	39		**Total number of species at risk either provincially or federally: 25**					
Plant	438							
Reptile	2							
Total	994							

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 that occurred in Year 2 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. The draft old-growth map (Fig. 20) will be field ground-truthed and compared with existing provincial Old Growth Management Areas (OGMAs).

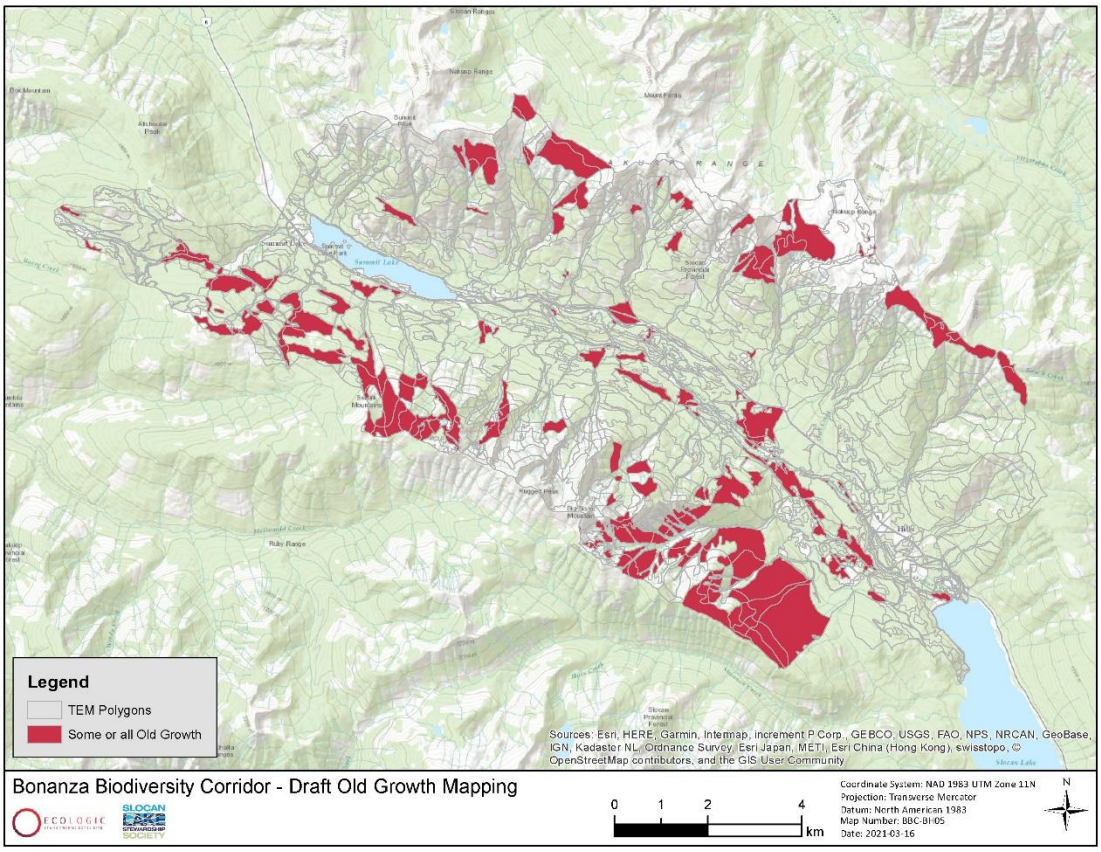


Figure 20. An initial map of old-growth forests in the Bonanza Biodiversity Corridor to be field ground-truthed in Year 3 of Kootenay Connect Priority Places (2021–2022).

Plans for Year 3 in the BBC include identifying vulnerable species and mapping important habitat from valley bottom to montane to develop relationships of suites of species into habitat types including riparian, wetland, mature cedar forests, and subalpine/whitebark pine. SLSS's team will integrate species at risk information and locations, beaver use, and habitat knowledge to develop a comprehensive Conservation Management Plan for the Bonanza Corridor to help guide the use of protective measures such as Wildlife Management or Habitat Areas, and designation of additional OGMAs.

COLUMBIA WETLANDS

Geographic Description

The 180-km long Columbia Wetlands within the Rocky Mountain Trench extends from Donald at the north end to Canal Flats in the south (Fig. 21). It is one of the largest intact wetland complexes in Canada, and an international Ramsar Site recognized by the United Nations. Much of the Columbia Wetlands is encompassed within the Columbia Wetlands Wildlife Management Area (CWWMA) with a mix of private and federal lands managed as National Wildlife Areas. This wetland separates the Canadian Rocky and Purcell Mountains across much of the northern portion of the valley from the US border up through Golden, BC.

a) b)

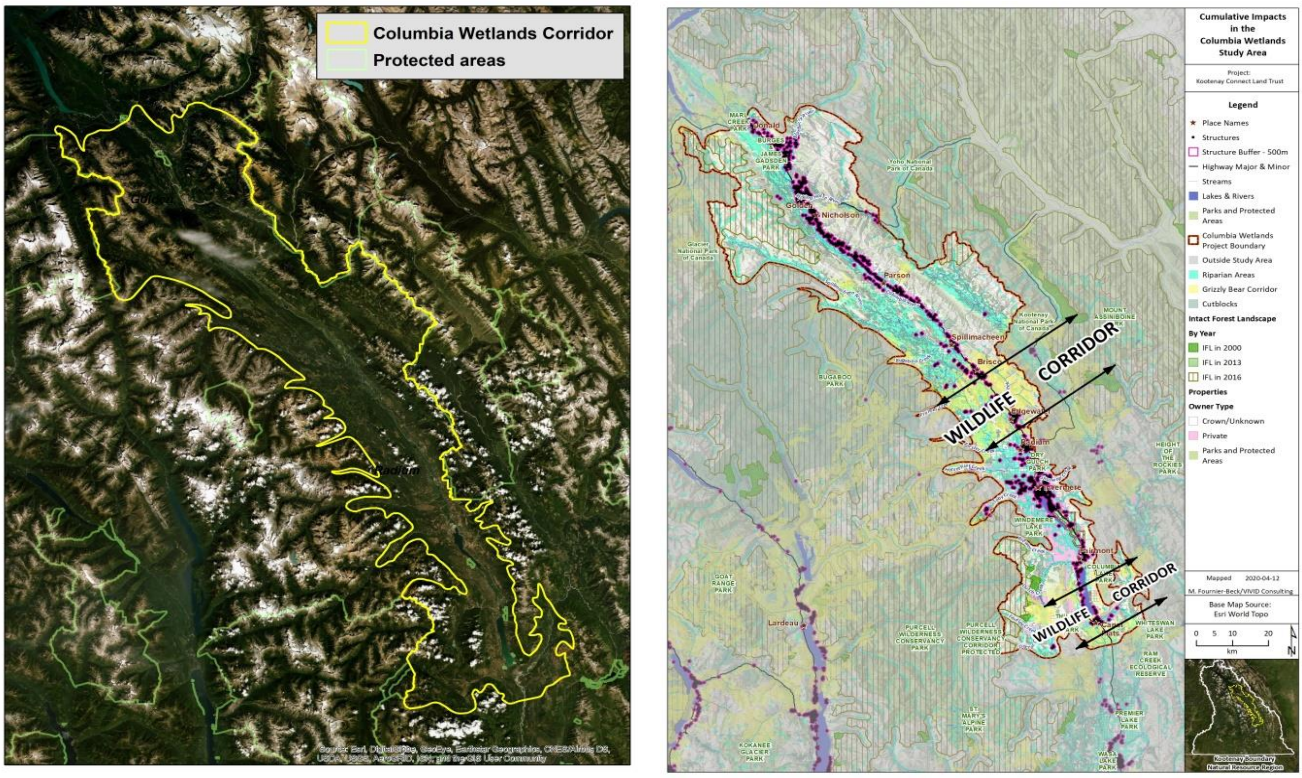


Figure 21. a) Google Earth image of the Columbia Wetlands north–south along the Rocky Mountain Trench (yellow), and b) the same area with grizzly bear core (tan) and linkage (yellow) habitats as identified by the Trans-border Grizzly Bear Project (Proctor et al. 2015) overlaid with cumulative impacts relative to preliminary east–west upland wildlife corridors connecting the Purcell and Rocky Mountains along BC Highway 93/95.

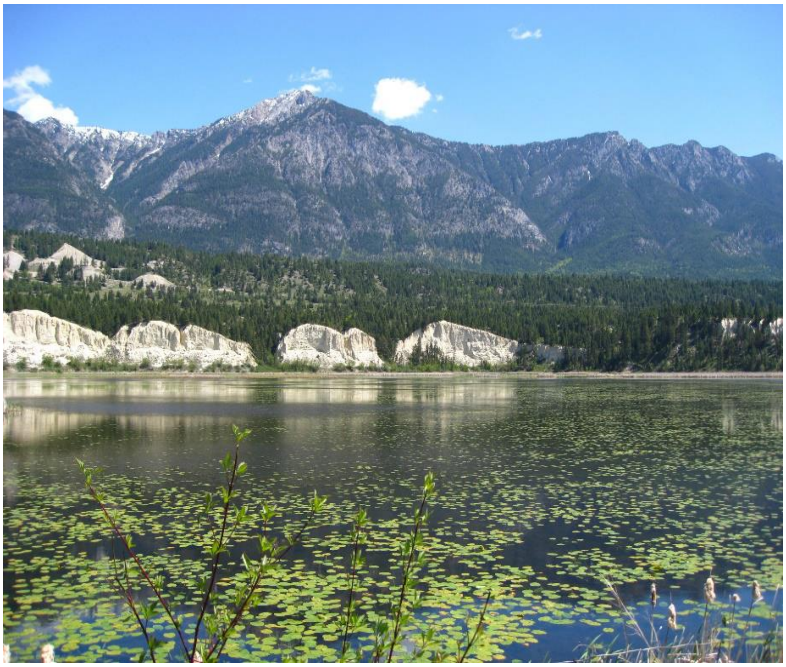
These upland corridors in Figure 21 will be updated with cumulative SAR and other species data collected in Year 2 (see below).

Leading Connectivity Conservation Groups

Most groups engaged in conserving and managing biodiversity and habitat connectivity in the Columbia Wetlands as 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 Columbia 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.

Kootenay Connect Workshop – Columbia Wetlands Corridor 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*[19]. Scientific recommendations led to identifying *conservation targets* (including species Tables 5 and 6, habitat types Table 7, habitat features Table 8, and ecological process Table 9); and *ecological threats* (Table 10) in Appendix A.



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

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

Two years later in November 2019, we held a Kootenay Connect – Columbia Wetlands Corridor workshop of 16 participants with diverse expertise and interests in conserving the Columbia Wetlands. During this Kootenay Connect workshop participants reviewed the target species, habitat types and features, and ecological processes generated at the 2017 Columbia Wetlands Conservation Action Forum (above), as well as species at risk added to the list by Kootenay Connect. Participants also identified additional ecological threats, conservation opportunities, and collaborative strategies that went beyond those identified at the 2017 Forum.

The workshop focused on how past habitat suitability models developed for ungulates could be updated; the benefits of creating a "conservation opportunities map" for Nature Conservancy of Canada and Nature Trust of BC for identifying all private lands with wetlands and other conservation values that occur along the boundary of the CWWMA; and how Kootenay Connect can provide scientific rationale for corridor identification and designation of Environmentally Sensitive Areas/Environmental Development Permit Areas (ESAs/EDPAs) within corridors for the new Steamboat Jubilee Mountain Official Community Plan (OCP) being developed over the next 1–2 years by the Regional District of East Kootenay.

Priority Conservation Actions for the Columbia Wetlands Corridor

- 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 that influence functionality and could impact the area's fish, wildlife, and overall biodiversity.
- Implement a regional conservation plan to facilitate species and habitat shifts necessary for resilient ecosystems to adapt to climate change, including connectivity for species and ecosystems.
- Floodplain management
    - Identify floodplain hazard zones – to be zoned as no development
    - Introduce management that slows water flow through the wetland and increases complexity and interconnected waterways within the Columbia Wetlands
    - Identify drainages with more permanent and colder sources of water
    - Identify and protect old-growth hotspots as potential climate refugia
    - Identify biodiversity hotspots for potential climate refugia
- Combine Trans-border Grizzly Bear Project habitat analysis and Kootenay Connect's science and maps to guide access management planning that is being initiated by FLNRORD for the Columbia Valley Recreation Access Management Plan (CVRAMP) to help identify "no go" zones for recreationists.

- 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 (DPA) relative to ESAs – Kootenay Connect can help define ESAs (high, medium, low) that would be managed through their existing permitting process
  - There is a need for accurate scientific rationale for designating corridors and incorporating them into land use planning – Kootenay Connect can provide scientific justification
  - Scientific rationale for ESAs includes sensitive habitats for species at risk, wetlands, riparian, wildlife corridors, etc. as well as important wetland-upland interface areas
  - Steamboat Jubilee Mountain Official Community Plan (OCP) is being updated over the next 1–2 years – Kootenay Connect can provide details for corridor identification
  - Identify for protection private and public lands adjacent to wetlands outside the CWWMA and Columbia Wetland Natural Areas
  - Identify and map important floodplain areas, alluvial fans, and hazard areas for management planning
- Identify potential Wildlife Habitat Areas under BC's Forest and Range Protection 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.

Kootenay Connect Priority Places Project

The organization leading the implementation of the Kootenay Connect Priority Places project in this corridor is the Columbia Wetlands Stewardship Partners. Here we report preliminary results from that project since they overlap with this first year of Kootenay Connect funded by FWCP.

The Columbia Wetlands Corridor activities included three primary subprojects in Year 1:

- Delineation of an ecological boundary for the Columbia Wetlands and adjacent uplands
- Using lidar remote sensing and Terrestrial Ecosystem Mapping (TEM) to map specific habitat types within the extensive wetlands complex to facilitate future conservation planning
- Identification of species at risk that rely upon Columbia Wetland habitats

The species at risk inventory undertaken by CWSP involved extensive literature and database searches, resulting 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 Year 2.

The Columbia Wetlands Corridor activities included five primary subprojects in Year 2:

- Field surveys of:
    - focal species at risk, such as **Lewis's woodpecker** (Fig. 22) to inventory suspected or known nesting sites on private and Crown land that are not currently designated as Lewis's Woodpecker Wildlife Habitat Areas (WHA)
    - **western painted turtle** (Fig. 23) to determine where they are nesting and basking in the Columbia Valley and potential threats to these areas to guide enhancement and restoration activities in Year 3
    - species of conservation interest such as **osprey** to assess whether nest sites outside of the CWWMA would be eligible for Wildlife Habitat Features (WHF) designation to afford protection of nest sites on private and Crown land
    - **alkali saltgrass–foxtail barley** ecological communities (Fig. 24) to revisit previously identified sites from provincial records located near Canal Flats, to investigate whether this rare ecological community still exists and in cases where it is still present, develop and submit a WHA proposal(s) to FLNRORD for its protection
    - **mountain goat** mineral licks to locate significant mineral links in Canyon Creek in Nicholson, Toby Creek near Invermere, and elsewhere on private or Crown land within the Columbia Wetlands by geo-referencing them and incorporating expert opinion from local biologists, hunters, and naturalists in order to submit WHF proposal to FLNRORD for protection of the mineral lick sites
- Identify priority lands for conservation based on results from Kootenay Connect Year 1 to identify biodiversity conservation opportunities for private land that might be purchased or included in land stewardship programs (Fig. 25)
- Hydrologic mapping of wetland communities that identifies hydrologic vulnerabilities in the Columbia Wetlands to determine priority wetlands where management actions like conservation or mitigation should be implemented
- Northern myotis bat habitat enhancement and trials with BrandenBark™ to mimic old-growth maternity roosting sites

Year 2 focal species surveys included Lewis's woodpecker, osprey, western painted turtle, and mountain goat mineral licks. Conservation actions emanating from this effort included, but were not limited to, recommendations and efforts to establish BC Provincial Wildlife Habitat Areas, Wildlife Habitat Features, and extensions to existing Wildlife Habitat Areas.

Lewis's woodpecker sites identified were all on private land so new WHA designations were not eligible (Fig. 22). However, Darvill (2021) recommended federally identified critical habitat be expanded and also identified several options for private land conservation relative to this species at risk.

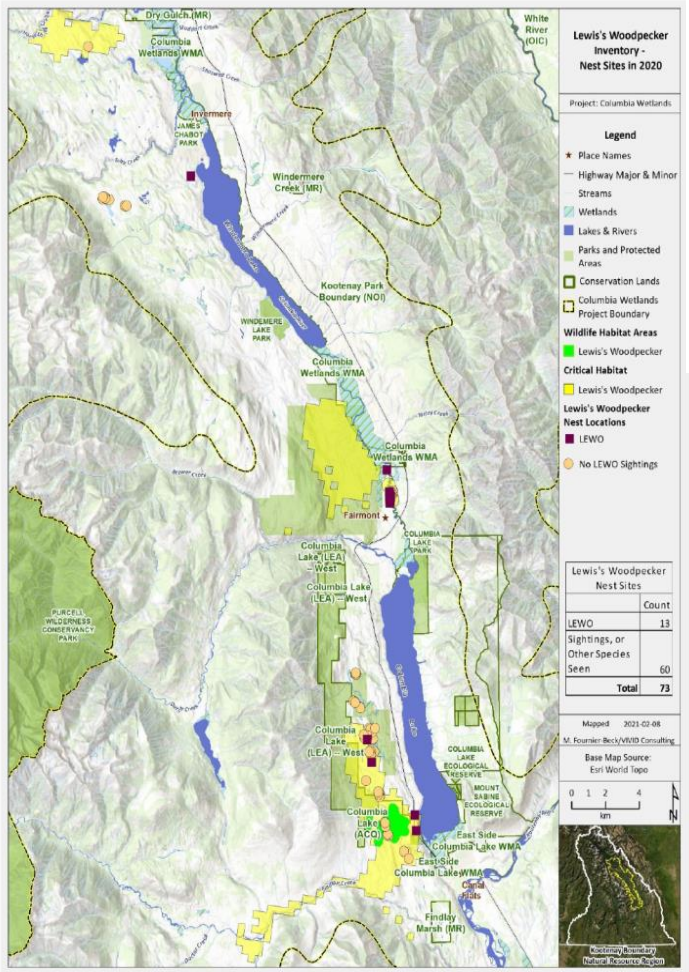


Figure 3. Point count locations for Lewis's Woodpecker in 2020, including identified nest sites.

Figure 22. Lewis's woodpecker nest sites located in the Columbia Wetlands along the upper Columbia River (Darvill 2021).

Our understanding of western painted turtles' nesting and basking sites (Fig. 23) increased measurably with field surveys in Year 2. The BC Conservation Data Centre noted three turtle nesting sites in the Columbia Wetlands prior to 2015, and in 2020 Kootenay Connect identified 12 sites (Darvill 2021). These sites are being prioritized for enhancement and restoration in Years 3 and 4. For example, it was noted that several important nesting sites are located near roads and road mortality is an issue. Plans are to mitigate this issue with exclusion fencing in cooperation with private landowners. Other sites will see improvements to nesting sites and basking habitat.

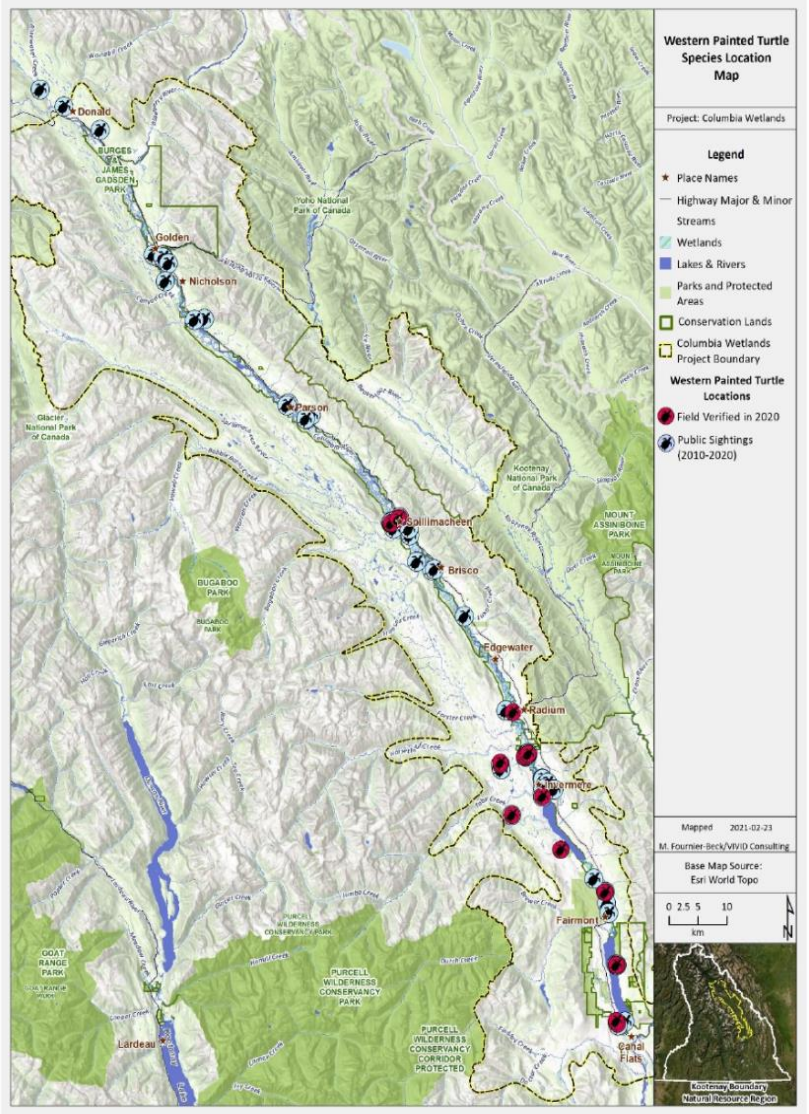


Figure 23. Western painted turtle sites identified by field surveys within the Columbia Wetlands.

Year 2 surveys of osprey nests resulted in the monitoring of 65 osprey nests, 19 of which produced offspring, a decrease in nest success from the previous year. Most nests were on power poles that do not qualify for WHF designation as the structures are not “natural”; however, the identified tree nests are already afforded some level of protection as they are on First Nation, Nature Conservancy, or National Wildlife Area lands.

During Year 2, two mountain goat mineral licks were identified and have been designated by the province as Wildlife Habitat Features through this project, affording these important sites protection under FRPA.

Inventories of the rare alkali saltgrass–foxtail barley ecological community confirmed its occurrence in previously identified locations. Two areas totalling 58 ha (Fig. 24) have been identified and proposed to be Wildlife Habitat Areas through FLNRORD.

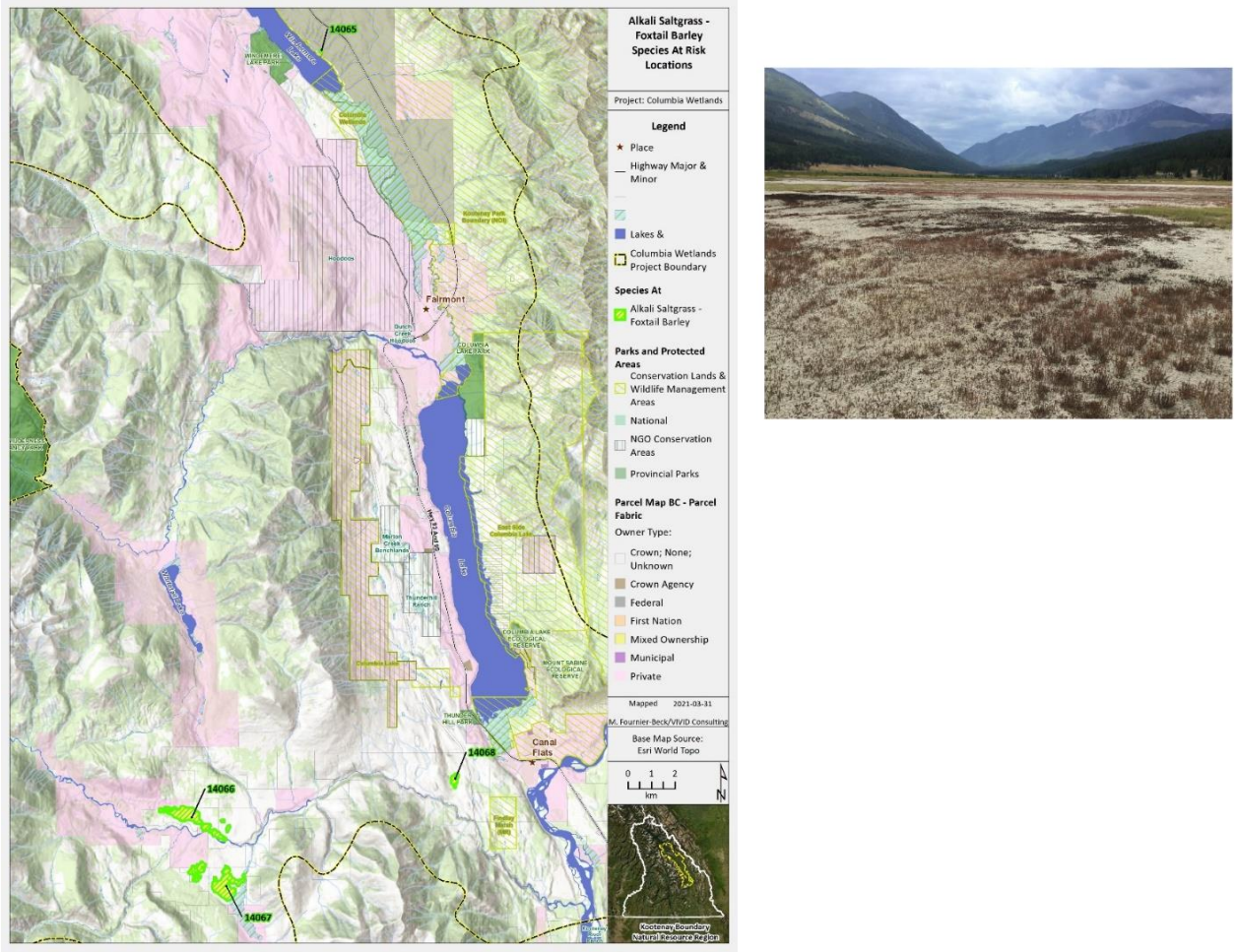


Figure 24. Proposed Alkali Saltgrass–Foxtail Barley Wildlife Habitat Area within the larger Columbia Wetlands ecosystem (Darvill 2021).

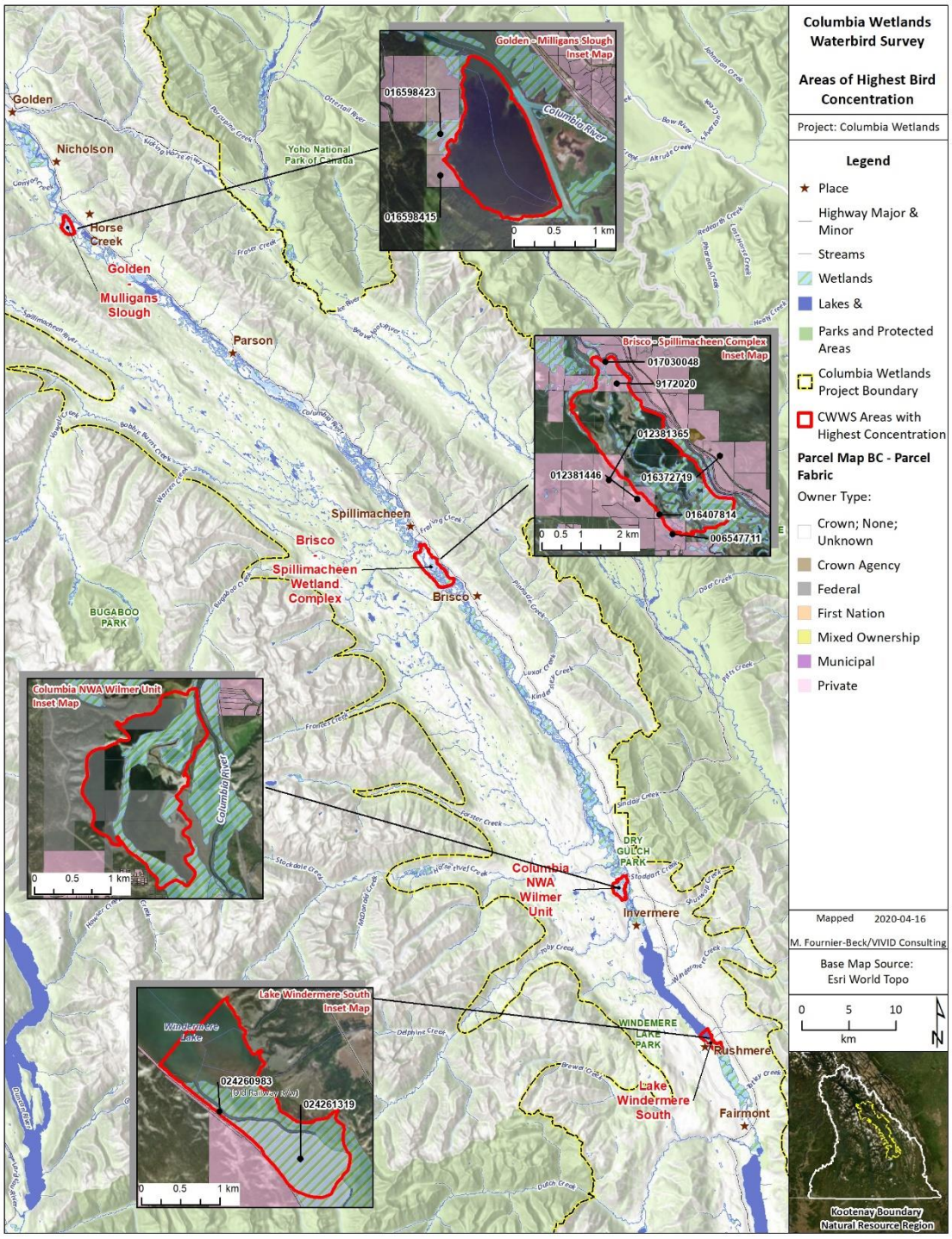


Figure 25. Areas of highest bird concentrations in the Columbia Wetlands that represent conservation opportunities (Darvill 2020, 2021).

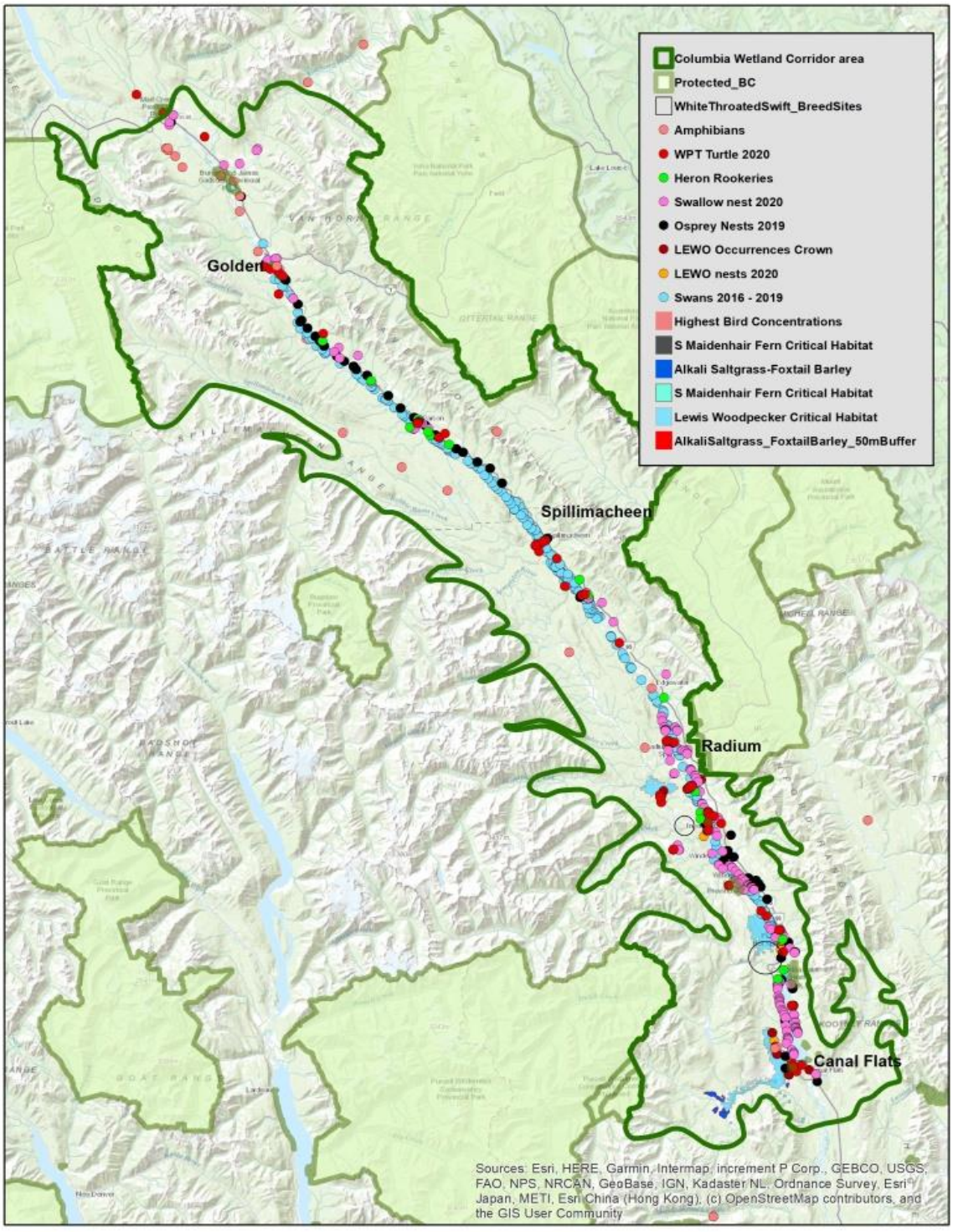


Figure 26. Results from two years of species at risk surveys and desktop research (Darvill 2020, 2021).

Another sub-project within Year 2 for Kootenay Connect in the Columbia Valley that was a first of its kind was the classification and mapping of wetland community types across the entire length of the Columbia Wetland (Fig. 27a, b), developed by Ecologic Environmental Consulting (Durand 2021).

a b

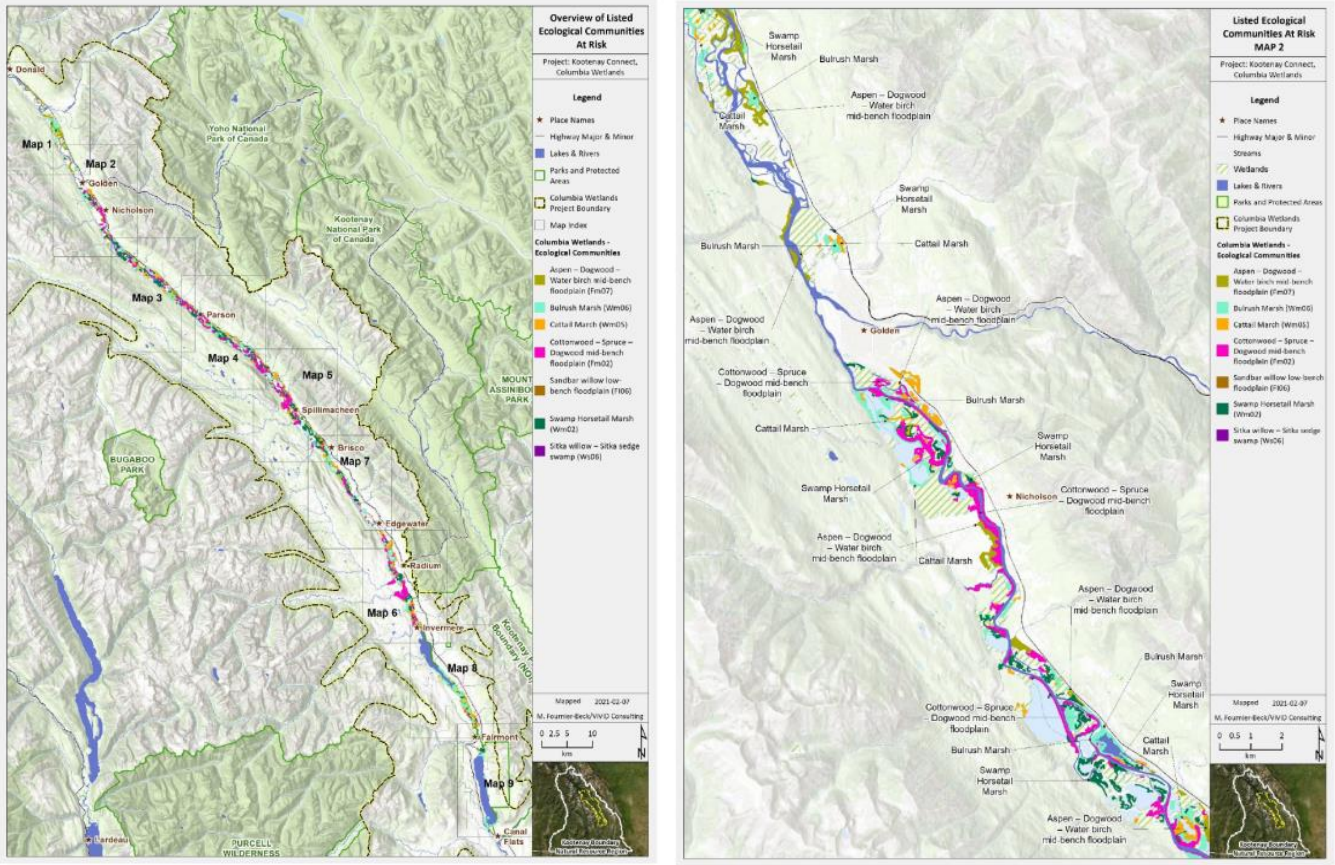


Figure 27. Ecological communities at risk identified in the Columbia Wetlands along the upper Columbia River captured in nine mapping units (Durand 2021, Darvill 2021); and b) Map #2 provides a closeup of at-risk communities in the Columbia Wetlands between Nicholson and Golden, BC.

All of Year 2'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 et al. 2021) discussed below.

Multi-species upland corridors

To help identify conservation opportunities related to cross-valley connectivity, Kootenay Connect gathered available data for modelling habitat selection for several large mammal species in an effort to estimate wetland-upland corridors along the 180-km length of the Columbia Wetlands (Table 2).

To assess the relationship between human settlement, private land, and forestry roads, we brought these layers together in GIS. Grizzly bear data was obtained from the Trans-border Grizzly Bear Project, which used GPS radio-collar data to derive habitat selection (Resource Selection Function, 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.

Table 2. Species used to identify multi-species wetland-upland wildlife corridors across the upper Columbia Valley.

Species	Data type	Corridor ID	Data source
Grizzly bear	GPS telemetry based habitat selection	Data-based	Trans-border Grizzly Bear Project
Wolverine	DNA survey derived Density surface	Estimated	Doris Hausleitner and BC FLNRORD
Mt Goat	Telemetry based Habitat selection	Estimated	BC FLNRORD
Elk	Telemetry based Habitat selection	Extrapolated	K Mulligan MSc
Badger	Telemetry based Habitat selection	Extrapolated	N Newhouse & T Kinley

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), provided by the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD). 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.).

Elk RSFs were generated from telemetry data collected in the southern portion of the nearby Elk Valley and extrapolated through the upper Columbia River drainage (Mulligan 2020a & b). Kootenay Connect contracted with K. Mulligan to extrapolate the RSF model (developed for her Master of Science thesis) up through Donald at the north end of the Columbia Valley (Fig. 28). 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 FLNRORD (Crombie 2020) 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 (Fig. 29a) to look for spatial patterns to predict several multi-species corridors (Fig. 29b).

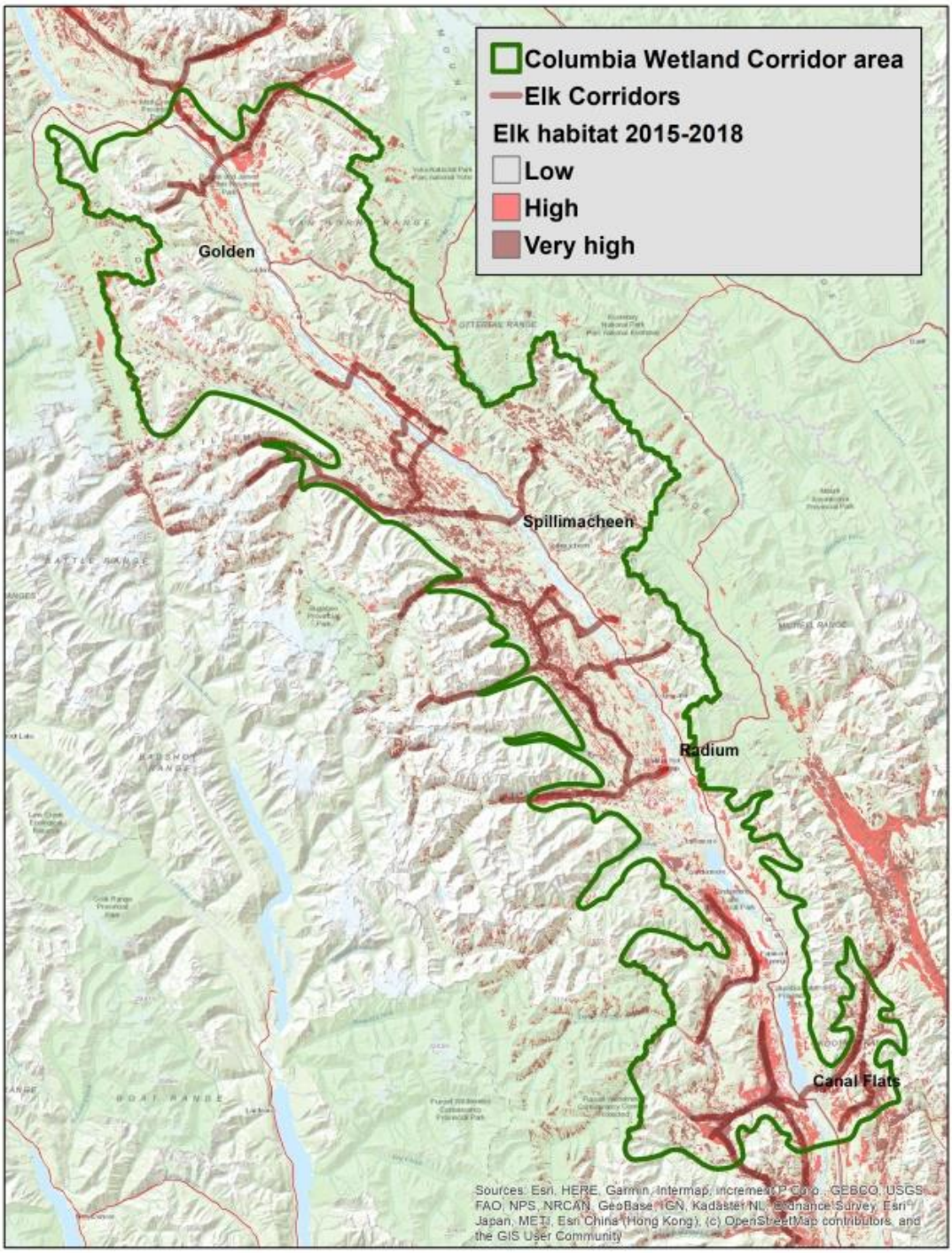


Figure 28. Habitat selection of Rocky Mountain elk across the upper Columbia Valley. Model extrapolation of data developed for the Cranbrook-Fernie area was commissioned by Kootenay Connect to aid in multi-species upland corridor planning (Mulligan 2020a & b).

a b

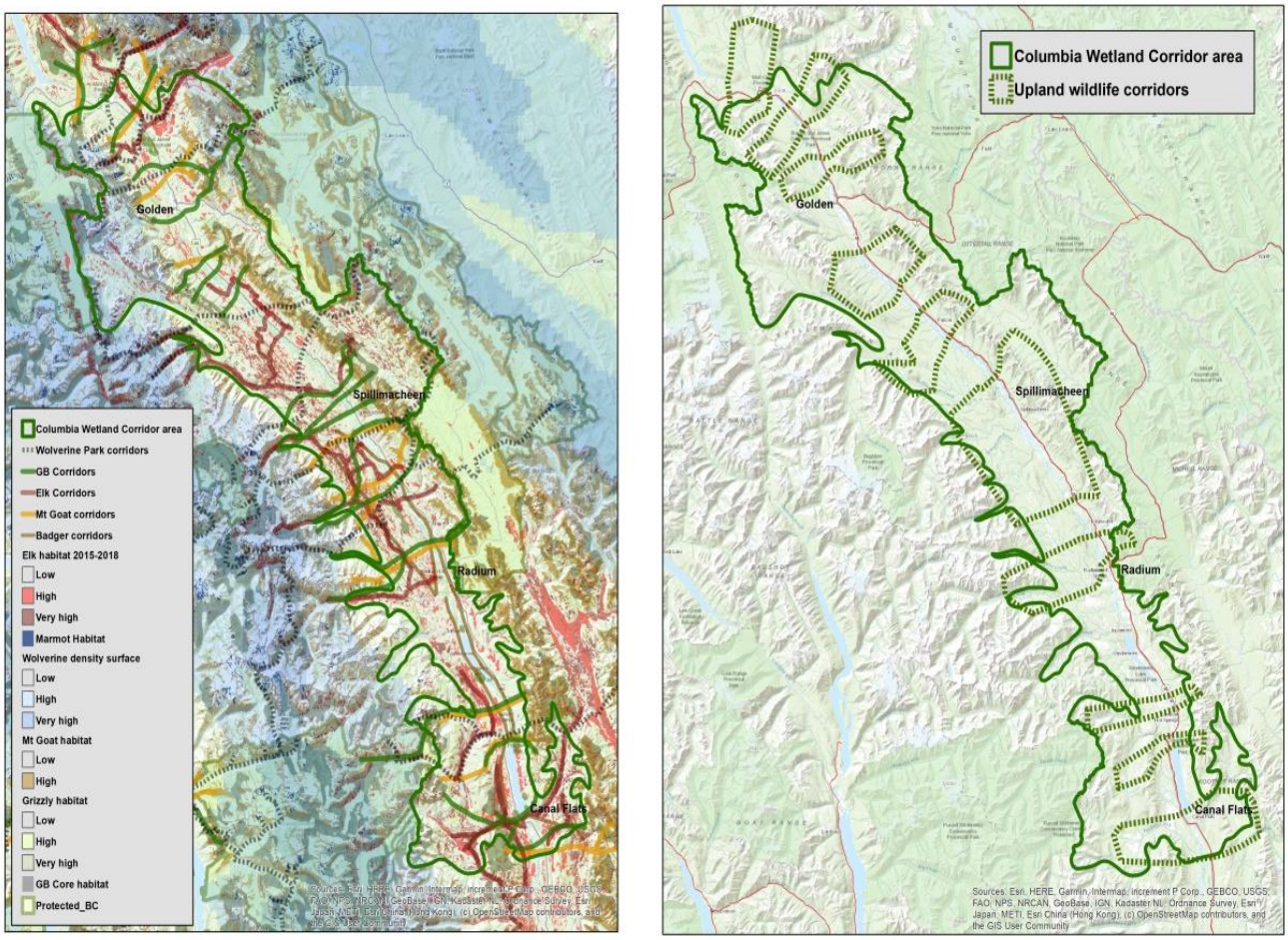


Figure 29. a) Estimated corridors for grizzly bear, elk, mountain goat, badger, and wolverine; and b) predicted multi-species wetland-upland corridors across the 180-km length of the Columbia Wetlands between the Purcell and Rocky Mountains.

Identifying Biodiversity Conservation Opportunities

One of the goals of our species and ecosystems at risk (Darvill 2020, 2021) and multi-species upland corridor identification work (Proctor 2021) was to integrate these results into an assessment of biodiversity conservation opportunities (BCOs). Originally, these were going to be "biodiversity hotspots" to protect, but we soon realized that the entire Columbia Wetlands is a biodiversity hotspot and it was impossible to single out particular areas that were more important than others. Further, much of the Columbia Wetlands are protected in one form or another (e.g., provincial Wildlife Management Areas or federal National Wildlife Areas). Therefore, our goal was to identify areas where this system could be improved to conservation benefit. Here we present a summary of our effort to identify BCOs and partition them into potential conservation streams, including expansions to WMAs, direct acquisition or conservation easements by land trusts (e.g., Nature Conservancy of Canada or Nature Trust of BC), inclusion in the private land conservation efforts of Farmland Advantage, or restoration activities facilitated through Kootenay Conservation Program and more. We do not present a map of these conservation opportunities as this information is of a sensitive nature and to protect the privacy of private landowners.

There were 126 properties identified overall (Table 3), 61 properties within the identified wetlands-upland corridors (Fig. 29b, including 4 on their border), and 64 not in these corridors, but more specific to species at risk habitats in the valley bottom. Seventy-five properties were directly associated with wetland habitats, 9 with floodplains, and 24 were in upland habitats.

Table 3. Potential biodiversity conservation opportunities for properties of interest relative to wetland-upland corridors or species at risk within the Columbia Wetland area. The categories do not sum to the total because of overlapping membership in several possible categories.

Category	#Properties
Overall Properties	126
Land Trust	83
Farmland Advantage/Stewardship Agreements	36
Stewardship Groups	72
WMA Expansion	26

Bats and artificial old-growth roosting habitats using BrandenBark™

As insectivores that consume large quantities of our region's insects to fuel their high metabolism, bat species play an outsized ecological role in the Kootenay region relative to their body size and public persona. Of the 16 species of bats in British Columbia, 11 likely use bark on old-growth snags for important roosting habitat. As old-growth forests are in decline in our region, and in much of BC (Price et al. 2020), this project is designed to mitigate the loss of old-growth roosting habitats for the endangered northern myotis (*Myotis septentrionalis*) and other old-growth-dependent bat species within the Columbia Wetlands by erecting artificial old-growth bark-like habitat that has been shown to work well in other areas. The idea is to increase potential habitat connectivity and roosting opportunities by creating more available habitat that fills in the gaps in old-growth patches while encouraging improved forest management for the natural regeneration of old-growth forests in the Columbia Wetlands and surrounding landscape.

This project erected two experimental artificial old-growth roost designs using BrandenBark™ (Fig. 30) on private property with considerable in-kind efforts by the landowner near Burges James Gadsden Provincial Park north of Golden. More sites will be erected in subsequent years based on monitoring results of these sites.

Figure 30. BrandenBark™ artificial old-growth roosting habitat for northern myotis bats (and other old-growth-dependent species) in a bat corridor (forest in lower right panel) along the Columbia Wetlands near good wetland foraging habitat in Burges James Gadsden Provincial Park north of Golden, BC.

Hydrological assessment of the Columbia Wetlands

Increasing temperatures and depleting snowpack in the mountainous Kootenay region is expected to impact the extent and function of floodplain wetlands along the upper Columbia River.

Hopkinson et al. (2020) combined groundwater, river, and wetland basin hydro monitoring with remote sensing within a portion of the Columbia Wetlands across 3½ decades (1984–2019) in order to identify wetlands that have lost water over this period (Fig. 31) and are vulnerable to the impacts of climate change. This work will be expanded to other areas along the Columbia Wetland and integrated into conservation planning relative to the expected influence of climate change on wetland function.

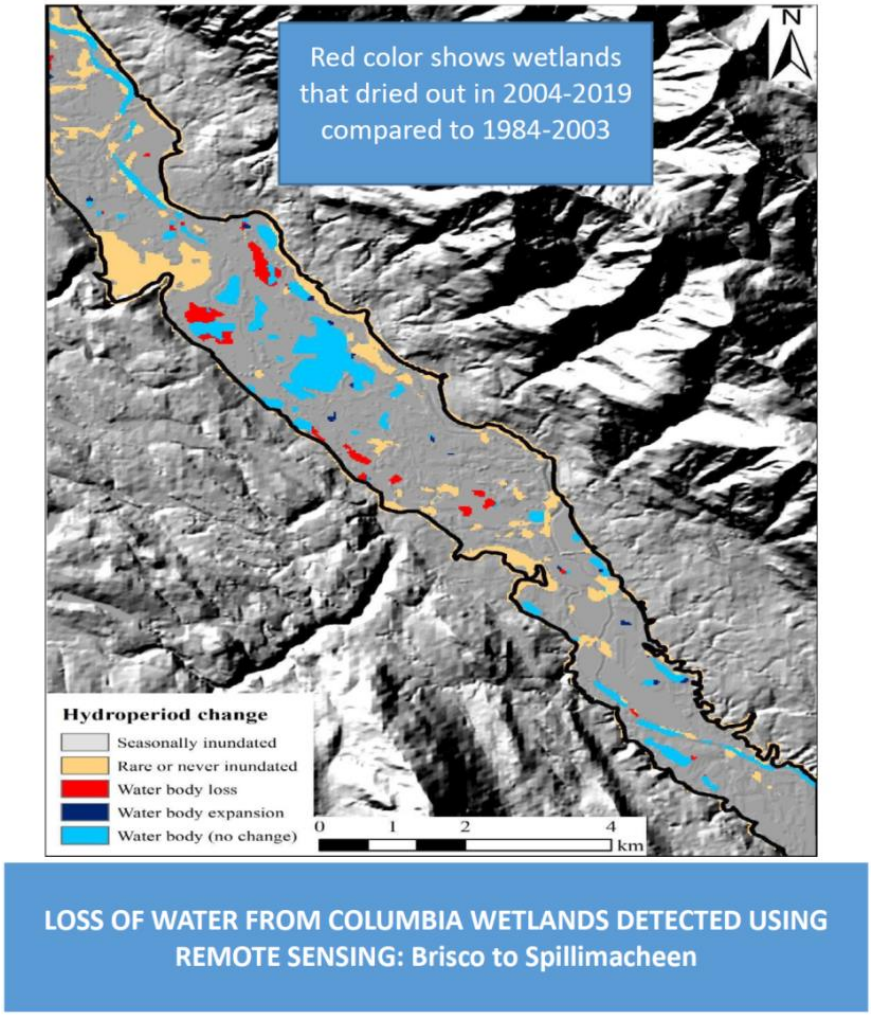


Figure 31. Wetlands that have lost water across 3½ decades between 1984 and 2019 as detected through remote sensing (Hopkinson et al. 2020).

WYCLIFFE WILDLIFE CORRIDOR

Geographic Description

This grassland-open forest corridor with scattered wetlands and riparian areas is located within the southern Rocky Mountain Trench between Kimberley and Cranbrook, BC (Fig. 32). The Wycliffe Wildlife Corridor is part of the ponderosa pine 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 restoration (Murphy 2016). The montane grassland component of the corridor provides some different habitat associations than the other riparian-wetland corridors within the Kootenay Connect focal areas; however, there are scattered riparian areas on smaller creeks as well as the St. Mary's River that support songbirds, reptiles, and amphibians. Wycliffe is well-known for its important winter range for deer and elk and important open forest habitat for Lewis's woodpecker, Williamson's sapsucker, and several federally and provincially listed plant species.

Within this corridor is the Wycliffe Conservation Complex, which encompasses 1,109 hectares (2,740 acres) of ecologically significant habitat that is managed in a partnership between the Nature Conservancy of Canada (NCC), the Nature Trust of BC (NTBC), and the Ministry of Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD). Throughout the complex, a mosaic of native grassland, open forest and closed forest provides a variety of habitat types to a suite of wildlife, including several species-at-risk. The conservation complex includes important areas such as the Luke Creek Wildlife Corridor and Pine Butte Ranch Conservation Area.

Wycliffe Corridor. (Photo R. Klafki)

a

b

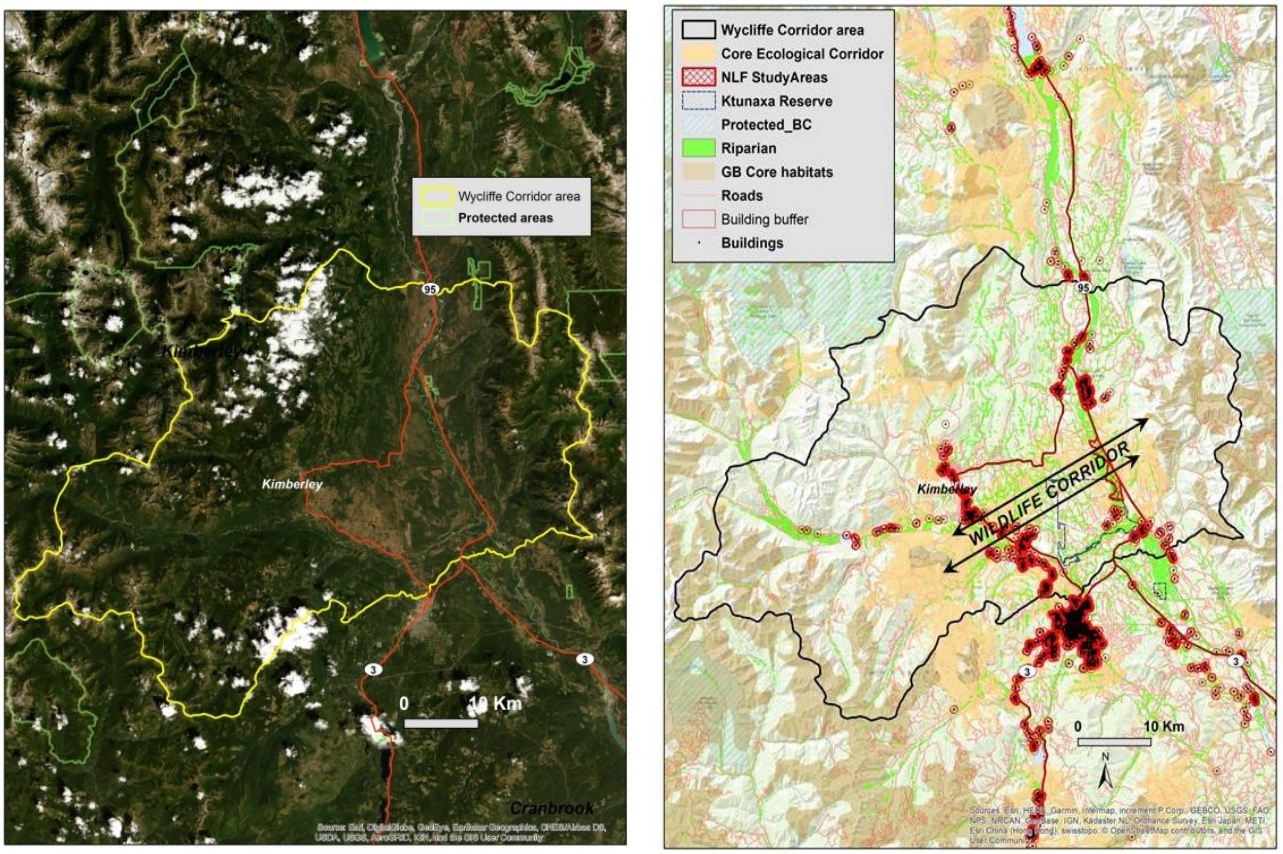


Figure 32. a) Google Earth image of the Wycliffe grasslands-riparian corridor between Cranbrook and Kimberley, BC separating the Rocky and Purcell Mountains, and b) the same area with grizzly bear core (tan), linkage (beige), riparian (green) habitats as identified by the Trans-border Grizzly Bear Project (Proctor et al. 2015), overlaid with cumulative impacts relative to preliminary upland wildlife corridors.

The Wycliffe Corridor is located within KCP's Upper Kootenay River Valley Conservation Neighbourhood (Fig. 6). KCP has not yet hosted a Conservation Action Forum in this region, thus the workshop organized by Kootenay Connect in September 2019 initiated an important discussion of conservation priorities. Participants included independent and government biologists, conservation land trusts (Nature Conservancy of Canada, the Nature Trust of BC), Regional District of East Kootenay (RDEK) regional planners, conservation organizations (e.g., Rocky Mountain Trench Natural Resources Society, Kootenay Community Bat Project), and First Nations (Ktunaxa, ʔaq̓am) who assessed conservation challenges, opportunities, and strategies for the Wycliffe Corridor.

The workshop began by discussing where to draw an ecological boundary for what has been generally referred to as the Wycliffe Wildlife Corridor. Cumulative human impacts, distribution of American badger, grassland habitat types, and ungulate migration linking the St. Mary's drainage to the open grassland complex informed delineation of this ecosystem. Participants discussed target species, habitat types and features, and ecological processes for Wycliffe. Recommendations led to identifying *conservation targets* (including species in Tables 5 and 6, habitat types in Table 7, habitat features in Table 8, and ecological process in Table 9); and *ecological threats* (Table 10) in Appendix A.

The Wycliffe Corridor has a large percentage of private lands, which greatly influences conservation planning. A key result of this workshop was the group's interest in increasing private land conservation and stewardship through various identified options. The group explored tools such as direct purchase and conservation easements in cooperation with the Nature Conservancy of Canada and Nature Trust of BC to build upon their success in the Wycliffe Conservation Complex, 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 already existing planning processes within the RDEK. The RDEK planners were especially interested in exploring how they could integrate Kootenay Connect's scientific data about natural values into their process of revising Official Community Plans (OCP) in which ESAs could be designated and managed using Development Permit Areas (DPAs). 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[20] offer expertise and financial support.

Specific Priority Conservation Actions for the Wycliffe Wildlife Corridor

- Integrate science-based criteria for ESAs and identify them for incorporation in RDEK's private lands Development Permit Area program and for potential inclusion within Official Community Plans to address private land within regional connectivity areas. This would include exploring compensatory tools for conservation zoning for willing landowners

[20] https://kootenayconservation.ca/KCPStewardship/

- Provide science-based information for FLNRORD access management planning in the area, particularly grizzly bear habitat use and huckleberry patch models from the Trans-border Grizzly Bear Project
- 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 the Nature Conservancy of Canada and the Nature Trust of BC to support new opportunities for private land securement
- 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, FLNRORD and Ktunaxa Nation on conservation priorities that span land ownership
- Fire management to reduce potential for catastrophic fires also relies upon cooperation between NCC, NTBC, FLNRORD and Ktunaxa Nation Council

Kootenay Connect Priority Places Project

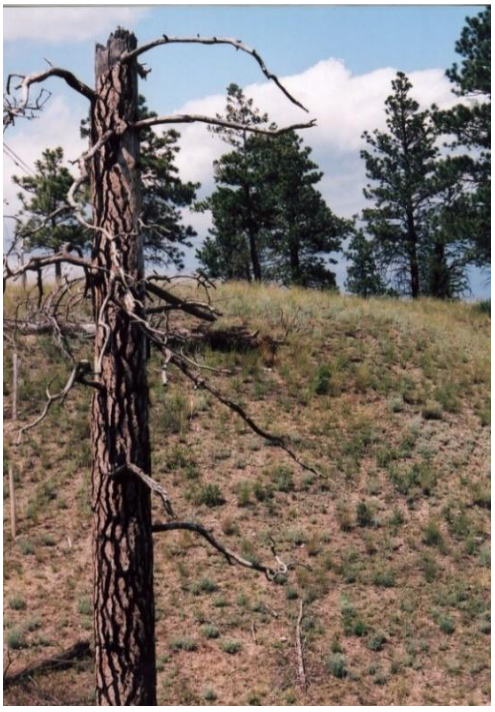
The lead organizations for Kootenay Connect Priority Places in this corridor are the Nature Conservancy of Canada and the Nature Trust of BC. Here we report Year 1 and 2 results from this project since they overlap with this first and second years of Kootenay Connect, funded by FWCP.

During Year 1 of Kootenay Connect Priority Places, activities in the Wycliffe Conservation Complex consisted of field surveys to assess habitat for Lewis's woodpecker and Williamson's sapsucker, and to develop management prescriptions for improving priority areas (Fig. 33). Results from 112 survey plots identified North Butte as the best area for habitat enhancement for Williamson's sapsucker 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 include 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, in Year 1 of Kootenay Connect Priority Places, 215 ha of the Wycliffe Conservation Complex was assessed for habitat enhancement opportunities to benefit Lewis's woodpecker 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 both Lewis's woodpecker and American badger. These Year 1 efforts will continue over 2–4 Years.

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 (Fig. 34).

In Year 2, management activities in the Wycliffe Corridor focused on grassland assessment (Fig. 35) and invasive species management (Fig. 36). In subsequent Years 3 and 4, additional habitat enhancements will include forest thinning for Williamson's sapsucker, Lewis's woodpecker and American badger, and fencing to exclude livestock from sensitive grasslands and wetlands.



a)

b)

a) Lewis's woodpecker-worthy snag in Wycliffe Corridor and b) a Lewis's woodpecker perched on a snag in Wycliffe Corridor. (Photos: R. Klafki)

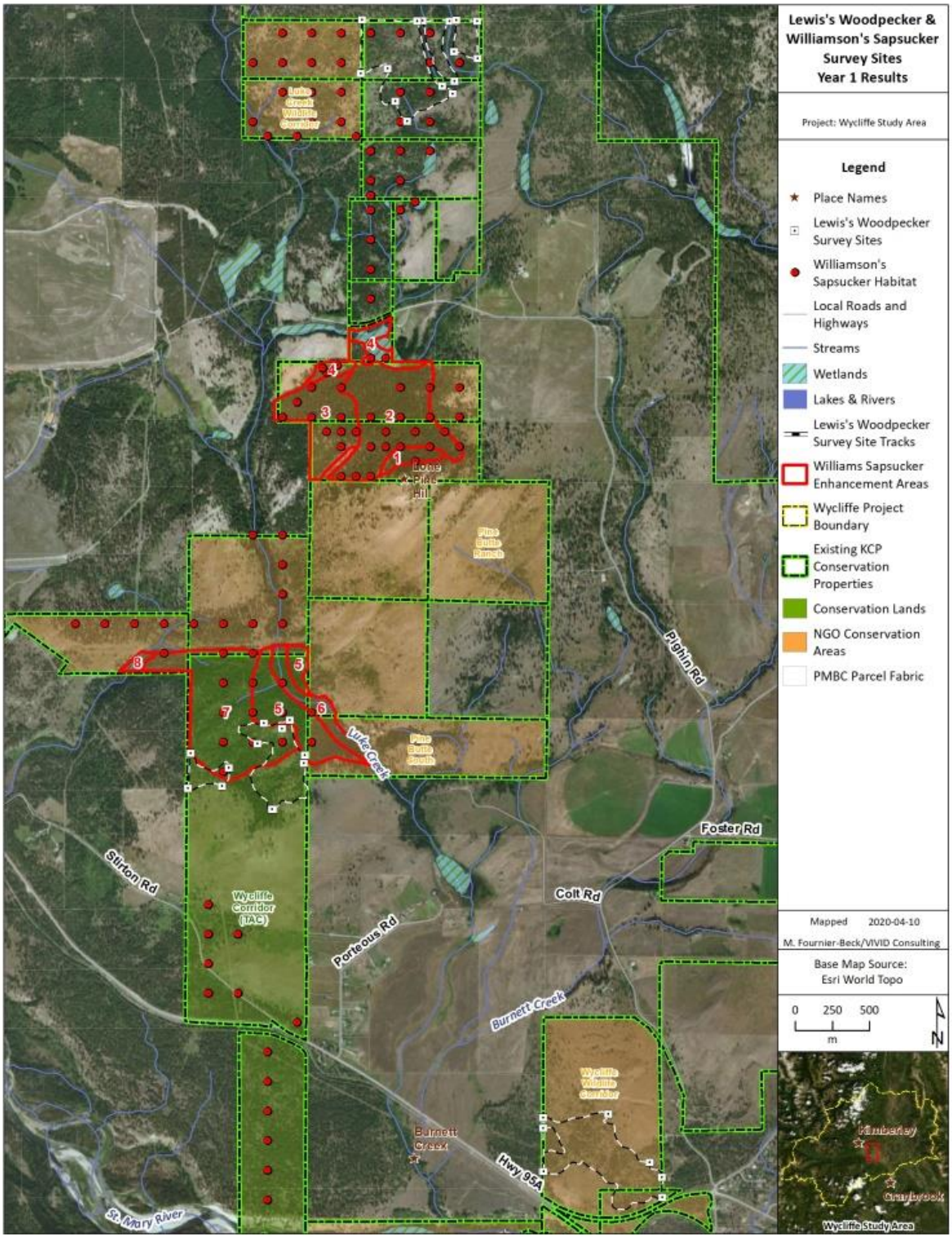


Figure 33. Williamson's sapsucker and Lewis's woodpecker survey work carried out with Kootenay Connect's ECCC funds by the Nature Conservancy of Canada and Nature Trust of BC in the Wycliffe Corridor in 2019–2020.

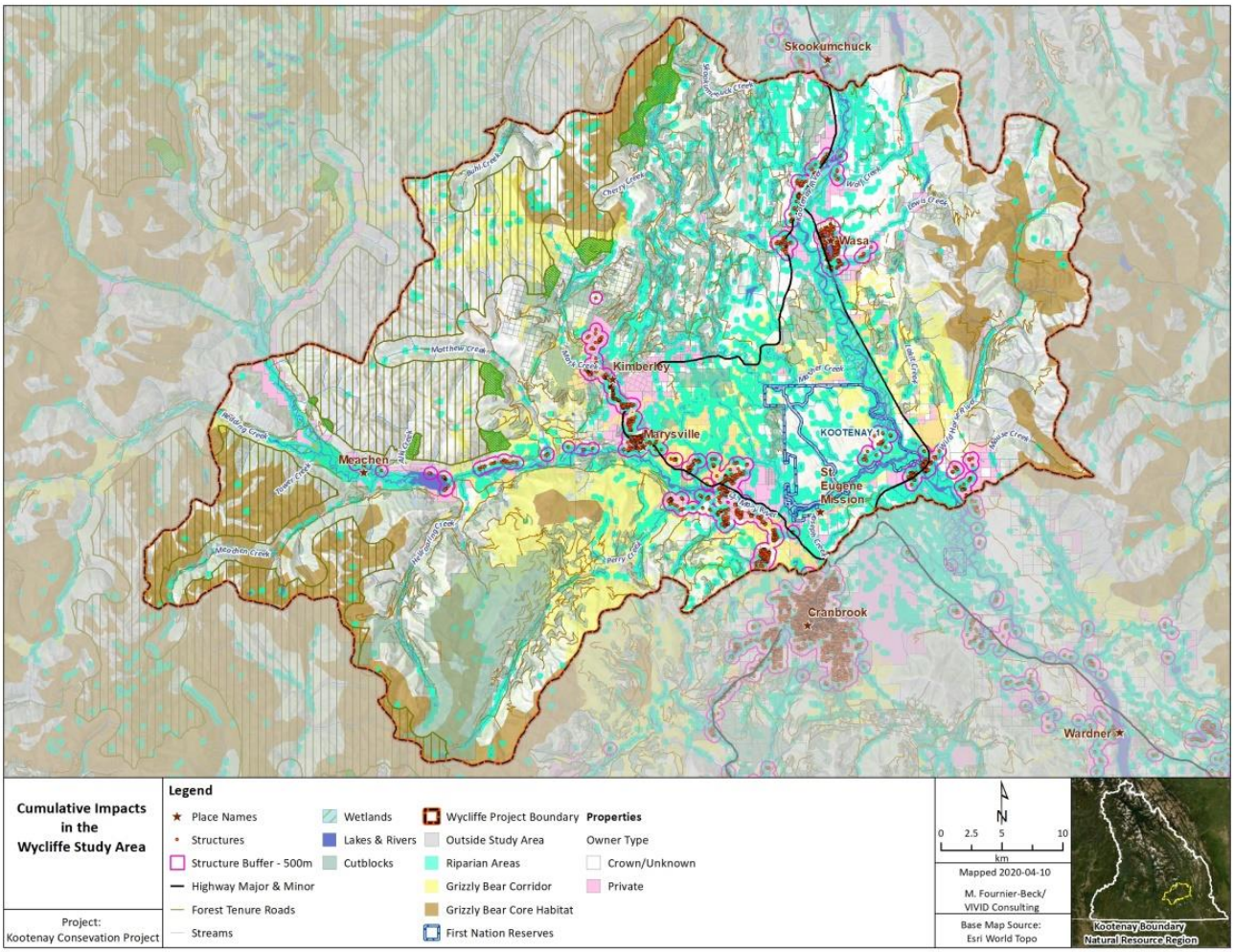


Figure 34. Cumulative impacts in the Wycliffe Corridor.

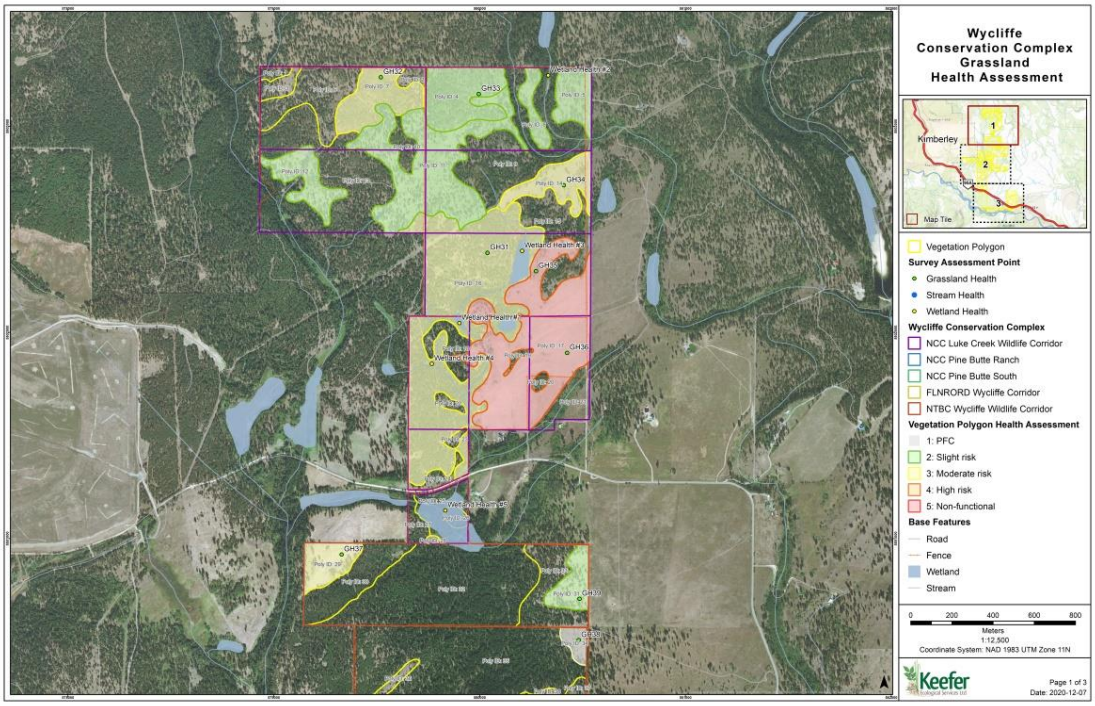


Figure 35. Grassland health assessment in the Wycliffe Corridor completed in Year 2 that will inform restoration activities in Years 3 and 4.

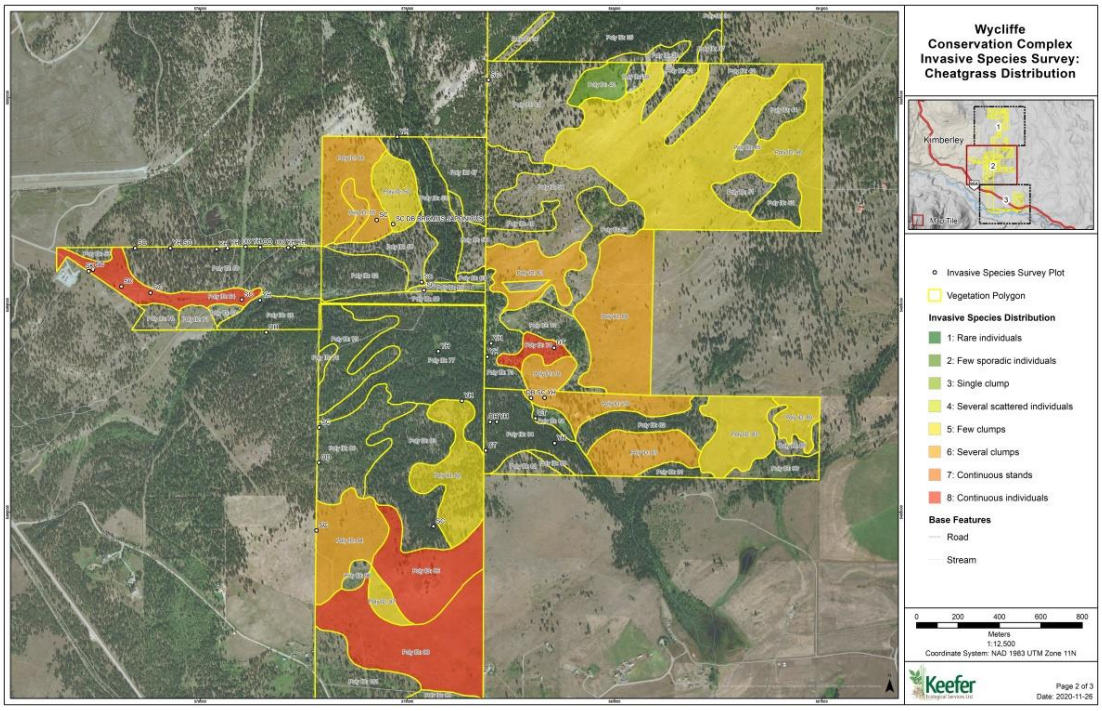


Figure 36. Invasive species survey results in the Wycliffe Corridor completed in Year 2 that will inform restoration activities in Years 3 and 4.

PROJECTS THAT SPAN KOOTENAY CONNECT FOCAL CORRIDORS

Great Blue Heron

The great blue heron is an important species at risk that was surveyed as part of Kootenay Connect 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 (Fig. 37, Machmer 2021), stimulating its inclusion as a focal species in Kootenay Connect. In 2020, breeding site locations occupied by great blue herons were updated in all four Kootenay Connect 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 experience nest failure (14.3%). In total for these sites, the nest failure rate was 66 of 161 nests or 41%, which is relatively high for herons. 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 Corridor even though herons had been present in the recent past (4 years ago).

In terms of conservation stewardship of herons on Crown land in 2020, a Wildlife Habitat Area boundary was delineated and mapped in the Parson area (Fig. 38) and an application was submitted to FLNRORD. The proposed Great Blue Heron WHA would incorporate all of 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 the last four years. Twelve of the 14 active heron nests at this site were successful again this year, producing an estimated 26 fledglings. It is hoped that these values will provide a compelling case for approval of this site as a heron WHA.

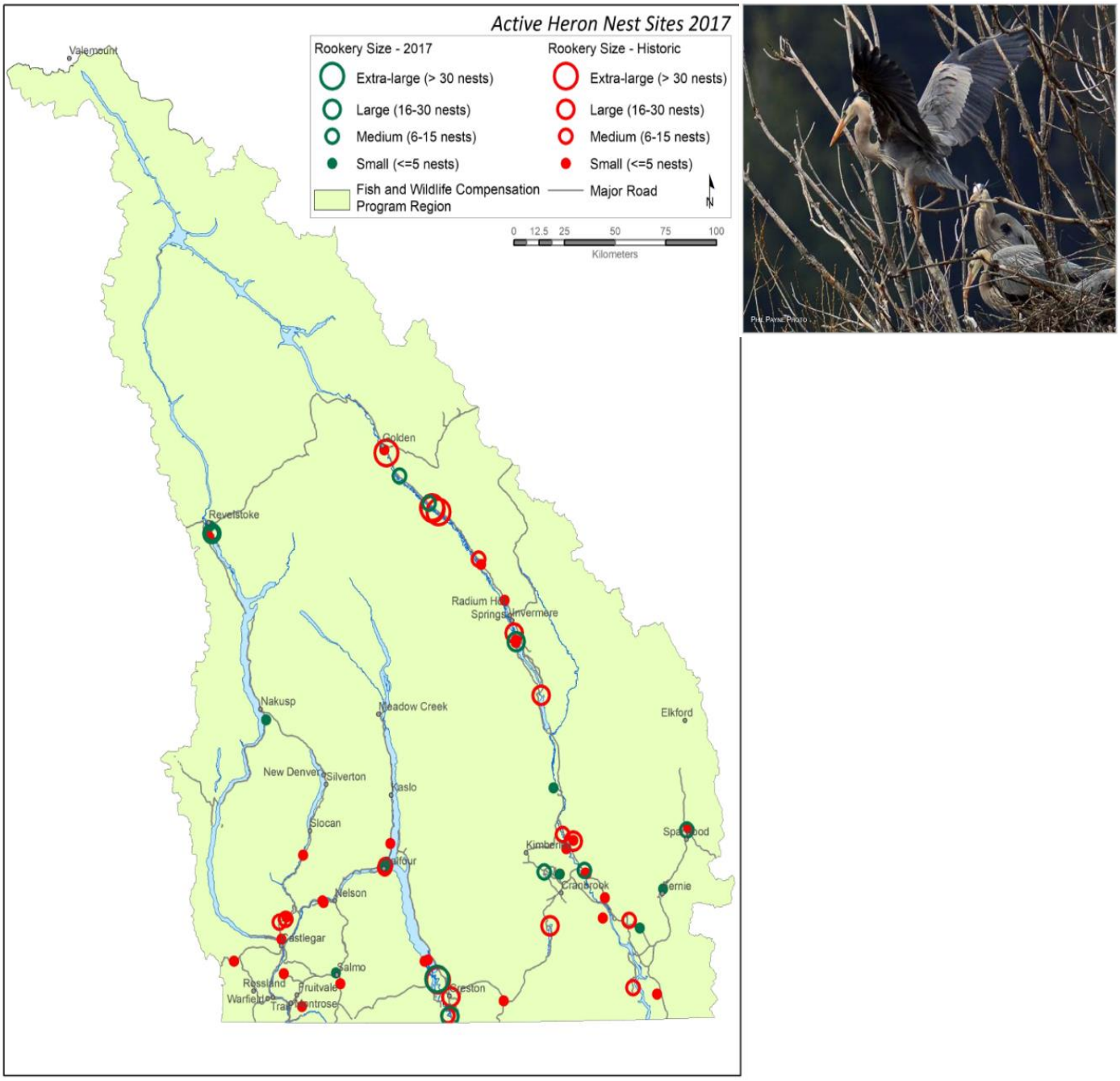


Figure 37. Great blue heron rookeries across Four Focal Corridors of Kootenay Connect that were surveyed for occupancy and fledgling success.

Figure 38. Proposed Wildlife Habitat Area for great blue heron on Crown land near Parson in the Columbia Wetlands.

North American Bat Monitoring Program

Wildlife Conservation Society Canada deployed bat detectors in six North American (NABat) grid cells within Kootenay Connect Focal Corridors in Years 1 and 2 (Fig. 39). The NABat program is a continent-wide monitoring effort that consists of a grid of 10 km x 10 km cells to track bat relative diversity, abundance, and trends over the long term to assess impacts from various cumulative threats such as climate change and the deadly white-nose syndrome (WNS) working its way to BC. This project will track WNS impacts on populations and inform development of species-specific habitat associations that will inform conservation actions.

Across all six Kootenay Connect sites, 12 species of bats were detected: big brown bat, Californian myotis, eastern red bat, fringed bat, hoary bat, little brown bat, long-eared bat, long-legged bat, silver-haired bat, Townsend's big-eared bat, western small-footed bat, and Yuma myotis (Table 6). More detailed results can be found in Rae (2021).

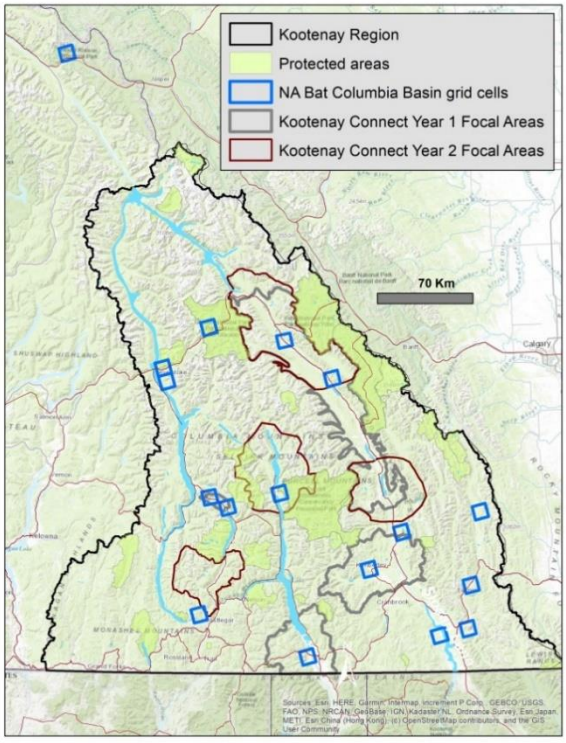


Figure 39. Bat monitoring cells within the Kootenay Connect focal corridors and across the Kootenay region.

Bat monitoring results will inform site selection for artificial old-growth roost structures (BrandenBark™, see above). In areas where Yuma and/or little brown myotis are abundant (and at risk of infection with white-nose syndrome) they will be prioritized for preventative probiotics treatment.

RESULTS: YEAR 2 IN FOUR NEW KOOTENAY CONNECT CORRIDORS

In Year 2 (2020–2021) of Kootenay Connect, we continued to advance activities in our first four focal corridors (as described above) and added four new corridors that we report on within this section. Between June 2020 and March 2021, we held Kootenay Connect workshops in each of these focal corridors: Lardeau Duncan (July 2020), Columbia Lake (Canal Flats, November 2020), Golden (a virtual event, November 2020), and Slocan River Valley (a virtual event, March 2021).

Tables 6–10 in Appendix A 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 in consultations with regional researchers, which informed creation of GIS data layers with biological, ecological, and human use attributes.

LARDEAU DUNCAN

Geographic Description

The Lardeau Duncan Valley is dominated by riparian-wetland habitat in the floodplain of the Duncan River at the north end of Kootenay Lake. This valley is a pinch point between Kootenay Lake and Duncan Reservoir in the north–south dimension, and between the Purcell Wilderness Conservancy in the Purcell Mountains and the Goat Range Provincial Park in the Selkirk Mountain in the east–west dimension (Fig. 40).

Hydrologic and ecosystem changes caused by the Duncan Dam since its completion in 1967 as part of the Columbia River Treaty has forever changed this landscape. Despite these impacts, the Lardeau Duncan Valley has exceptional ecological values worthy of enhancement and protection. The valley bottom downstream of the Duncan Dam, locally referred to as the flats, contains the confluence of the Lardeau and Duncan Rivers. This area is being managed to enhance black cottonwood riparian habitats for wildlife and biodiversity through mimicking historic water regimes (BC Hydro 2017) and has received considerable conservation attention in the form of private land conservation and wetland restoration work. Previous wildlife surveys document provincially red-listed western grebe, and blue-listed western painted turtle, great blue heron, bobolink, caribou, and grizzly bear (Herbison 1996, 1999; BC Hydro 2017). Herbison (1996) suggested this riparian-wetland area is important for species that also use upland habitats. Ecologically significant conservation lands are owned and managed by the Nature

Trust of BC and BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development.

The Lardeau Duncan area is located within KCP's Duncan-Trout Lake Conservation Neighbourhood (Fig. 6). 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.

Leading Connectivity Conservation Groups & Supporters

Organizations working toward conservation of the Lardeau Duncan area include the Nature Trust of BC, Nature Conservancy of Canada, Friends of the Lardeau, Wildlife Habitats for Tomorrow, Friends of Kootenay Lake Society, and Living Lakes Canada in addition to local professional biologists, interested citizens, and staff from FLNRORD, Regional District of Central Kootenay, and Columbia Basin Trust.

Specific Priority Conservation Actions for the Lardeau Duncan Corridor

The workshop began with a review of the land ownership patterns within the Lardeau Duncan corridor. Approximately 500 hectares of the valley bottom are conservation lands either held and managed by the Nature Trust of BC or the provincial government that provide an important conservation core for this area (Fig. 41). Although somewhat outdated, the Duncan-Lardeau Flats Conservation Properties Land Management Plan remains a guiding document for managing the private-Crown land conservation complex.

Priority actions identified at the workshop:

- 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 Area, 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 canary grass, burdock, thistle, hawkweed, etc.

In addition to identifying these conservation actions, two desired outcomes of the Kootenay Connect workshop were achieved. First, a local working group was formed to continue bringing a landscape-scale perspective to conservation opportunities in the valley. Secondly, with Kootenay Connect's assistance, this group developed a package of restoration projects that was submitted to the Columbia Basin Trust's Ecosystem Enhancement Program in Fall 2020.

a b

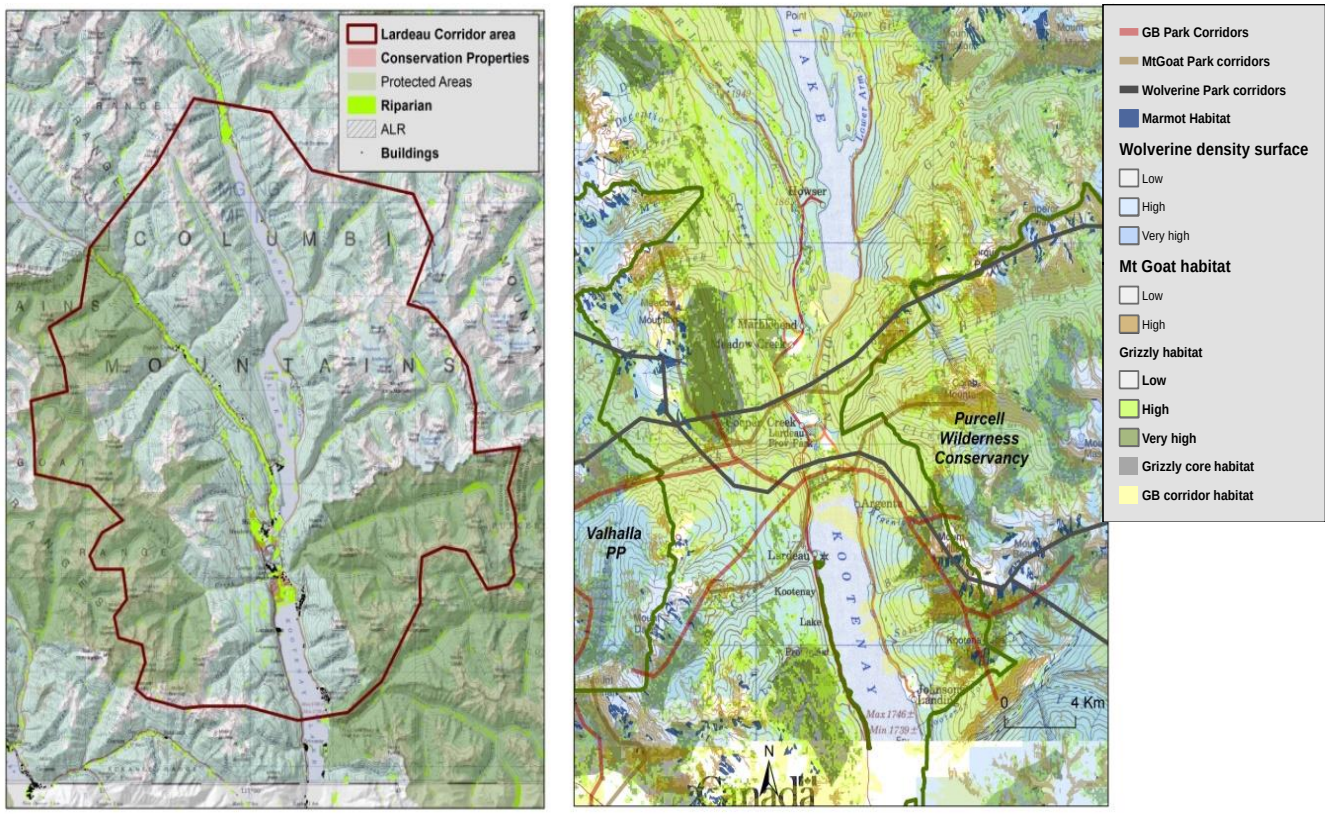


Figure 40. a) The Lardeau Valley is between Kootenay Lake to the south, and Duncan Reservoir to the north; and b) multi-species corridors between protected areas in the Purcell and Selkirk mountain ranges.

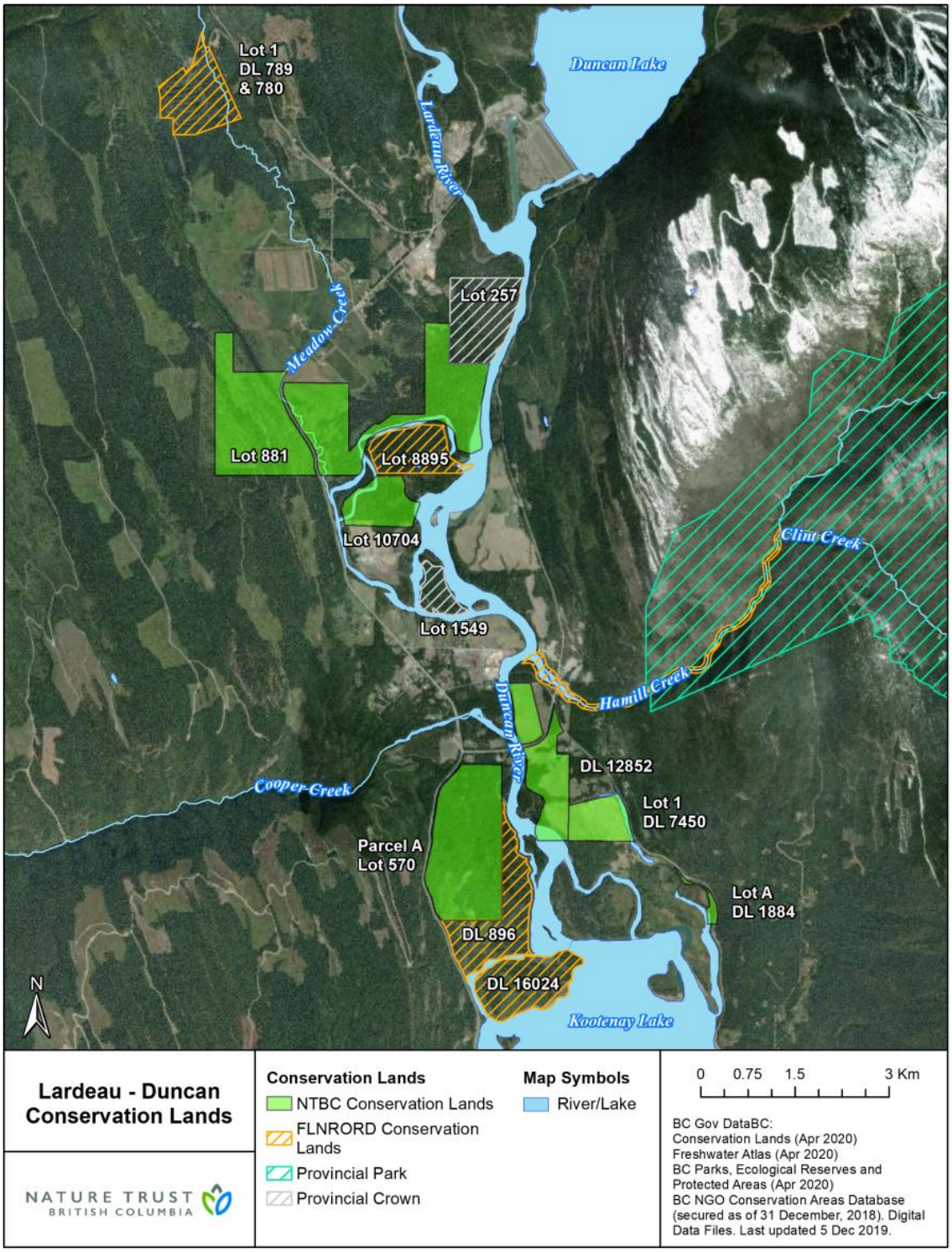


Figure 41. The Lardeau Duncan has approximately 500 hectares of protected lands between Kootenay Lake and Duncan Reservoir that are owned and managed by the Nature Trust of BC and the Provincial government. (Source: NTBC)

COLUMBIA LAKE

Geographic Description

The area surrounding Columbia Lake is a rich natural system that contains myriad species at risk and several important east–west wildlife corridor options as well as north–south linkage potential. The East Side Columbia Lake Wildlife Management Area (ESCLWMA) is an extensive ~69 km^2 area near Canal Flats that encompasses habitat on the east side of the lake and wraps around the south end to include an important riparian-wetland area.

Wetland complex at south end of Columbia Lake.

The 290-hectare Columbia Lake Provincial Park extends the ESCLWMA along the north lakeshore and connects to another small WMA that encompasses a riparian-wetland complex at the north end of Columbia Lake (Fig. 42). 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, Lewis's woodpecker, American badger, and flammulated owl Wildlife Habitat Area, and several locations of the rare alkali saltgrass–foxtail barley plant community (Fig. 43a).

At a landscape scale, the Columbia Lake watershed 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 (Fig. 43b). 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 (Fig. 43b).

View looking south across Columbia Lake.

The Columbia Lake area is located within KCP's Columbia Valley Conservation Neighbourhood (Fig. 6). KCP has not yet hosted a Conservation Action Forum specifically for Columbia Lake area, thus the workshop organized by Kootenay Connect in October 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.

Leading Connectivity Conservation Groups & Supporters

Organizations working toward conservation of the Columbia Lake area include the Canal Flats Wilderness Club, East Kootenay Wildlife Association (EKWA), Columbia Lake Stewardship Society, Columbia Wetlands Stewardship Partners, Ktunaxa Nation Council, Nature Trust of BC, Nature Conservancy of Canada, Farmland Advantage, Kootenay Conservation Program, Fish and Wildlife Compensation Program, and FLNRORD. Kootenay Connect teamed up with the Canal Flats Wilderness Club to co-host the workshop in Canal Flats because of the club's growing concern that the Columbia Lake area has been experiencing an unsustainable increase in development pressure that is threatening to eliminate options for habitat connectivity at the north and south ends of Columbia Lake.

Specific Priority Conservation Actions for the Columbia Lake Corridor

At the 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. Several maps included possible locations for wildlife corridors that were discussed by the group including grizzly bear, elk, mountain goats, and badgers (Fig 43b). Recommendations from FLNRORD led to subsequent Kootenay Connect mapping of potential elk, bighorn sheep, and mountain goat corridors and mineral licks. Kootenay Connect commissioned a recent graduate student to extend their radio telemetry-based elk habitat model across the Columbia Lake area that now helps inform our multi-species connectivity areas (Fig. 43b).

Information-sharing led to identification of conservation opportunities at the north and south ends of the 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 larger-scale upland cross-valley connectivity corridors, as well as being arenas for smaller-scale conservation opportunities for species at risk (Fig. 43).

Priority actions identified at the workshop:
South end of Columbia Lake

- Encourage the Village of Canal Flats to create a protective buffer between the south end of Columbia Lake along 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 WMA and Village of Canal Flats to the east to Sabine-Desmet area along 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

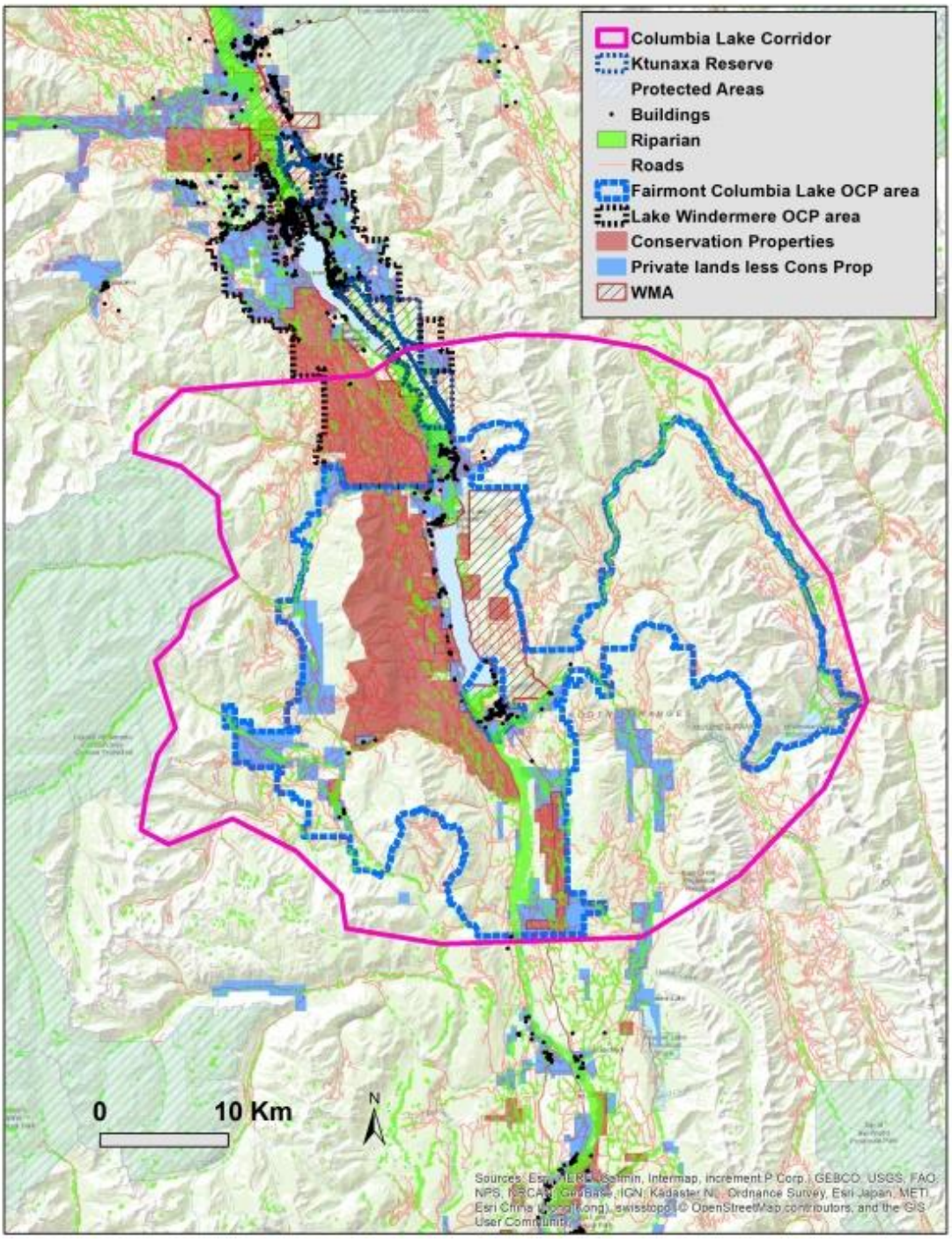


Figure 42. Columbia Lake corridor area with human developments (houses, roads), private lands, conservation lands, and Official Community Plan boundaries.

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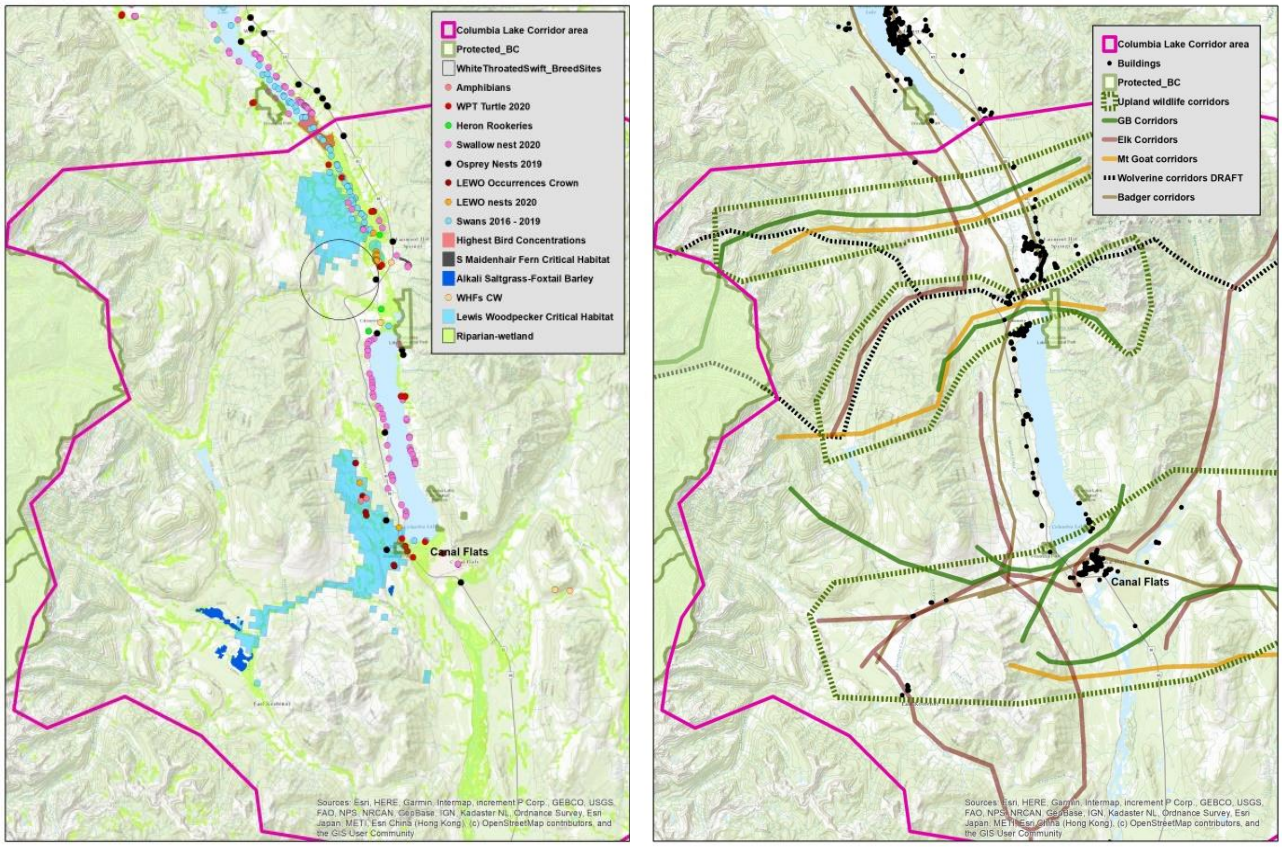

Figure 43. a) Species at risk occurrences in the Columbia Lake area (Darvill 2020, 2021); and b) multi-species upland corridors north and south of Columbia Lake (Proctor 2021).

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 the lake
- Evaluate stewardship and conservation opportunities for the Columbia River corridor between Fairmont 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 and Aksiq'nuk on the east side of the Columbia River, and include NTBC's Hoodoos property at Dutch Creek of 9,711 acres (3,930 ha) on west side of the riparian/wetlands complex

GOLDEN AREA

Geographic Description

KCP's Golden Conservation Neighbourhood (Fig. 6) extends from Spillimacheen and the southern boundary of the Columbia Shuswap Regional District to just north of the TransCanada Highway 1 at Donald. Nestled between Yoho National Park 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 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 (Fig. 44).

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 range 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).

Leading Connectivity Conservation Groups & Supporters

In November 2020, Kootenay Connect co-hosted a virtual Conservation Action Forum using the Zoom platform with KCP and Wildsight Golden focusing on the Golden area. Participants included Golden District Rod & Gun Club, Shuswap Indian Band, Wildlife Conservation Society Canada, Nature Conservancy of Canada, Nature Trust of BC, BC Wildlife Federation, Columbia Wetlands Stewardship Partners, Columbia Shuswap Invasive Species Society, Wolf Awareness,

independent biologists as well as staff from Parks Canada, Columbia Basin Trust, and FLNRORD, who 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. We briefly report on the results here. For more details, refer to *Golden Conservation Action Forum Summary Report*[21].

Specific Priority Conservation Actions for the Golden Area

During the Forum, scientific recommendations led to identifying *conservation targets* (including species at risk Tables 5 and 6; habitat types Table 7; habitat features Table 8; ecological process Table 9; and ecological threats Table 10 in Appendix A. This group process of identifying important biological and ecological values within the Golden area provided a robust foundation for setting common conservation priorities.

Over 60 actions were initially recommended by science experts and participants that would make the most difference in the Golden Area over the next 1–3 years. 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 align with participants' organizational and programmatic interests.

The Golden Forum Resulted in Five Priority Action Plans (not ranked):

1. Combine Science and Indigenous Knowledge to Protect Habitat for Species at Risk and Biodiversity (5 identified activities)
2. Identify and Prioritize for Conservation Multi-Species Wildlife Corridors (10 identified activities)
3. Reduce Intensity of Human Disturbance in Backcountry, Sensitive Areas and Wildlife Corridors (24 identified activities)
4. Mitigate Recreational Impacts by Incorporating Recreation and Ecological Data to Inform Land Use Decision-Making (9 identified activities)
5. Build Climate Disruption, Adaptation and Mitigation Thinking into All Conservation Activities (7 identified activities)

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

Wildsight Golden will use the Forum's five priority action plans to inform their conservation initiatives over the next three years. These priorities will help guide their West Bench Study and help plan for new projects. They also will share and promote these priority actions to government and sectors in the Golden Backcountry Recreation Access Committee and Golden and Area A Trails Alliance. The information shared at the Forum will be very useful in reviewing industrial and recreational development plans.

Kootenay Connect will nurture a working group in Golden to champion connectivity in the region. It 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 (Fig. 45). Data and maps generated by Kootenay Connect will be shared with interested First Nations and will be available to help inform local and provincial government decision-making.

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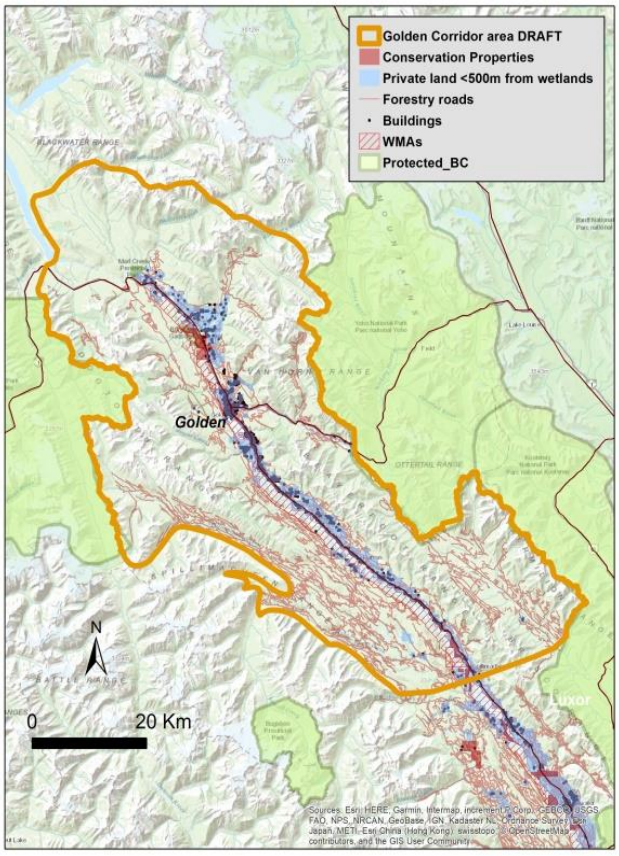

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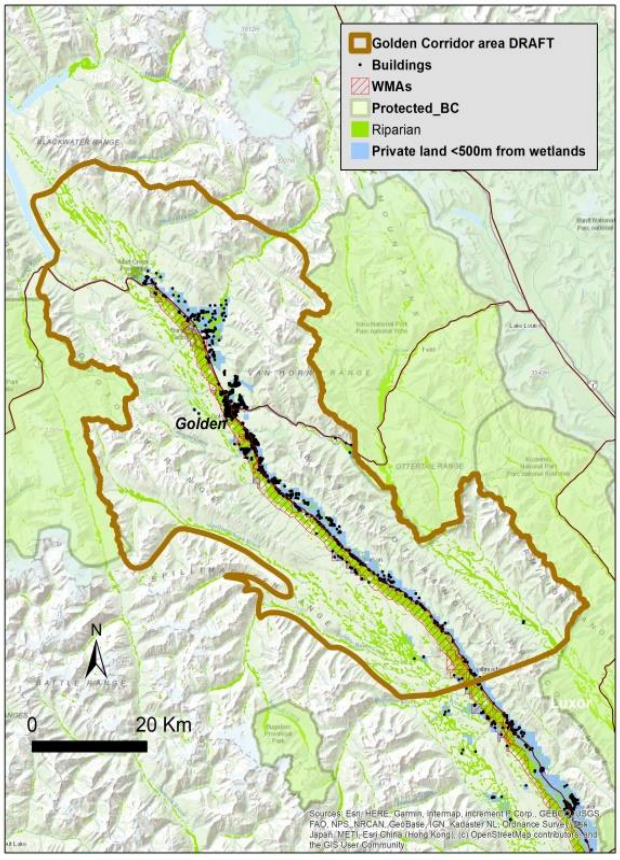

Figure 44. a) Human footprint in the Golden area; and b) juxtaposition of riparian habitat, Wildlife Management Areas, private property, and buildings.

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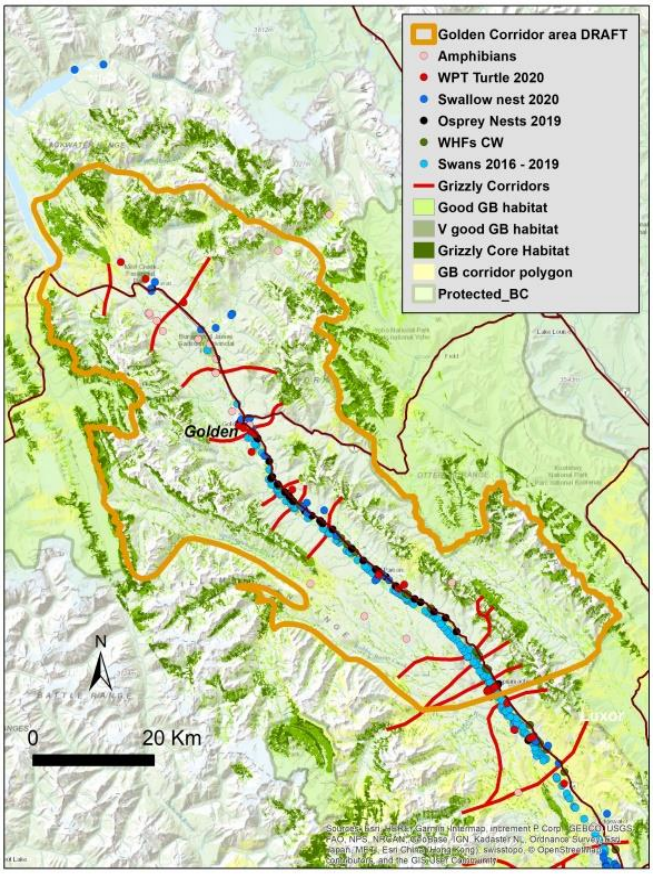

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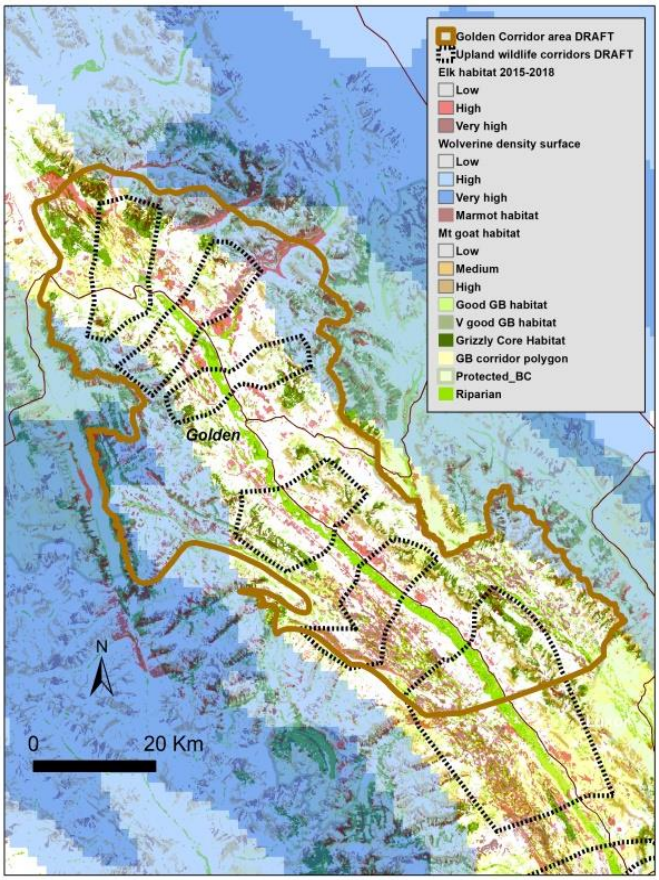

Figure 45. Species at risk in the wetlands and grizzly bear habitat and cross-valley corridors in the Golden area; and b) multi-species habitat layers and potential cross-valley upland corridors to focus conservation attention.

SLOCAN RIVER VALLEY

Geographic Description

Slocan Lake drains into the Slocan River which is joined by a major tributary, the Little Slocan River, in Passmore. 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 trees. The Slocan 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 corridors from the headwaters of Slocan Lake south along the Selkirk Mountains to the east and the Valhalla Mountains to the west that frame this valley.

The Slocan Valley's topographic and microclimate variability result in a diverse suite of ecosystems within the Inland Temperate Rainforest, including floodplains, forests, meadows, wetlands, and alpine environments that are home to a diverse assemblage of species, large and small. Currently, the Slocan Valley Biodiversity Project[22] has recorded 1,791 different taxa, including 25 provincial or federal species at risk. The valley's rich human history has intersected with this natural diversity in many ways. Small homesteads and farms lining much of the valley bottom continue to bring significant changes to ecological processes such as changes in hydrology, predator-prey cycles, fire dynamics, forest regeneration, and the unpredictable shifting of habitat with climate change.

Looking south down the Slocan River Valley towards Frog Peak.

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

Leading Connectivity Conservation Groups & Supporters

In March 2021, Kootenay Connect co-sponsored a virtual workshop with the Slocan River Streamkeepers Society using the Zoom platform. The Slocan Valley attracts and inspires people who deeply care about protecting their watershed (Fig. 46). Along with several members of the Slocan River Streamkeepers, workshop participants included the Slocan Lake Stewardship Society, Slocan Wetlands Assessment & Monitoring Project (SWAMP), 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 FLNRORD and the Regional District of Central Kootenay.

Three short scientific presentations helped set the stage by highlighting results from Sensitive Ecosystem Inventory of habitats within the river corridor, 40+ restoration projects of wetlands and riparian areas, and a new community-based biodiversity inventorying project using iNaturalist. With the stage set, the discussion turned to pressing conservation issues, threats, knowledge gaps, and opportunities for action. The overarching message was that the valley needed an integrated approach to conservation that would incorporate species-level to landscape-scale efforts. Participants agreed that individual projects needed to be embedded into a larger conservation story to help advance more investment in conservation, build political leverage, and attract funding. To accomplish this, the group began exploring how to integrate their projects into an overall package that would make a difference at a landscape scale and benefit species, habitats, water quality, connectivity, and ecological processes. For example, cross-valley corridors identified by Kootenay Connect could become 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 private land conservation by land trusts in the valley bottom and eco-friendly forestry in the uplands by tenure-holders like SIFCo that aspire to incorporate management practices to increase protection of old forests, reduce road densities, and increase overall habitat security on Crown land.

Kootenay Connect identified two potential cross-valley corridors that provided a starting place for thinking of multi-species, multi-scale conservation projects in the Slocan River Valley (Fig. 47a,b). 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."

Specific Priority Conservation Actions for the Slocan River Valley Corridor

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 from Slocan Lake to Lemon Creek, which is an important sanctuary for wildlife
- Initiate a second phase of Sensitive Ecosystem Inventory 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 Wildlife Habitat Area (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
- Continued 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[23] 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

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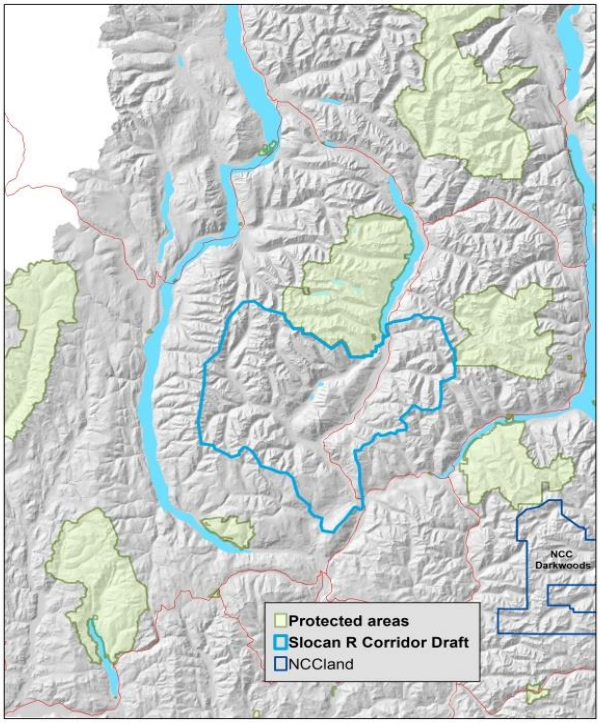

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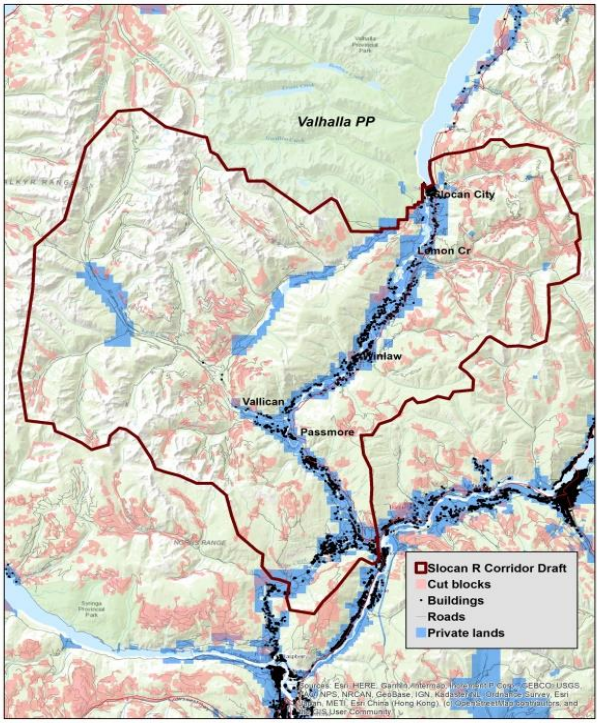

Figure 46. a) Regional perspective of the Slocan Watershed relative to protected areas in the West Kootenay; and b) the human footprint in the Slocan River watershed.

[23] https://www.perryridge.org/

a b

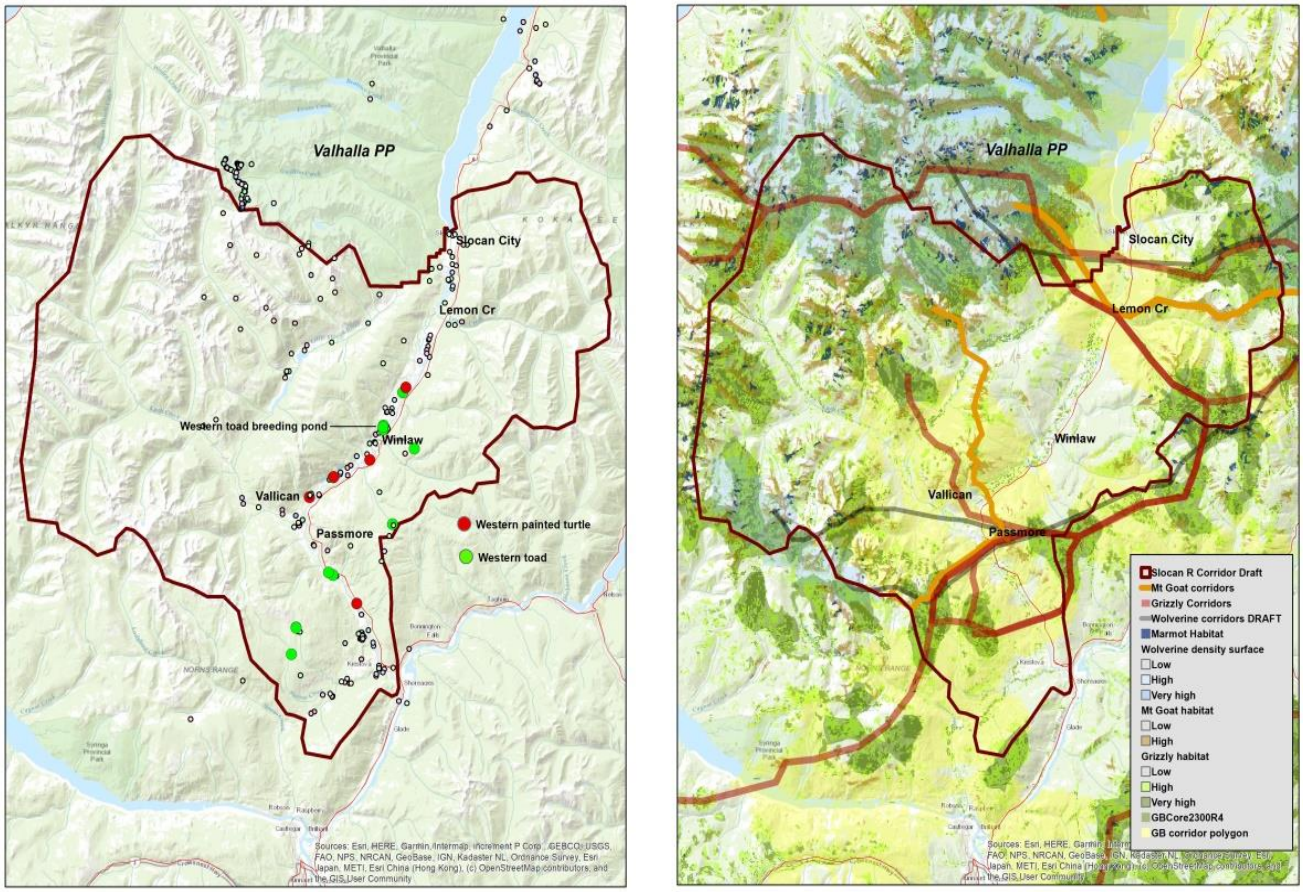

Figure 47. a) Biodiversity survey results with > 1,000 species represented based on data from the iNaturalist Slocan Valley Biodiversity Project; and b) potential multi-species corridors across the Slocan Valley based on data from the Trans-border Grizzly Bear Project, FLNRORD, and local wolverine researchers.

RECOMMENDATIONS BASED ON YEARS 1 AND 2

We found consistent and similar conservation values and threats across the Eight Focal Corridors we investigated between 2019–2021 (Tables 5–10 in Appendix A). However, unique approaches to conservation and stewardship emerged when each group began identifying priority actions and recommendations. Specific tools and who might address these activities are detailed below in Table 4.

Looking across the Eight Focal Corridors, at a high level we recommend:

- Improving efforts to inventory SAR to capture existing biodiversity
- Prioritizing the identification of critical habitats and biodiversity hotspots and opportunities for protection
- Integrating Kootenay Connect's mapping of connectivity areas that link valley bottom riparian and wetland areas to upland habitat to guide protection of species whose inter-seasonal and inter-generational life cycles span the riparian-upland interface (e.g., western toads, western painted turtles, great blue herons, western screech-owls)
- Increasing the effectiveness of measures to reduce recreational access and pressures impacting species at risk and connectivity habitats, i.e., access management practices should be initiated in these corridors and the areas adjacent to them
- Assessing landscapes in terms of conservation opportunities for both private and public land, for example, being creative about how land trust acquisitions can complement WHA designations for key species at risk
- Detecting, preventing, managing and monitoring invasive terrestrial and aquatic species
- Viewing landscape-scale processes such as fire dynamics, forest regeneration, invasive species management, predator-prey cycles, hydrologic fluctuations, and climate change as necessarily requiring private and Crown land management solutions
- 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 (e.g., catastrophic fires)
- Enhancing intra-wetland hydrologic connectivity throughout the region to increase climate resilience and mitigate drought
- Using Kootenay Connect's data and maps to underpin and inform efforts by its partners and all levels of government to pursue official designation and establishment of "Wildlife and Ecological Corridor" status for identified areas to integrate connectivity conservation within and in addition to the existing system of protected areas including BC Parks and Parks Canada, Wildlife Management Areas, and private conservation lands managed by land trusts (e.g., NCC, NTBC)

- **Evaluating how an integrated Kootenay-wide ecological network that connected valleys to uplands and protected areas like federal and provincial parks could increase our region's climate resilience while at the same time addressing the loss of biodiversity and old-growth forest that many listed species depend upon for survival**

Our last recommendation is highlighted because based on the past two years of research and workshops throughout the Kootenays, we believe it's imperative to begin envisioning a process to formally designate of a network of Wildlife and Ecological Corridors with the provincial and regional district governments. We know that connectivity is critical to maintaining the biological and ecological resilience of the Kootenay region and the next step is to investigate the inter-jurisdictional nature of private and public lands that comprise connectivity areas in our region.

We acknowledge that provincial and regional authority over private lands is limited; however, we are optimistic because we have received such a positive response from Regional District planners, in both the East and West Kootenay. We are encouraged by the potential for managing sensitive or critical habitats on private lands through Environmentally Sensitive Areas/Environmental Development Permit Areas (ESAs/EDPAs) within Development Permit Areas, and that inclusion of private property may be within the scope of an inter-jurisdictional Wildlife and Ecological Corridor designation. These Regional District tools already exist, and the work that Kootenay Connect is doing results in the type of information they require within that planning and regulatory process.

In terms of Crown land conservation opportunities, provincial biologists and land managers who have attended Kootenay Connect workshops have been very supportive and collaborative in providing wildlife data as well as exploring new designations of Wildlife Habitat Areas, Wildlife Habitat Features and expansion of Wildlife Management Areas. Kootenay Connect and Parks Canada have begun exploring how their Natural Legacy Program can help achieve connectivity objectives between Mount Revelstoke-Glacier and Lake Louise, Yoho and Kootenay National Park field units.

In the upcoming year, Kootenay Connect will continue to facilitate dialogues between federal and provincial government and Regional Districts in order to advance a multi-agency landscape approach to connectivity and a new type of designation of Wildlife and Ecological Corridor that will encourage inter-jurisdictional cooperation for conservation and climate change resilience. This type of cooperation is necessary to develop and implement a connectivity conservation strategy 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 4. Summary of recommended priority actions for Kootenay Connect's Eight Focal Corridors.

These priority actions 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	KC
	Identify biodiversity hotspots	Biological assessment	KC
Identify and protect high-quality habitats	Private land - develop farm/ranch biodiversity plans	Conservation values assessment	FLA
	Private land purchase of conservation lands	Conservation values assessment	NCC, NTBC, 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, KC, KCP
	Provincial lands - restore and/or protect high quality habitats	WMA expansion, WHA WHF designations	FLNRORD, KC
	Federal lands - restore and/or protect high quality habitats	Migratory Bird Sanctuaries, Key Biodiversity Areas	CWS, KC
Propose designation for Wildlife and Ecological Corridor status	Articulate the ecological + climate change case; lobby BC provincial government; build collaborations of local, regional, provincial and federal government	Multi-agency strategic collaborations focused on landscape scale analysis, conservation and data-sharing	KC, SLSS, CWSP, Shuswap Indian Band, Prov of BC, BC Parks, Parks Canada

Conservation values	Priority actions	Tools	Who
Access management planning in upland corridors	Assess and develop plans for access management with BC gov	Work and develop plans with recreational groups and BC gov through assessment management processes	TBGBP, KC, Prov of BC
Manage & monitor invasive species to protect sensitive areas	Prevent introduction of new species Contain / prevent spread of existing species	Control, inventory and monitor species within Invasive Plant Management Areas (IPMAs)	Prov of BC, invasive species societies
Manage for climate change	Manage for reduced fire severity on lower slopes in climate corridors	Fire interface planning	Prov of BC, land trusts
	Develop a Climate Change Adaptation Strategy for the Kootenay Region	Expert analysis (e.g., Holt and Utzig)	KC, CWSP, SLSS, Prov of BC
	Identify and protect wet, cool old-growth patches	Habitat mapping/WHA designation	Prov of BC, land trusts
Climate change – intra-wetland hydrologic connectivity	Restore hydro connectivity	Channel dredging; culvert placement	CVWMA, Lower Kootenay Band, CWSP, SLSS
Reduce recreational pressure	Assess important habitats with recreational pressure	Work with recreational groups, regional and provincial governments	Local stewardship groups, KC, RDEK, RDCK, Prov of BC

YEAR 3 OF KOOTENAY CONNECT

As discussed above, Kootenay Connect has been gaining momentum and achieving results. Given the success of our approach, in Year 3 we plan to expand our riparian-wetland corridor focus to include four new corridors: Koocanusa (South Country), Elk Valley, Retallack-Highway 31A, and Salmo.

1. The **Koocanusa Corridor** includes Highway 93 in the East Kootenay south of Cranbrook. This transboundary corridor provides an important east–west corridor between the Rocky and Purcell mountain ranges along the Canadian portion of the Koocanusa Reservoir and linkage to the Kootenay River Valley to the south in Montana, USA.
2. The **Elk Valley Corridor** includes the Elk Valley along Crowsnest Highway 3 in the East Kootenay along the BC/Alberta border including several large riparian areas between Elko and Sparwood. Wildlife corridors in this area have been identified by several research projects and are being managed to benefit wildlife movement. As this valley is experiencing increased mining development, human settlement and recreational pressure, the window for conservation is closing, especially for north–south connectivity within this biologically diverse and internationally important transboundary region.
3. The **Salmo Corridor** includes Highway 6 in the West Kootenay south of Nelson. This corridor complements connectivity provided within the Creston Valley, being on the west side of the Selkirk Mountains and just north of the US border. This area contains a rich diversity of riparian-wetland habitat and holds great significance for several First Nation bands.
4. The **Retallack Corridor** includes Highway 31A in the mountain pass of the Selkirk Mountains between Kaslo and New Denver. The area is known for its critical western toad breeding area at Fish Lake and excellent and remote grizzly bear habitat. Otter, moose, wolverine, and mountain goat use the habitat on both sides of the mountain pass that is a landscape linkage between Kokanee Glacier and Goat Range Provincial Parks. Due to increasing recreational pressure over the last decade, this remote area is in need of more conservation-related science to help inform conservation options and land use decisions.

NEXT STEPS FOR YEAR 3 (2021–2022)

The following steps will assist with moving the Kootenay Connect initiative forward in Year 3.

1. **Mapping**. Finalize ecological mapping of multi-species carnivore/wildlife/riparian/ climate change corridors to be considered for enhanced protection and connectivity management. Integrate the grizzly bear connectivity model, with other species models as available, the regional ecological climate-response modelling by Kutenai Nature Investigations, and information gathered from several regional wildlife and riparian experts.
2. **Integrate GIS layers.** Integrate our accumulated natural, geophysical, and human use GIS layers with our regional climate change adaptation modelling and land ownership patterns to identify specific sites that need protection or restoration on both public and private lands.
3. **Work with champions in Focal Corridors to facilitate on-the-ground conservation activities.** Repeat Year 1 and 2's activities in the next four corridors during Year 3: Koocanusa, Elk River, Retallack, and Salmo riparian-wetland complexes.
4. **Report out to partners and funders.** The results of these activities are presented in this report. Considerable effort has been invested in this report to showcase the initiative as well as serve as our blueprint for future conservation efforts across the region. It presents a matrix of Kootenay Connect corridor-specific needs, activities, and conservation tools to improve our approach to new corridors in Year 3.
5. **Apply Kootenay Connect concept in other areas of the Kootenays.** In Year 3, Kootenay Connect will continue to provide a framework and tools for scaling up local conservation efforts to provide solutions for landscape conservation. We will work with stewardship groups, First Nations, and local and provincial land managers to implement the corridor-specific conservation strategies decided upon in Years 1 and 2. This may include, but not be limited to, fundraising for specific actions, strategic land or conservation easement purchasing, Wildlife Management Area enhancements, riparian-wetland restoration, private land management initiatives and more.
6. **Develop a process for designating Wildlife and Ecological Corridors.** In the upcoming year, Kootenay Connect will continue to facilitate dialogues between federal and provincial government and Regional Districts in order to advance a landscape approach to connectivity and a new type of designation of Wildlife and Ecological Corridor that will encourage inter-jurisdictional cooperation for conservation and climate change resilience.

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 the Kootenay Conservation Program and Trans-border Grizzly Bear Project sponsored a workshop dedicated to connectivity with a dozen initial collaborators (*).

Current Partners and Collaborators of Kootenay Connect:

- BC Ministry FLNRORD, Habitat and Ecosystem Section*
- Canal Flats Wilderness Club*
- Calgary Zoo
- Columbia Wetlands Stewardship Partners*
- Creston Valley Wildlife Management Authority*
- East Kootenay Wildlife Association*
- Ecological Consulting
- Elkford Rod and Gun Club
- Goldeneye Ecological Services
- Integrated Ecological Research
- Kootenay Conservation Program*
- Ktunaxa Nation Council
- Kutenai Nature Investigations*
- Lake Windermere District Rod & Gun Club*
- Nature Conservancy of Canada*
- Okanagan Nation Alliance
- Pandion Ecological Research*
- Regional District of Central Kootenay
- Regional District of East Kootenay
- Sinixt Nation
- Slocan Lake Stewardship Society
- Slocan River Streamkeepers
- Slocan Wetlands Assessment & Monitoring Project
- Sparwood Fish and Wildlife Association
- The Nature Trust of BC*
- Trans-border Grizzly Bear Project*
- University of Lethbridge
- Valhalla Foundation for Ecology and Social Justice
- Wildlife Conservation Society of Canada
- Wildsight (Regional and Branches: Golden, Invermere, Elk Valley, Creston)
- Yellowstone to Yukon Conservation Initiative

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APPENDIX A. SUMMARY TABLES OF CONSERVATION TARGETS & THREATS IN EIGHT FOCAL CORRIDORS

Table 5. Summary of species at risk across Kootenay Connect's Eight Focal Corridors.

These data were summarized from Table 6 (below), which was developed with extensive consultation with local species at risk biologists (independent and government), local stewardship groups, conservation organizations, First Nations and literature reviews.

Focal area	SARA listed			COSEWIC	BC listed	
	Endangered	Threatened	Special Concern	Listed	Red	Blue
Creston Valley	3	5	11	34	9	17
Columbia Wetlands	5	7	7	20	8	19
Wycliffe Corridor	6	6	4	43	8	14
Bonanza	1	5	7	15	2	13
Lardeau	2	6	5	15	2	13
Columbia Lake	5	7	11	25	7	21
Golden	5	5	10	21	8	19
Slocan River	0	6	8	16	0	16

Table 6. Species at risk plus ecologically and culturally important species across Kootenay Connect's Eight Focal Corridors.

This is the result of extensive consultation with local SAR biologists (independent and government), local stewardship groups, conservation organizations, First Nations, and literature reviews. "1" in the columns indicates that these species are important, of high conservation value, and therefore deserving attention within the indicated Focal Corridor.

SAR and Important Species	Focal Corridors								Conservation Status		
Species	**Creston**	**Columbia Wetlands**	**Wycliffe**	**Bonanza**	**Lardeau**	**Columbia Lake**	**Golden**	**Slocan River**	**SARA listed**	**COSEWIC**	**BC**
Jumping Slug	1									Special Concern	Blue
Native bees		1	1		1	1	1				
Western Bumblebee				1				1			
Rocky Mt Ridged Mussel	1		1			1	1		Special Concern	Endangered	Red
C d'A Oregonian Snail	1			1				1	Special Concern	Special Concern	
Coeur d'Alene Salamander	1			1	1			1		Special Concern	
Northern Alligator Lizard					1						
Northern Leopard Frog	1	1	1			1	1		Endangered	Endangered	Red
Northern Rubber Boa						1		1	Special Concern	Special Concern	
Western Toad	1	1		1	1	1	1	1	Special Concern	Special Concern	
Western Painted Turtle	1	1			1	1	1	1	Special Concern	Special Concern	Blue
Western Skink	1			1				1	Special Concern	Special Concern	Blue
Bull Trout	1	1	1	1	1	1	1	1		Special Concern	Blue
Burbot	1	1	1			1	1				Red
Dace		1	1			1	1				
Kokanee	1	1	1	1	1	1	1	1			
Gerrard Rainbow Trout					1						
Rainbow trout								1			
Salmon reintroduction?						1		1			
Sculpin		1	1			1	1				
Westslope Cutthroat	1	1	1	1		1	1	1	Special Concern	Special Concern	Blue

SAR and Important Species	Focal Corridors								Conservation Status		
Species	**Creston**	**Columbia Wetlands**	**Wycliffe**	**Bonanza**	**Lardeau**	**Columbia Lake**	**Golden**	**Slocan River**	**SARA listed**	**COSEWIC**	**BC**
White Sturgeon Columbia R		1	1				1		Endangered	Non-active	Red
White Sturgeon Kootenay R	1					1			Endangered	Non-active	
American Avocet	1	1									Blue
American Bittern	1	1	1			1	1				Blue
American Dipper								1			
American White Pelican	1										Red
Bank Swallow	1	1	1	1		1	1	1	Threatened	Threatened	Blue
Barn Swallow	1	1	1	1	1	1	1	1	Threatened	Threatened	Blue
Black Swift				1	1		1	1		Endangered	Blue
Bobolink	1	1	1		1	1	1		Threatened	Threatened	Blue
Clark's Nutcracker		1			1	1	1				
Common Nighthawk	1	1	1	1	1	1	1	1	Threatened	Special Concern	
Double-crested cormorant	1										
Eared Grebe		1				1	1				
Flammulated Owl		1	1			1			Special Concern	Vulnerable	Blue
Forster's Tern	1		1								Red
Great Blue Heron	1	1	1	1	1	1	1	1			Blue
Great Gray Owl								1			
Horned Grebe		1				1	1			Special Concern	
Kingfisher								1			
Lewis's Woodpecker	Occas.	1	1			1		1	Threatened	Threatened	Blue
Long-billed Curlew	1	1	1			1	1		Special Concern	Special Concern	Blue
Olive-sided flycatcher	Uncom.			1	1			1	Threatened	Special Concern	Blue
Osprey				1	1			1			
Pacific Wren								1			
Peregrine Falcon *anatum*	1	1				1	1		Special Concern		Red
Pied-billed Grebe		1				1	1				
Pileated woodpecker					1						

SAR and Important Species	Focal Corridors								Conservation Status		
Species	**Creston**	**Columbia Wetlands**	**Wycliffe**	**Bonanza**	**Lardeau**	**Columbia Lake**	**Golden**	**Slocan River**	**SARA listed**	**COSEWIC**	**BC**
Sandhill Crane	1	1	1			1	1				
Sharp-tailed Grouse						1			Extirpated		
Short-eared Owl	1	1				1	1		Special Concern	Special Concern	Blue
Vaux Swift								1			
Western Grebe	1	1		1	1	1	1		Special Concern	Special Concern	Red
Western Screech-Owl	1	1			1	1		1	Threatened	Threatened	Blue
Williamson's Sapsucker			1						Endangered	Endangered	Red
Yellow-breasted chat	Occas.								Endangered	Endangered	Red
American Badger	Uncom.	1	1			1	1		Endangered	Endangered	Red
American Beaver	1	1	1	1	1	1	1	1			
Big Brown Bat		1	1			1	1	1			
California myotis					1						
Fringed myotis	1										Blue
Grizzly Bear	1	1	1	1	1	1	1	1	Special Concern	Special Concern	Blue
Hoary bat							1			Under review	
Little Brown Myotis	1	1	1	1	1	1	1		Endangered	Endangered	
Long-eared myotis					1		1	1			
Long-legged myotis					1		1				
Moose		1	1			1	1				
Mountain Caribou		1	1	1	1	1	1		Threatened	Endangered	Red
Mountain Goat		1	1	1	1	1	1	1			Blue
Mule Deer		1	1		1	1	1				
Muskrat		1				1					
Northern Myotis		1	1		1	1	1		Endangered	Endangered	Blue
Northern pocket gopher	1	1				1					Red
Porcupine		1	1			1	1				
Red tailed chipmunk	1										Red

SAR and Important Species	Focal Corridors								Conservation Status		
Species	**Creston**	**Columbia Wetlands**	**Wycliffe**	**Bonanza**	**Lardeau**	**Columbia Lake**	**Golden**	**Slocan River**	**SARA listed**	**COSEWIC**	**BC**
River otter								1			
Rocky Mt Bighorn Sheep		1	1			1	1				Blue
Rocky Mt Elk	1	1	1	1		1	1	1			
Silver-haired Bat		1	1			1	1	1			
Townsend's Big-eared Bat	1	1	1		1	1	1	1			Blue
Wolf		1	1	1		1					
Wolverine		1		1	1		1	1	Special Concern	Special Concern	Blue
Yuma Myotis		1	1		1	1	1				
Antelope Bitterbrush			1								
Black huckleberry					1						
Mountain Moonwort				1							Blue
Traditional plants, bitterroot, balsamroot, highbush cranberry, saskatoon, soapberry, wapato		1	1	1	1	1	1	1			
Limber Pine		1				1	1				Blue
Ponderosa Pine			1								
Whitebark Pine	1	1	1	1	1	1	1	1			Blue

Table 7. Important habitat types across Kootenay Connect's Eight Focal Corridors.

These habitats were identified through extensive consultation with local SAR biologists (independent and government), local stewardship groups, conservation organizations, First Nations, and literature reviews. "1" in the columns indicates that these habitats are important, and of high conservation value, and therefore deserving attention within the indicated Focal Corridor.

Habitat features	Creston	Columbia wetlands	Wycliffe	Bonanza	Lardeau	Columbia Lake	Golden	Slocan River
Abandond buildings	1	1		1	1	1	1	1
Avalanche chutes					1			
Bat hibernacula	1	1	1	1	1	1	1	1
Burrows/denning areas	1	1	1	1	1	1	1	1
Calcareous rocks/soils	1	1	1	1	1	1	1	1
Climax grasslands	1	1	1			1	1	
Cold water sources								1
Deep cool pools								1
Fish feeding/rearing areas	1	1	1	1	1	1	1	1
Fish spawning beds	1	1	1	1	1	1	1	1
Huckleberry patches	1	1	1	1	1	1	1	1
Ice fields / glaciers						1	1	
Mainstem spawning habitat	1	1	1	1	1	1	1	1
Migratory stopover sites	1	1	1	1	1	1	1	1
Mineral licks	1	1	1	1	1	1	1	1
Nesting/roosting sites	1	1	1	1	1	1	1	1
Non draining ponds		1						
Perched ponds							1	
Rock caves	1	1	1	1	1	1	1	1
Rocky outcrops	1	1	1	1	1	1	1	1
Snake hibernacula								1
Steep sided slope clay banks		1	1			1	1	
Ungulate winter range		1	1		1		1	
Wildlife corridors	1	1	1	1	1	1	1	1
Wildlife trees	1	1	1	1	1	1	1	1

Table 8. Important wildlife habitat features across Kootenay Connect's Eight Focal Corridors.

These wildlife features were identified through extensive consultation with local SAR biologists (independent and government), local stewardship groups, conservation organizations, First Nations, and literature reviews. "1" in the columns indicates that these features are important, of high conservation value, and therefore deserving attention within the indicated Focal Corridor.

Habitat features	Creston	Columbia wetlands	Wycliffe	Bonanza	Lardeau	Columbia Lake	Golden	Slocan River
Abandond buildings	1	1		1	1	1	1	1
Avalanche chutes					1			
Bat hibernacula	1	1	1	1	1	1	1	1
Burrows/denning areas	1	1	1	1	1	1	1	1
Calcareous rocks/soils	1	1	1	1	1	1	1	1
Climax grasslands	1	1	1			1	1	
Cold water sources								1
Deep cool pools								1
Fish feeding/rearing areas	1	1	1	1	1	1	1	1
Fish spawning beds	1	1	1	1	1	1	1	1
Huckleberry patches	1	1	1	1	1	1	1	1
Ice fields / glaciers						1	1	
Mainstem spawning habitat	1	1	1	1	1	1	1	1
Migratory stopover sites	1	1	1	1	1	1	1	1
Mineral licks	1	1	1	1	1	1	1	1
Nesting/roosting sites	1	1	1	1	1	1	1	1
Non draining ponds		1						
Perched ponds							1	
Rock caves	1	1	1	1	1	1	1	1
Rocky outcrops	1	1	1	1	1	1	1	1
Snake hibernacula								1
Steep sided slope clay banks		1	1			1	1	
Ungulate winter range		1	1		1		1	
Wildlife corridors	1	1	1	1	1	1	1	1
Wildlife trees	1	1	1	1	1	1	1	1

Table 9. Key ecological processes across Kootenay Connect's Eight Focal Corridors.

These ecological processes were identified through extensive consultation with local SAR biologists (independent and government), local stewardship groups, conservation organizations, First Nations, and literature reviews. "1" in the columns indicates that these ecological processes are important, of high conservation value, and therefore deserving attention within the indicated Focal Corridor.

Ecological processes	Creston	Columbia wetlands	Wycliffe	Bonanza	Lardeau	Columbia Lake	Golden	Slocan River
Beaver wetland creation		1				1	1	
Breeding & nesting	1	1	1		1	1	1	1
Carbon storage	1	1		1	1	1	1	1
Elevational connectivity, valley bottom to top								1
Fish overwintering	1		1	1	1	1	1	1
Fish passage					1			
Fish spawning & rearing	1	1	1	1	1	1	1	1
Geomorphic processes. Erosion, levees, sedimentation	1	1	1	1	1	1	1	1
Hydrologic processes, filtering, recharge, flood control, storage	1	1	1	1	1	1	1	1
Natural fire regime	1		1	1	1	1		1
Natural veg succession		1				1		
Nutrient dymanics	1	1	1	1	1	1	1	1
Pollination	1			1	1		1	1
Predator-prey dynamics	1	1	1	1	1	1	1	1
Stand maintaining fires		1						
Wildlife movement	1	1	1	1	1	1	1	1

Table 10. Ecological threats across Kootenay Connect's Eight Focal Corridors.

These ecological threats were identified through extensive consultation with local SAR biologists (independent and government), local stewardship groups, landowners, conservation organizations, First Nations, and literature reviews. "1" in the columns indicates that these threats are present, of concern, and therefore deserving study and/or management actions to mitigate or alleviate within the indicated Focal Corridor.

Bold red indicates a significant threat. **Bold black** indicates an important threat. Plain text indicates a presence of threat.

Threat category	Threat	Creston	Columbia wetlands	Wycliffe	Bonanza	Lardeau	Columbia Lake	Golden	Slocan River
Direct loss or impairment of habitat / species	agricultural expansion and/or intensification	**1**	**1**	**1**	1		1		1
	conifer encroachment on native grassland	1	**1**	**1**			1	1	
	declining water quality	1	**1**	1	**1**		1	1	1
	erosion and sedimenation						1	1	
	exclusionary fencing to wildlife		1	**1**				**1**	
	extensive logging and road building	**1**	1	**1**	**1**	1	1	**1**	**1**
	extreme fire and fire suppression	**1**	1	**1**	**1**		1	1	**1**
	harvest and/or falling of wildlife trees	**1**	**1**	**1**	1	1	1	1	1
	herbicide/pesticide run-off	1	**1**		1		1		1
	human wildlife conflicts	**1**	1	1	**1**	1			1
	loss of instream complexity (e.g. large woody debris, gravel, and sediment)	**1**	**1**		**1**	1	1	**1**	**1**
	loss of old structures for bats and barn swallows	**1**			**1**	1			1
	loss of plant diversity due to loss of natural flood processes					1			
	loss of river-wetland-floodplain hydrologic connectivity	**1**	1		**1**				
	loss of side channels in river								**1**
	loss of wildlife cross valley connectivity					1	1	**1**	**1**
	mine closures (providing bat hibernacula)		1	1			1		
	mining & gravel extraction						1	1	1

Threat category	Threat	Creston	Columbia wetlands	Wycliffe	Bonanza	Lardeau	Columbia Lake	Golden	Slocan River
Direct loss or impairment of habitat / species	natural system modification (e.g., water diversion, diking, railway bed)	1	1	1	1	1	1	1	1
	over-grazing or poor range management	1	1	1			1	1	
	recreation activitiy causing wildlife displacement							1	
	residential development/urban sprawl	1	1	1	1	1	1	1	1
	stream bank erosion and sedimentation	1	1	1	1				1
	timing of harvest interfering with nesting & fledging	1			1				
	transportation corridors and hydro lines	1	1	1	1		1	1	1
	Baciliius thuringiensis subspecies israelensis (BTI) for mosquito control	1	1			1	1	1	1
	unregulated wildcrafting, overhunting					1	1	1	
	wildlife collisions on transportation corridors	1	1	1	1	1	1	1	1
	woody vegetation encroachment into wetlands	1							
Invasive species	American bullfrog	1	1	1	1		1	1	1
	chronic wasting disease (CWD)	1			1				
	chytrid fungus	1	1	1	1	1	1	1	1
	creation of linear corridors (increases spread)	1	1		1		1		1
	domestic sheep diseases (infecting native Bighorn Sheep)	1	1	1	1		1	1	
	fungus causing white-nose syndrome for bats	1	1	1	1	1	1	1	1
	invasive plants	1	1	1	1		1	1	1
	non-native fish	1	1		1		1		1
	reed canary grass & invasive plants					1			
	West Nile virus (ticks)								
	whirling disease	1			1				
	white pine blister rust	1	1	1	1		1	1	1
	zebra and quagga mussels	1	1	1	1		1	1	1

	Threat	Creston	Columbia wetlands	Wycliffe	Bonanza	Lardeau	Columbia Lake	Golden	Slocan River
Recreational pressure	dogs off leash	1							
	increased access to backcountry and high alpine areas	1	**1**	1	1	1	1	**1**	**1**
	increased human activity in the wetlands	**1**	**1**		1	1	1	1	**1**
	increased river use (e.g. tubers, etc)								**1**
	increased trail and off-trail usage (e.g., multi-use and non-motorized use)	1	**1**	**1**	**1**	1	1	**1**	**1**
	increased trail building (authorized and unauthorized)	1		**1**	**1**		1	1	
	increased motor boat activity in sensitive waterways					1	1	1	**1**
	increased winter recreation							**1**	
Uncertainty of climate change	catastrophic fire	**1**	**1**	**1**	**1**	1	1	1	**1**
	changes in nutrient inputs caused by floods and droughts	**1**			1				1
	changing species distributions						1	**1**	1
	forest pest spread (e.g., mountain pine beetle and other insects)	1	1	1	**1**	1	1	1	1
	hydrological changes (causing floods or extreme drought)	**1**	**1**	**1**	**1**	1	1	**1**	**1**
	increased stream temperature	**1**			**1**				**1**
	irrigation depleting water resource during drought	1			1				1
	loss of snowpack / loss of cold water creeks	**1**	**1**	**1**	**1**	1	1	1	**1**
	mudslides / landslides		1	1	**1**	1	1	1	**1**
	vegetation changes / habitat shifting	**1**	**1**	1	**1**	1	1	**1**	**1**
	water impoundments and other water storage may affect hydrology	1	**1**		1		1	**1**	1
	wildlife disease spread	1	1	1	1		1	1	1
Cumulative effects	impacts from multiple threats	1	1	1	1	1	1	**1**	1

APPENDIX B. GIS LAYERS & DATABASES FOR KOOTENAY CONNECT

Table 11. List of GIS layers and databases that underpin analyses and conservation planning.

Layer type	GIS layers	Source
Species layers of interest		
	Grizzly bear habitat model	TBGBP[1]
	Grizzly bear core habitats model	TBGBP[1]
	Grizzly bear corridor model	TBGBP[1]
	Wolverine density	BC Gov
	Marmot habitat	BC Gov
	Badger habitat model	Nancy Newhouse
	Ungulate winter range [2]	BC Gov
	Caribou habitat areas	BC Gov
	Big horn sheep data	BC Gov
	Mountain goat	BC Gov
	Elk habitat model	Kootenay Connect, K. Mulligan
	Multi-species upland corridor model	Kootenay Connect, M. Proctor
	Species at risk & of concern observations[3]	BC Gov
	Northern Leopard Frog breeding areas	NLF Recovery Team
Biological		
	Bird survey data	Rachael Darvill
	Swan data	Rachael Darvill
	Osprey nests	M Machmer
	Heron nests	M Machmer
	Western toad breeding ponds	Many donors
	Western painted turtle breeding & basking ponds	Rachael Darvill
	Swallow nest sites	Rachael Darvill
	Lewis's woodpecker nest sites, critical habitat	Rachael Darvill
	Amphibian sites	Jakob Dulisse
	Ecological comminities at risk	Rachael Darvill
	Alkali saltgrass - foxtail barley community	Rachael Darvill
	Old growth management areas	BC Gov
	Riparian/wetland areas	TBGBP[1]
	Lidar	BC Gov
	Ortho Photos	BC Gov
	Itemized Conservation Opportunities	Kootenay Connect, R. Darvill
	NC BEC units	BC Gov

Layer type	GIS layers	Source
Human influence		
	Forestry roads	BC Gov
	Road density	TBGBP[1]
	Highways	GIS data online
	Human settlement	TBGBP[1]
	Highway road kill data	BC Gov
	RDEK Land use designation areas	RDEK
Land ownership and management		
	First Nations lands	Ian Adams
	Private lands	
	Cadastral data	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
	Canfor High Value Conservation Areas	Canfor
	Greg Utzig Conservation planning areas	G Utzig
	Agricultural Land Reserve lands	BC Gov
Data gaps		
	Habitat models for most species	
	Connectivity models for most species	
	Hydrology models	
	Columbia Shuswap RD Area A	
	Movement data for wolves, wolverine & badgers	
	[1]Trans-border Grizzly Bear Project	
	[2] Moose, Elk, Whitetail deer, Mule deer, Bighorn sheep, Mt Goat, Caribou	
	[3]Bald Eagle, Flammulated Owl, GB Heron, Osprey, Lewis's woodpecker, W Screech-Owl, Williamson's sapsucker	
	[3]Cougar, Elk, Moose, Mule deer, N Goshawk, NLF, Painted turtle, Western toad, Whitetail deer,	
	[3]Fisher, Western toad, Long-billed curlew, N Goshawk, Marten	

APPENDIX C: COMPLEMENTARY INITIATIVES

Table 12. Global, national, provincial and regional initiatives complementary to the purposes of Kootenay Connect.

Initiatives	Purpose	Goal/Objective	Implications
Global Initiatives			
United Nations Strategic Plan for Biodiversity for 2011–2020 and Aichi Biodiversity Targets **See Post-2020 Global Biodiversity Framework for update*	Set global targets for conservation under the Convention on Biological Diversity.	Strategic Goal C: *To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity.*	This goal includes a specific target for spatial conservation, **Aichi Target 11**, which states: *By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.* https://www.cbd.int/sp/targets/rationale/target-11/
Post-2020 Global Biodiversity Framework[24] (In progress)	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 framework: *To take urgent action across society to put biodiversity on a path to recovery for the benefit of planet and people.* **Four long-term goals to achieve 2050 Vision for Biodiversity:** 1. 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; 2. Nature's contributions to people (e.g., sustainable diets and food security, access to safe drinking water and resilience to natural disasters) have	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

[24] The term "post-2020 global biodiversity framework" is used as a placeholder, pending a decision on the final name.

		been valued, maintained or enhanced through conservation and sustainable use supporting global development agenda for the benefit of all people; 3. The benefits, from the utilization of genetic resources are shared fairly and equitably; 4. Means of implementation are available to achieve all goals and targets in the framework.	
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.*	KBAs can help achieve the Aichi Biodiversity Targets (in particular Target 11, above), 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. http://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 in order 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 300 partner groups have joined forces to connect and protect this landscape. Since Y2Y's inception, protected areas have increased from 11 to 21 percent within the Yellowstone to Yukon region, while better management practices have improved conservation across an additional 30% of lands to help ensure functional wildlife corridors that connect protected areas and allow wildlife to roam. https://y2y.net/

National Initiatives	Purpose	Goal/Objective	Implications
2020 Biodiversity Goals and Targets for Canada	Set new medium-term goals and targets developed by federal, provincial and territorial governments to achieve long-term biodiversity outcomes.	**Strategic Goal A:** *By 2020, 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 2020, at least 17 percent of terrestrial areas and inland water, and 10 percent of coastal and marine areas, are conserved through networks of protected areas and other effective area-based conservation measures.*	These goals and targets describe results to be achieved through the collective efforts of a diversity of players both public and private whose actions and decisions have an impact on biodiversity. Target 1 for Canada is especially relevant to Kootenay Connect and is linked with the global Aichi Target 11 (discussed above). Canada is expected to prepare National Reports featuring successful case studies to the Convention on Biological Diversity. https://biodivcanada.chm-cbd.net/2020-biodiversity-goals-and-targets-canada#target_1
Target 1 Challenge Fund of the Canada Nature Fund Administered by Environment and Climate Change Canada	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 UN Post-2020 Biodiversity Framework** **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.*	The Challenge component of the Canada Nature Fund will provide up to $175 million over 4 years to establish new protected and conserved areas. In December 2018, the Target 1 Challenge Fund launched an Expression of Interest phase with the first cohort of successful projects to be notified in May 2019. The duration of the Canada Nature Fund is until March 31, 2023. 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 (IPCA), 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. 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 significant new investments and developing new partnerships to collaboratively deliver wildlife stewardship.	**Five Goals of Together for Wildlife Strategy:** 1. All British Columbians have a voice in 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	There are 24 actions that support the goals, including opportunities to: develop inclusive and cooperative governance structures and to make existing engagement 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-decisionmaking. 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	Over the course of five years, the Trust's Ecosystem Enhancement Program aims to identify and support one to three projects in each subregion, focusing on two subregions during each year of the program.	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.	Supported projects will focus on enhancement, restoration and conservation by seeking input from community groups, First Nations representatives, and government experts. With a budget of $10 million spread over five years, the Trust focuses on two subregions each year and identifies project opportunities to implement on-the-ground actions to support ecological health at a landscape level. Targeted landscapes include: Year 1 targets Southern Rocky Mountain Trench and Kootenay Lake subregions; Year 2 targets Columbia Valley and Arrow/Slocan subregions; Year 3 targets Lower Columbia and Elk Valley subregions; Year 4 targets North Columbia and Upper Columbia subregions; Year 5 will review additional project opportunities across the Basin. 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 areas.	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 D: LAND USE DESIGNATIONS, LAWS, AND POLICIES TO PROTECT BIODIVERSITY TOOLBOX

The following Tables 13 and 14 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 13. Land Use Designation Tools to Protect Biodiversity.[25]

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.

[25] 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 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.	None.

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.	None.

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, Development Permit Areas, etc.	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 14. Legislation and Regulation of Land & Water Uses and Activities That Affect Biodiversity.[26]

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.

[26] 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.	Strong 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 creative 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	√					Act created in 1909 with a focus on the Great Lakes. Boundary waters are bodies of fresh water that the US-Canada border flows through. Addresses conflicts and rights arising between the two countries over the use of 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; **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.	N/A

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.

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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.