Elk Valley Cottonwood Conservation and Restoration Strategy

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PREPARED FOR: FISH & WILDLIFE COMPENSATION PROGRAM

PREPARED BY: THE ELK RIVER ALLIANCE, FERNIE BC

WITH FINANCIAL SUPPORT FROM: PREPARED WITH FINANCIAL SUPPORT FROM THE FISH & WILDLIFE COMPENSATION PROGRAM, ON BEHALF OF ITS PROGRAM PARTNERS BC HYDRO, THE PROVINCE OF B.C., FISHERIES AND OCEANS CANADA, FIRST NATIONS AND PUBLIC STAKEHOLDERS.

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Executive Summary

In 2022 the Elk River Alliance initiated a program to conserve and restore riparian and floodplain deciduous forest (Cottonwood forest) in the Elk Valley, BC. The overarching goal of the program was to develop an understanding of cottonwood dynamics in the Valley in order to identify, secure and restore priority sites. Restoration goals, broadly speaking, are to improve aquatic and terrestrial habitat and improve erosion and flood resilience. To this end, the current and historical extent of cottonwood forest was surveyed, potential sites were assessed, valley residents and subject matter experts were consulted, and restoration prescriptions were drawn up for three priority properties.

The overall program, and Phase 1 (this FWCP project) aligns with a number of FWCP Priority Actions, primarily COLRRA.ECO.HB.14.01 (River and Riparian areas: Cottonwood stand restoration/recruitment-P1) & COLWRA.ECO.HB.15.01 (Wetland and Riparian Areas: Cottonwood stand restoration/recruitment-P1). Both action items are similar, described as: *Support recruitment and restoration of critical cottonwood stands (those that benefit multiple species), including exploring opportunities to work with partners to establish methodology and prioritize action. Evaluate the influence of upland/wetland riparian/river habitat on cottonwood stands.*

It was estimated that cottonwood dominated forest occurred on approximately 1,708 ha prior to settler arrival in the Elk valley. Since then, an estimated 871 (51%) ha has been cleared for agriculture, urban and commercial development. The majority of current and cleared cottonwood forest occurs on the floodplains of relatively densely populated area between the communities of Elkford and Fernie.

Over 100 potential restoration sites were investigated for restoration potential, and three restoration prescriptions developed for riverside sites experiencing high levels of erosion with good restoration potential.

The Elk valley community was surveyed and a community workshop hosting 48 attendants. Biologists, ecologists, a knowledgeable Yaq̓it ʔa·knuqƚi ‘it representative and landowners were consulted. Findings were used to inform restoration prioritization criteria and better align the project with Yaq̓it ʔa·knuqƚi ‘it expectations.

Due to a loss of funding and field survey difficulties, condition mapping was not conducted, and the final restoration prioritization criteria report was not finished. Future work will focus on these areas in order to better granularize mapping and site selection efforts to date.

Despite setbacks, the project outcomes were satisfactory in setting the stage for a viable restoration program in the Elk Valley, BC. As a result of this effort, the extent of cottonwood (and its loss) has been mapped, and restoration work on approximately 40 ha of streamside conservation land will commence in 2023, along with several private properties pending land securement. Additional sites will be added to the program over the coming years.

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Introduction

Elk Valley Cottonwood Background information

Black cottonwood (*Populus trichocarpa*) is the foundation of riparian forests in the Elk River watershed (Jamison, Allen, and Polzin 1997). To naturally develop, these stands require specific conditions and events such as light, high moisture, and nutrient-rich soils. Stands typically propagate with the assistance of moving water and thus grow on floodplains and adjacent rivers and creeks. Initial seeding occurs on the gravel bars of meandering rivers via seeds and clonal branch fragments that remain when floodwaters decrease at the close of spring (Kalischuk, Rood, and Mahoney 2001; Polzin and Rood 2006; Rood et al. 2003; BC Gov 2020; Jamieson et al. 2001, 2). As the water level recedes and the river meanders away from the gravel bar, saplings trap soil and organic matter to eventually develop a stand of mature cottonwoods with a functional understory. These mature cottonwood forests provide valuable habitat for a multitude of wildlife including deer, elk, moose, black and grizzly bear (blue listed), blue heron (blue listed), osprey, and many more mammals and birds (Egan, Cadrin, and Cannings 1997). Cottonwood habitat complexity and richness increases over time as trees mature, and is amplified in larger, older stands (Jamieson et al. 2001).

In addition to providing habitat, cottonwoods also offer green infrastructure protection from high water and flood events (Walker et al. 2016). The roots of large trees such as cottonwoods anchor stream banks, preventing streamflow from moving rocks and soil (which erodes the stream bank), while also slowing the shifting position of watercourses more effectively than forbs and grasses (Rood et al. 2015). Additionally, cottonwood habitats naturally mitigate downstream flood risk. The water velocity of overland flooding that flows through cottonwood habitat is dampened significantly more than if water flowed through forbs and grasslands. This decrease in floodwater velocity, as well as the natural capacity for cottonwood habitat to flood without damage to these flood-adapted landscapes, helps mitigate the downstream potential for damage related to flooding.

Figure 1: Flood damage to an Elk Valley watercourse (Coal Creek) during the November 2021 flood event.

Foreground: The unvegetated field in the foreground experienced extensive scouring and erosion. Background: Thick cottonwood vegetation on a right angle 'dog l

Cottonwood forests are considered threatened ecosystems in British Columbia, with cottonwood forest site series (or types vegetation) red and blue-listed (BC Gov 2020). Unfortunately, the flat fertile floodplains where cottonwood forest grows are desirable for agriculture and other land uses (Polzin 1998). Other significant threats include conversion to conifer for timber extraction, overgrazing, housing and urban development as well as the impending issue of climate change and decreasing water availability (Jamieson et al. 2001; KCP 2019).

Shifting watercourses and flood events are the primary stimulants of cottonwood regeneration (Cordes, Hughes, and Getty 1997). Thus, development along the riverbank (including bridges, buildings, forest harvest and flood mitigation infrastructure such as dikes) not only constrains watercourses' ability to meander, but also impedes new cottonwood stand development. Because of this relationship between river and cottonwood propagation, rivers constricted by linear developments are unlikely to naturally replenish cottonwood forest (Cordes, Hughes, and Getty 1997). As such, regeneration of cottonwood stands will likely require human intervention.

In the Elk Valley, valley floor vegetation that contains cottonwood forest can be broadly defined by four vegetation systems (Figure 2: Dry Cool Montane Spruce (MSdk1) in the upper valley, Dry Warm Montane Spruce (MSdw) from Elkford to Sparwood, Interior Cedar Hemlock Moist Cool (ICHmk4) from Sparwood through Fernie, and Kootenay Dry Mild Interior Douglas-Fir (IDFdm2) in the southern-portion the Elk Valley (MacKillop et al. 2018). Cottonwood forests in the East Kootenays are typically defined by forest dominated by cottonwood (>50% canopy cover) and may have several sub-dominant tree species including aspen, birch, and spruce with varying understories. Elk Valley cottonwood ecosystems are typically adjacent to rivers and creeks on flat, middle-bench flood ecosystems (Fm) and generally fall into two vegetation types (or site series): Fm01 (Cottonwood-Snowberry-Rose) and Fm02 (Cottonwood-Spruce-Dogwood) (MacKillop et al. 2018).

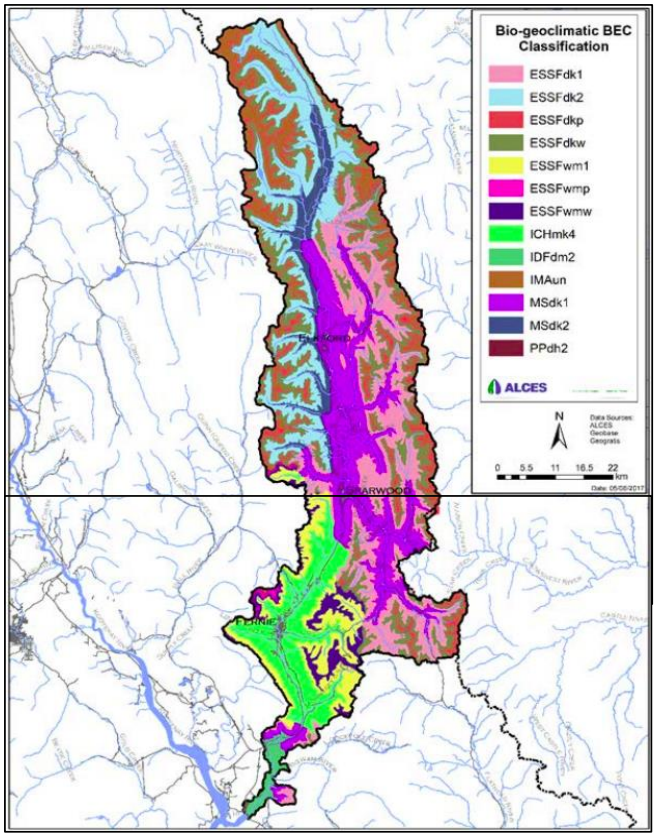

Figure 2: Map of the Elk River Catchment with BEC (Biogeoclimatic ecosystem classification zones).

Cottonwood forest typically occurs in MSdk2, MSdk1, ICHMk4 and IDFdm2 zones. (Taken from the Elk Valley CEMF Old and Mature Forest Cumulative Effects Assessment Report (Holmes et al. 2018))

Despite its relatively remote nature, the Elk River has experienced many of the human impacts that affect cottonwood forests, with a significant amount of linear development, over-grazing, urban development and clearing for agriculture, particularly in the lower half of the river and along the Michel Creek tributary (KCP 2019). Cleared cottonwood forests in developed parts of the Elk Valley are therefore not expected to replenish naturally in the future as river meander generally occurs at a slow rate, particularly in those areas where constrained by riverfront development and flood protection work such as riprap and dikes.

There is a clear need for enhancing the fragmented cottonwood ecosystem while also supporting sustainable human use of cottonwood habitat. The Elk Valley hosts impressive hunting opportunities, but decreasing populations of game animals such as moose, elk, and deer has resulted in community concern (CDT 2019; Kuzyk 2016). While the cause of these declines is complex, habitat loss and fragmentation are thought to play a large role. Fragmentation, or separation of a singular ecosystem into smaller areas, negatively impacts ecosystems and their dependent species' populations (Haddad et al. 2015). While cottonwood forests are not the only habitat threatened by fragmentation, they play a large role in overwintering habitat for these significant species, where improving the health and connection of these valley bottom habitats provides a significant possible benefit to ecological health.

The need to protect Elk Valley cottonwood forests has been previously noted; most recently the FWCP Columbia Region Wetlands and Riparian Action Plan identifies that "The floodplain system between the communities of Elko and Elkford is the most important riparian system within the priority area. There are

few cottonwood-dominated floodplain systems with an unaltered hydrograph and natural cottonwood recruitment remaining in B.C., Western Canada, or the Columbia Region" (FWCP 2019). The Kootenay Conservation Program 2019 report also highlights the need for conservation and protection of Elk Valley cottonwood forests (KCP 2019).

Table 1: Preliminary desktop analysis: Elk Valley cottonwood forest and restoration potential categorized by landowner type.

'% restoration potential' indicates how much land with restoration potential is found within each ownership type. i.e. In the first line, 41% indicates that of cottonwood dominated land with potential for restoration, 41% is found on Crown (other) lands.

Vegetation Type	Land ownership type	Area (m^2)	% total	% Restoration potential
Cottonwood dominated	Crown (Other)	4,520,689	4%	41%
	Crown (Conservation/ Park)	185,300	0%	2%
	Federal	2,180	0%	0%
	Private	4,430,251	4%	40%
	Private Conservation	1,992,555	2%	18%
	Unknown/other	24,191	0%	0%
	Total	**11,155,164**	**10%**	**100%**
Cottonwood Present	Crown (Other)	7,947,646	7%	63%
	Crown Conservation/Park)	139,980	0%	1%
	Private	4,258,000	4%	34%
	Private Conservation	350,577	0%	3%
	Total	**12,696,204**	**11%**	**100%**
Unforested with cottonwood rehabilitation potential	Crown (Other)	15,919,972	14%	17%
	Crown (Conservation/Park)	161,607	0%	0%
	Federal	20,844	0%	0%
	Private	70,912,615	61%	76%
	Private Conservation	5,673,085	5%	6%
	Unknown/other	28,600	0%	0%
	Total	92,716,723	80%	100%
	Grand Total	**116,568,091**	**100 %**	

Table 1 details a preliminary analysis of existing vegetation mapping performed in early 2022 by Keefer Ecological Services Ltd using the Elk Valley Cumulative Effects Management Framework Aquatic Habitat Riparian and Floodplain study area (Elk River and tributaries riparian zone below 1600m (Figure 3) (Davidson et al. 2018). Cottonwood typically does not persist below 1600 m in the elk valley. Land ownership data was taken from public sources (CADASTRE, ParcelMapBC, ParcelMapBC open data), and vegetation mapping. The BC provincial 'Vegetation Resource Inventory' (VRI) was used for this analysis, and while this resources is not perfect, it provides a good basis for initial assessment.

While this analysis used broad vegetation mapping and requires refinement and ground truthing, it shows conservation land accounts for just 2% of the 10% existing cottonwood dominated forest in the Elk Valley. Furthermore, only 6% of unforested and cleared land with potential for cottonwood forest restoration is situated on conservation lands. A further 17% of potential restoration areas are located on crown land.

The majority (76%) of unforested potential cottonwood restoration areas are located on private land. This creates a significant issue for restoration efforts. Either restoration must occur on private land with landowner agreement for ongoing protection of restoration areas, or land must be purchased or granted to conservation groups prior to restoration activities.

To date, several organizations have undertaken cottonwood conservation and restoration projects in the Elk Valley. For example, the Nature Conservancy Canada (NCC) purchased a section of land near Morrissey that includes the world's oldest recorded cottonwoods (a stand dated at 400 years). Additionally, the NCC restored a gravel pit near Hosmer in 2018, which returned wetland characteristics - including cottonwood riparian restoration - to the area (Rood, Braatne, and Hughes 2003; Klafki 2018). The Elk River Alliance (ERA) has been active in wetland and riparian stand restoration in the valley since 2016, with projects including the maintenance of the NCC's Morrissey ancient cottonwood stand.

Conservation and restoration of individual stands in the Elk Valley is important, and a landscape level approach to cottonwood protection that takes into account ecosystem health, connectivity, and coverage is needed to fully realize the benefits of restoring habitat for both cottonwoods and dependent wildlife. The NCC and groups including the Elk Valley Cumulative Effects Framework (EV CEMF) have identified the importance of protecting wilderness corridors along the length of the Elk Valley. However, there is no comprehensive strategy to date to assess and, more importantly, outline how to conserve, protect and restore cottonwood forests along the valley. As the population in the region rises, and with it the pressure to exploit natural resources, a coherent strategy to protect this critical natural resource is essential.

Elk Valley Cottonwood Program background

In 2020 and 2021, the Elk River Alliance (ERA) identified the need for a strategic, comprehensive understanding of cottonwood forest dynamics in the Elk Valley, site selection prioritization criteria and viable restoration prescriptions to inform landscape level restoration work. In past years, ERA has played a key role in the original Elk Valley Cumulative Effects Management Framework (CEMF) (EV CEMF 2018). This program intends to align with the initial CEMF program and bolster the original CEMF goals as well as the Old and Mature Forest CEMF Report (Holmes et al. 2018).

For the purposes of this project, ‘cottonwood’ and ‘cottonwood forest’ is used interchangeably and refers to riparian and floodplain forest with canopy dominated by deciduous broadleaf vegetation, typically black cottonwood (*Populus trichocarpa*), but may include a dominant component of Trembling Aspen (*Populus tremuloides*), and a sub-dominant component of spruce (*Picea glauca)* or Western Red Cedar (*Thuja plicata)*.

Originally, the program (survey and on the ground restoration work) was presented as a singular project, with the Fish and Wildlife Compensation Program (FWCP) providing funding for preliminary survey and restoration planning. As the project evolved, it became apparent the scope of activities and objectives would be better served as individual projects or phases, and a wider program structure was adopted (

Table 2).

The updated program contains four broad phases, with phase 1 completed by this FWCP funded project. Project phases are expected to be rolled out largely on a concurrent, as-needed basis, as opportunity, funding and feasibility allow. The FWCP funded Phase 1 work in 2022 allowed for expediated development of Phase 2 & 3 in late 2022 and roll out in 2023.

- **Phase 1**: Information gathering and synthesis step necessary to establish the overall program. This includes high level survey of cottonwood dynamics, historical (pre-settler) extent, preliminary site assessments, development of prescriptions for three existing restoration sites and community consultation.
- **Phase 2**: Initial restoration work focusing on priority conservation lands that consist of bare pasture adjacent the main stem of the Elk River. These sights were selected as principal restoration sites due to the clear and urgent need for riparian stabilization and aquatic habitat enhancement, ease of restoration activities and pre-existing status as conservation land.
- **Phase 3**: Assisting private landowners to restore and enhance their properties to advance the goals of the Program, namely enhance property environmental function as well as improve erosion and flood resilience.
- **Phase 4**: Outreach with large commercial and industrial landowners to encourage conservation and restoration of riparian and floodplain habitat.

This report outlines Phase 1 preliminary work funded by FWCP, conducted for the purposes of establishing a landscape level cottonwood restoration program in the Elk Valley.

Table 2: Updated 'Elk Valley Cottonwood restoration program' structure and status

Program Component	Activities	Status
Phase 1 Survey & Site Assessment (Principal Funder: FWCP)	• Assessment of Elk Valley cottonwood • Current and Historical extent mapping, • Restoration site assessment & selection • Community education	**Largely Complete** **Planned additional work** • Additional sites to be assessed under Phases 2-4 • Ongoing community education as required • Additional survey with provincial gov partners as needed (condition mapping, granularization to site series etc)
Phase 2 Conservation Property Restoration (Current major Funders: Columbia Basin Trust, EcoAction (pending) & others)	• Landowner outreach and discussion • Partnership development • Fundraising activities • Restoration prescriptions • Live staking/seedlings • Ground treatments • Erosion control • Maintenance • Effectiveness Monitoring	**In progress** Current conservation restoration properties: • Big Ranch (NTBC): 2023-2026 • Morrissey Meadows (NCC): 2023-2026 • Hosmer Wetland (NCC): 2025-2027
Phase 3 Private Landowner Restoration (Funder/Partner organisations: Farmland Advantage)	• Landowner outreach and discussion • Partnership development • Fundraising activities • Restoration prescriptions • Live staking/seedlings • Ground treatments • Erosion control • Maintenance • Effectiveness Monitoring	**In progress** One property in landowner negotations • Private property 1 (unnamed pending agreement) • Private property site 2 (unnamed pending landowner negotiation
Phase 4 Commercial and Industrial Restoration (Funders: Land owners & TBD)	• Outreach to industrial and commercial privately owned land. • Input on restoration prescriptions • Partnership on restoration	**Pending**

Goals, Objectives and Linkage to FWCP Action Plans

Broadly speaking, the over arching Cottonwood Program aims to develop an understanding of cottonwood dynamics in the Elk Valley and conduct restoration on priority sites in a strategic manner to bring about landscape level improvements to:

- Aquatic ecosystems and habitat,
- Terrestrial ecosystems and habitat, and
- Improve flood and erosion resilience to habitat and communities

Specifically, the FWCP funded project objectives were to:

- Inventory and map the cottonwood ecosystem in the Elk Valley.
    - Map the current distribution of cottonwood forest in the elk valley
    - Map the historical extent of cottonwood forest in the elk valley
    - Assess and map the condition of cottonwood forest in the elk valley
- Consult with the community and subject matter experts, and develop prioritization criteria for cottonwood ecosystem conservation and restoration in the Elk Valley
- Identify priority cottonwood sites for conservation and restoration.
- Produce restoration prescriptions for high value selected properties

The following goals have been applied to Phases 2, 3 & 4 of the program and are not addressed in this report:

- Secure priority cottonwood sites for conservation and restoration
- Conduct restoration work on public and private lands

The overall cottonwood program directly addresses or is aligned with a number of Priority Action items (Table 3). The original FWCP proposed project was better aligned the entire Cottonwood Program, while the updated 'Phase 1' is specifically focused on a subset of action items. It should be noted that while reduced in scope, Phase 1 is critical for the future success of the overall program.

Table 3: Linkage to FWCP action plans

Priority Action Code	Priority Action Item	Cottonwood Program	Phase 1 alignment
COLRRA.ECO.HB.14.01	Cottonwood stand restoration/recruitment-P1	X	
COLWRA.ECO.HB.15.01	Cottonwood stand restoration/recruitment-P1	X	
COLWRA.CXP.HB.06.01 & COLRRA.CXP.HB.06.01	Connectivity habitat-P1	X	
COLWRA.ECO.RI.10.01	Cottonwood abundance-P2	X	
COLWRA.ECO.RI.11.01	Identify candidate wetlands and riparian areas for ecosystem restoration-P1	X	X
COLWRA.ECO.HB.12.01	Development of ecosystem restoration plans-P1	X	X
COLWRA.ECO.HB.13.01	Restore and create wetland/riparian habitat-P1	X	
COLWRA.ECO.HB.17.01	Improve habitat connectivity-P1	X	

Priority Action Code	Priority Action Item	Cottonwood Program	Phase 1 alignment
COLWRA.ECO.HB.20.01	Stewardship opportunities to improve habitat-P1	X	
COLWRA.ECO.LS.22.01	Secure wetland and riparian habitats-P1	X	
COLWRA.ECO.RI.07.01	Mapping of wetland and riparian habitat-P1	X	X
COLRRA.ECO.HB.15.01	Restore riparian vegetation and stabilize erosion-P1	X	
COLRRA.ECO.HB.14.01	Cottonwood stand restoration/recruitment-P1	X	
COLWRA.ECO.HB.15.01	Cottonwood stand restoration/recruitment-P1	X	
COLWRA.CXP.HB.06.01 & COLRRA.CXP.HB.06.01	Connectivity habitat-P1	X	
COLWRA.ECO.RI.10.01	Cottonwood abundance-P2	X	
COLWRA.ECO.RI.11.01	Identify candidate wetlands and riparian areas for ecosystem restoration-P1	X	X
COLWRA.ECO.HB.12.01	Development of ecosystem restoration plans-P1	X	X
COLWRA.ECO.HB.13.01	Restore and create wetland/riparian habitat-P1	X	
COLWRA.ECO.HB.17.01	Improve habitat connectivity-P1	X	
COLWRA.ECO.HB.20.01	Stewardship opportunities to improve habitat-P1	X	
COLWRA.ECO.LS.22.01	Secure wetland and riparian habitats-P1	X	

Study Area

The study area for this project can be broadly defined as the Elk River watershed, and more specifically, the Elk River floodplain.

Following a desktop study by Keefer Ecological Services, the study area was refined using available datasets to outline the Elk River system's riparian and floodplains, as shown in

Figure 4. For further information regarding study area delineation see Elk River Alliance – Cottonwood Rehabilitation Final Report, March 2023 (Keefer Ecological Services Ltd.).

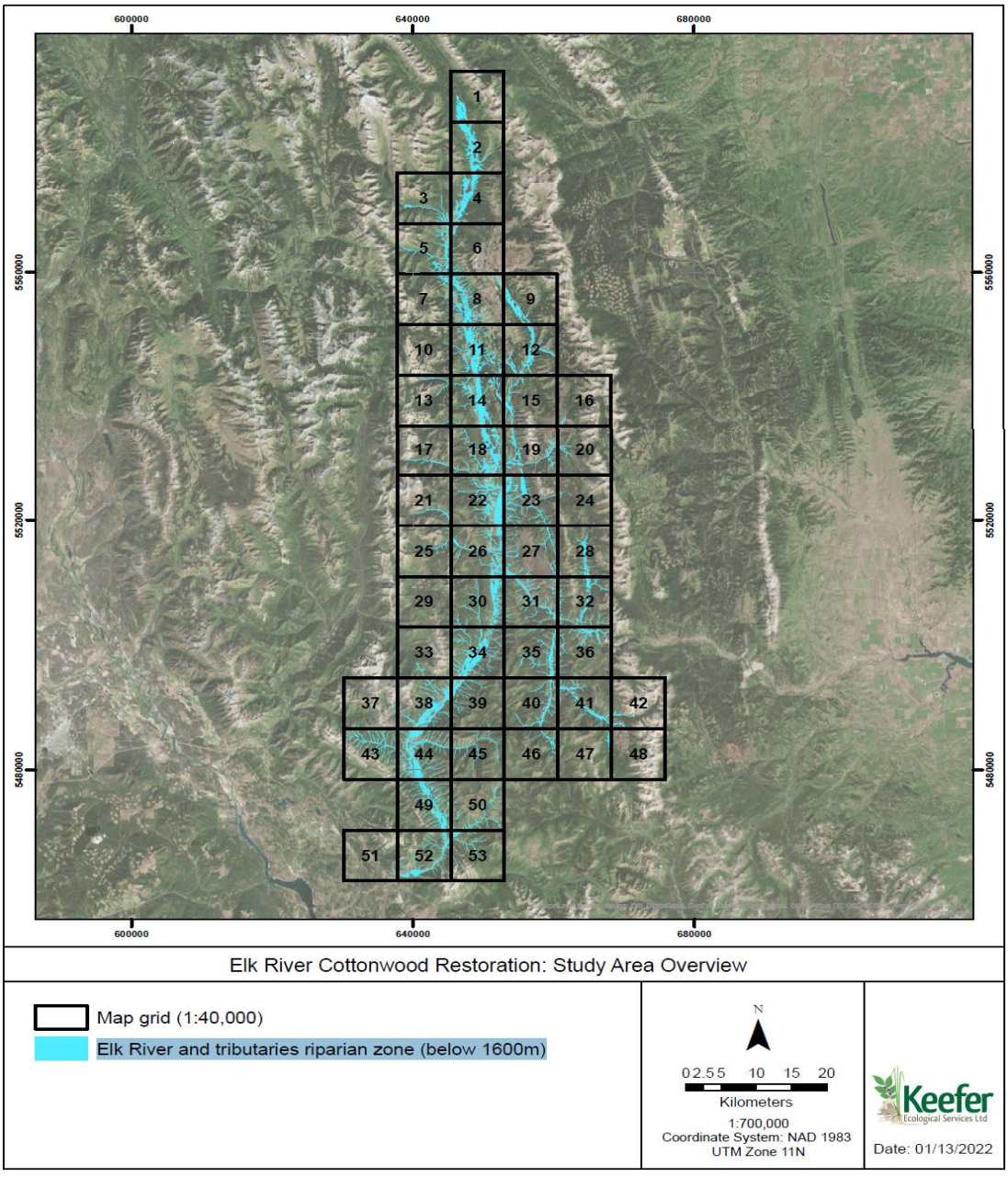

Figure 3: Preliminary study area for the Elk Valley Cottonwood Strategy

Methods

Cottonwood forest survey and mapping

The following methodology is copied from 'Elk River Alliance – Cottonwood Rehabilitation Final Report, March 2023 (Keefer Ecological Services Ltd.)'.

Desktop survey:

The mapping of existing cottonwood relied on provincial Vegetation Resource Inventory (VRI) data to locate stands where cottonwood was either the leading species (>50%) or present within the stand (<50%). The VRI mapping was queried within the floodplain of the Elk River, Michel and Alexander Creeks (other tributaries are generally too steep sided to have any significant mid-bench floodplains found). The bounds of the floodplain were assessed using the imagery observed with ArcGIS and GoogleEarth.

Ground truthing:

To determine if the desktop mapping exercise was accurate, sites identified in VRI mapping were ground-truthed. From the 235 cottonwood polygons identified from VRI analysis, 73 polygons were ground-truthed (i.e., 31%). During field observations 12 additional stands, totalling 87 ha, of cottonwood stands were recorded and added to the final mapping.

Although not all polygons were ground-truthed during assessments in 2022, due to the accuracy of the mapping (i.e., sites identified as present or leading during mapping were largely correct following ground-truthing), we can be reasonably confident that the remaining polygons are correct.

Historical cottonwood mapping:

One of the objectives of the project was to estimate the extent of historic cottonwood stands prior to settler contact. We recognize that floodplains are dynamic and flood regimes alter with climatic cycles. We assessed the historic extent based on present floodplain topography and vegetation.

This section outlines methods used and challenges encountered, to estimate and assess the total area that may have previously contained cottonwood stands. These assessment methods were also utilized to determine potential rehabilitation sites (discussed in section 4.0. Restoration Site Assessment and Selection). We conducted the historic mapping after the completion of field work (site assessments). This allowed us to delete some cottonwood historical mapping areas that we determined were high bench floodplains (rather than mid-bench floodplains) and would be transitory cottonwood sites at best.

The areas along the Elk River, Michel Creek, and Alexander Creek that exhibited mid-bench floodplain characteristics were examined using aerial imagery both in ArcGIS and GoogleEarth Pro. Characteristics used include:

- *Flat terrain*
- *Less than 2 meters above the mean stream level (as assessed using Google Earth elevation data)*
- *Adjacent to the streams*
- *Within the elevational bounds for cottonwood occurrence*

Areas that had been cleared of trees for agricultural purposes, urban or rural development, highway or railway construction on mid-bench floodplain sites were delineated as potential historic cottonwood sites. Areas that met the above criteria (bulleted list) but appeared to have been cleared for forest harvesting purposes were likely harvested for conifers, these were not delineated as potential cottonwood sites.

Potential restoration site inspections

The following methodology is copied from 'Elk River Alliance – Cottonwood Rehabilitation Final Report, March 2023 (Keefer Ecological Services Ltd.)'.

Due to the large number of sites identified within the Project area, restricted access to numerous sites, and limited time to conduct detailed site inspections, different levels of inspections were completed. The size of the area, accessibility, and potential priority of the site determined the level of inspection. At potential rehabilitation sites identified in mapping (i.e., candidate, visual, uncertain), three levels of site inspection were determined:

1. *On-site, visual assessment only (no detailed information collected)*
2. *Visual assessment from a distance (site was inaccessible by road, no detailed information collected)*
3. *On-site detailed assessment*

At visually assessed sites limited information was collected. This style of site assessment focused on presence of eroding bank, height above river, and current vegetation. It is anticipated that if/when these sites can receive rehabilitation, further information will be collected.

On-site, visual assessment only

If a site was small (e.g., 400m2 or less), yet an on-site visual assessment determined the site would benefit some level of rehabilitation (e.g., small-scale and no site preparation required), a detailed site inspection was not completed at this time. These sites were marked as 'potential rehab site' with a low-medium priority. Figure 4 demonstrates an example of a site that could receive minimal rehabilitation efforts, however, did not warrant a detailed site inspection to be completed.

Alternatively, where crews could access the site, however due to current work, rip rap, or adjacent stands only containing spruce species, rehabilitation was determined not possible or necessary and simply marked 'no rehab potential'. Figure 5 demonstrates an example of these sites.

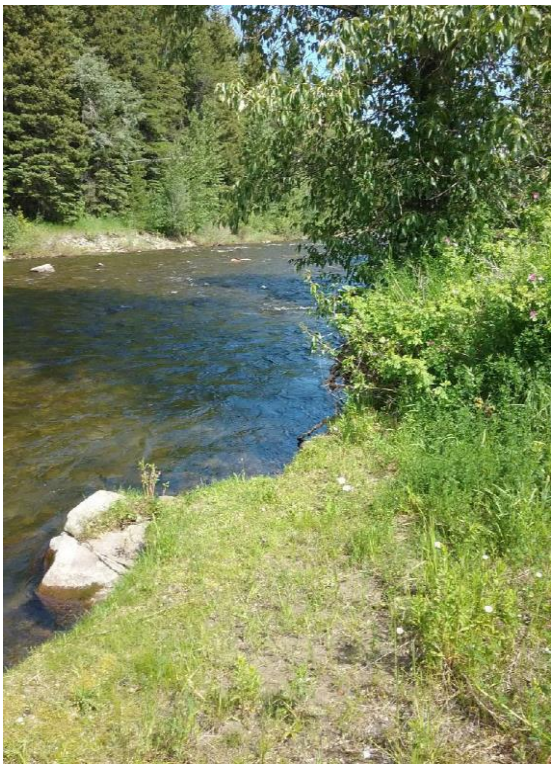

Figure 4: Small rehabilitation site where a detailed site inspection was not completed.

Figure 5: Example of site where rehabilitation has been determined not possible or necessary.

Visual assessment from a distance

If sites were inaccessible yet identified as potential locations for rehabilitation, limited information was collected. Assessments may have been conducted on the other side of the river of the site location, or from a road/highway a reasonable distance from the site using binoculars. If rehabilitation seemed plausible once access has been further evaluated, they were marked with 'potential, requiring further ground-truthing'.

On-site detailed assessment

If a site was determined suitable for rehabilitation and of a medium to large size, detailed information was collected (see Appendix B for inspection form). Features assessed at potential restoration sites included:

- *Soil characteristics;*
- *Dominant vegetation;*
- *Presence of invasive species;*
- *Wildlife or domestic animal use;*
- *Presence of eroding banks;*
- *Height above river level;*
- *Depositional processes;*
- *Limiting factors for restoration; and*

- *Rehabilitation priority ranking and rationale (note: this was a subjective ranking by field crews, and would not necessarily align with formalized selection criteria)*

Restoration Prescriptions and monitoring protocols

Restoration prescriptions for three properties were prepared by Keefer Ecological Services Ltd in consultation with Elk River Alliance, Dr. Stewart Rood (University of Lethbridge), various persons with relevant restoration experience and landowners (Nature Trust of BC, Nature Conservancy of Canada & the private landowner). Prescriptions take into account overall restoration goals with the aim to create cost effective restoration.

More information can be found in the following restoration prescriptions:

- Elk River Alliance – Nature Conservancy of Canada Morrissey Meadows Cottonwood Rehabilitation Prescription, March 2023 (Keefer Ecological Services 2023b)
- Elk River Alliance – Nature Trust of BC Big Ranch Conservation Complex Cottonwood Rehabilitation Prescription, March 2023 (Keefer Ecological Services 2023c)
- Elk River Alliance – Private Property Cottonwood Rehabilitation Prescription, March 2023 (Keefer Ecological Services 2023d)

Community consultation and site selection criteria

A cross section of the community was consulted to develop site prioritization criteria that is in line with the Elk Valley communities' values and expectations. To this end, an online survey was distributed to understand the general population's values and attitudes towards project goals. Knowledgeable individuals were also consulted, including biologists and cottonwood ecophysiologists and first nations representatives.

Results and Outcomes

Desktop and field mapping; current and historical cottonwood extent

Survey results indicate around 50% of cottonwood in the Elk Valley may have been cleared following settler arrival (Table 4). While historical mapping was not able to differentiate between cottonwood present vs dominated stands, it is fair to assume cleared areas follow current numbers. The mapping exercise indicates over half of the cottonwood dominated riparian and floodplain habitat in the Elk Valley may have been cleared since the arrival of settlers. The majority of this land is between Elkford and Fernie.

Table 4: Survey results showing current and historical cottonwood present and leading coverage in the Elk Valley, BC.

	Cottonwood Present	Cottonwood Leading/Dominant	Total
Current extent	683 ha (45%)	837 ha (55%)	1,520 ha
Historical cleared stands	710 ha (estimated)	871 ha (estimated)	1,581 ha
Total historical extent	1,393 ha (estimated)	1,708 ha (estimated)	3,101 ha
Estimated % remaining	49%	49%	49%

Of the 1,581 ha of cleared potential cottonwood land, approximately 200 ha is no longer available for restoration due to ground alteration and infrastructure.

The full survey report can be found at the end of this 'Results and Outcomes' section.

Site Prescriptions

Restoration and effectiveness monitoring prescriptions were completed for three sites on the mainstem of the Elk River (Table 5).

Table 5: Site restoration prescriptions completed

Property	Owner	Location	Lat/Long	Notes
Big Ranch Nature Complex	Nature Trust of British Columbia	15 km North of Sparwood, Elk valley	49.861582, -114.870046	Restoration activities planned to commence in 2023
Morrissey Meadows	Nature Conservancy Canada	30 km south of Fernie, Elk Valley	49.372666, -115.012969	Restoration activities planned to commence in 2023
'Private Property 1'	Private Owner	Approx. 11 km North of Sparwood, Elk VAlley	n/a (pending landowner agreement)	Restoration activities commencing in 2023 pending funding and landowner agreement

Full restoration prescriptions can be found at the end of this 'Results and Outcomes' section.

Potential restoration site inspections

A total of 91 sites were assessed for restoration potential along the Elk River and tributaries (Alexander and Michel Creek). While low level in nature, these inspections have sufficient information for preliminary site selection process, including soil evaluation, surrounding vegetation, feasibility of restoration and likely benefits to aquatic and terrestrial habitat, as well as erosion and flood resilience.

Condition mapping

Field efforts encountered numerous access issues, including but not limited to poor road networks, significant private property ownership on the floodplain and water hazards. As condition mapping requires close visual inspection this component of the survey was not completed.

While this survey was not able to adequately map cottonwood condition, survey crews did note that in several stands however cattle grazing had significant impact to understory structure and health. In many cases these stands appeared to be 'normal' and healthy in aerial photography.

Community outreach and restoration prioritization criteria

Due to budget constraints and unforeseen expenses, the criteria prioritization was not completed, however the information collected is considered adequate for purpose.

One hundred and seventeen Elk Valley residents and Elk River users responded to the criteria development survey (Figure 6), with the majority of respondents from the Fernie area. The vast majority of respondents indicated all three program focus areas were a high priority (Figure 7)Figure 7.

A community information night/workshop was held in early 2023 with 48 community members attending. An overview of cottonwood dynamics was presented, along with the overall program and provide information to landowners on options for land-use compatible restoration. Feedback was overwhelmingly positive and echoed the results of the survey. The night also served to recruit volunteers for restoration work in 2023.

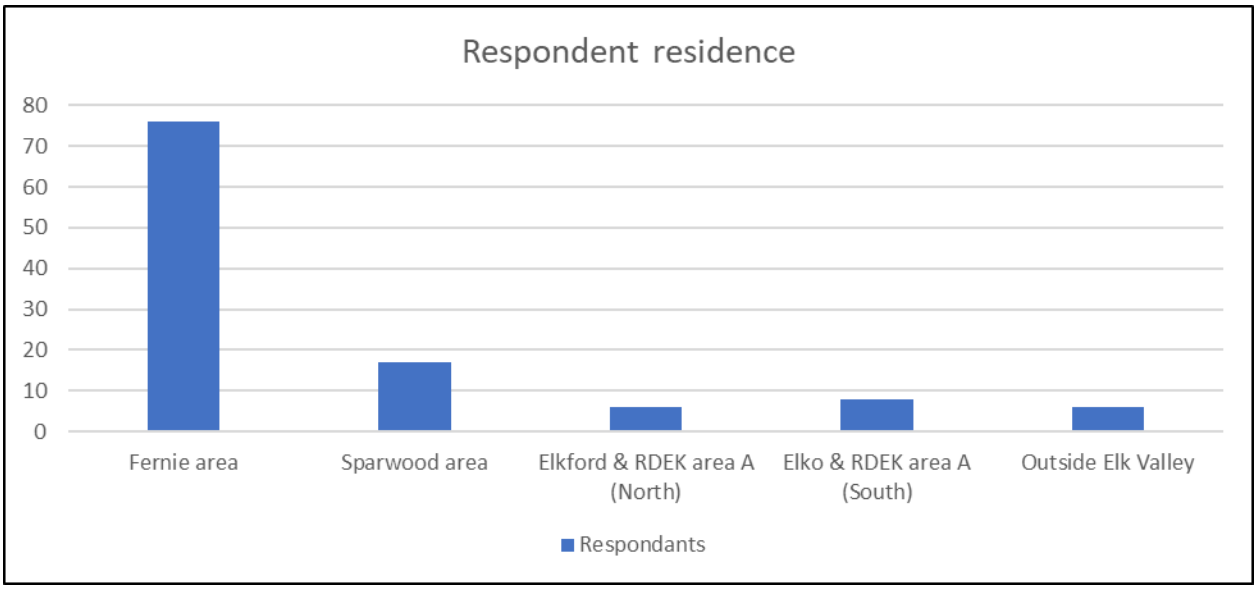

Figure 6: Restoration prioritization survey respondent residence

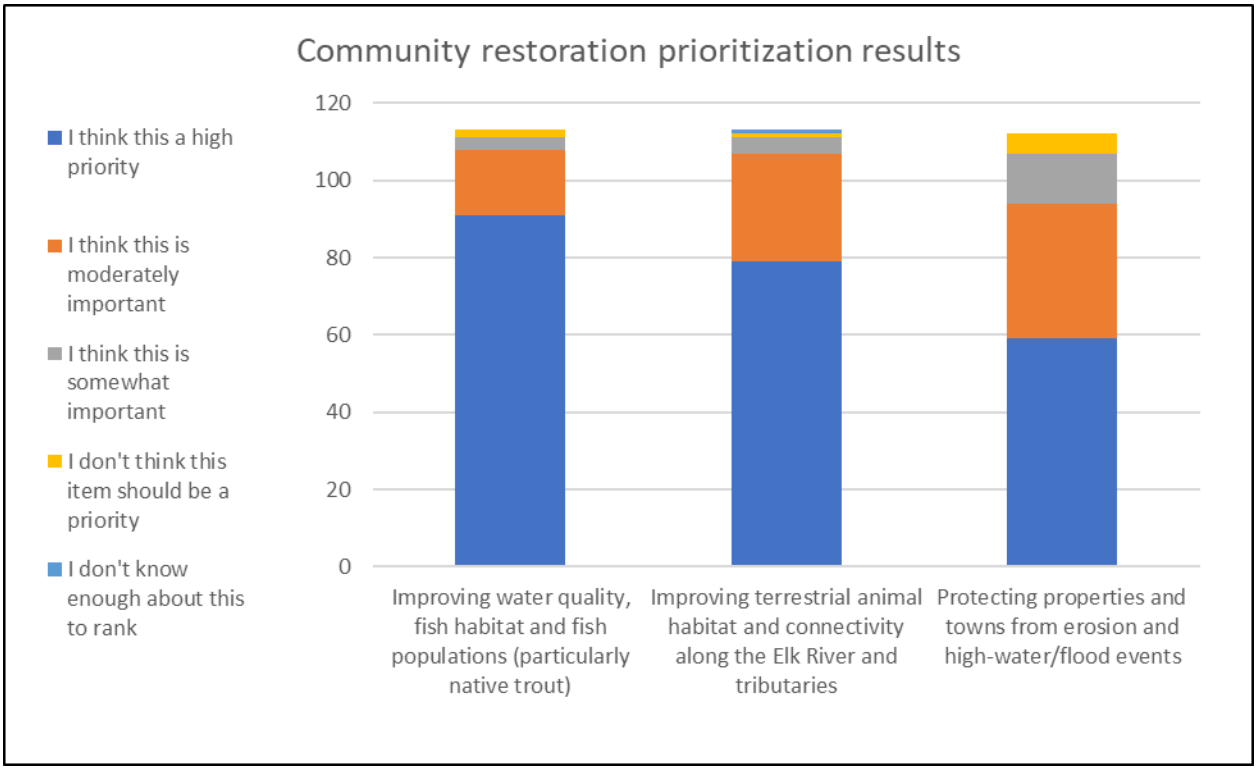

Figure 7: Restoration prioritization criteria survey results

A land manager with Yaq̓it ʔa·knuqƛi ‘it (Tobacco Plains Indian band) was consulted to identify First Nation land uses, expected outcomes, potential cultural barriers, expected restoration outcomes and potential to align the program to improve cultural land use in the Elk valley.

A wildlife researcher (Clayton Lamb) was consulted to provide input into improving site selection for terrestrial animal populations (focus on grizzly and ungulate populations)

The Elk River Alliance has been in discussions with fish and aquatic habitat specialists for many years, and these learnings have been assimilated into site selection processes.

While the site selection criteria document is currently unfinished, it provides sufficient information and context for internal ERA use in preliminary site selections and further investigation for restoration criteria.

Documents

Several documents were generated over the course of this project work, which provide additional contextual information.

Survey report

- Cottonwood Rehabilitation Final Survey Report, March 2023 (Keefer Ecological Services 2023a)
    - Mapbook: Cottonwood current and historical extent (cottonwood dominated and cottonwood present)
    - Mapbook: Potential restoration sites and unvisited sites

Restoration Prescriptions

- Nature Conservancy of Canada Morrissey Meadows Cottonwood Rehabilitation Prescription, March 2023 (Keefer Ecological Services 2023b)
- Nature Trust of BC Big Ranch Conservation Complex Cottonwood Rehabilitation Prescription, March 2023 (Keefer Ecological Services 2023c)
- Private Property Cottonwood Rehabilitation Prescription, March 2023 (Keefer Ecological Services 2023d)

Discussion

Cottonwood extent and restoration

Elk Valley cottonwood forest is commonly viewed as less impacted by human development than other areas of British Columbia, however, this survey's results indicate over 50% of cottonwood forests may have been lost since settler arrival. Cottonwood forest in the Elk Valley may be more impacted by human development than previously understood.

The majority of cottonwood forest loss has occurred between Elkford and Fernie, as expected given this area has the highest population, as well as most attractive floodplain for agriculture and development. As the majority of clearing in this area is for agricultural purposes, there is little infrastructure on many potential sites, and in some cases restoration options exist to allow for pre-existing purposes. For example, cattle grazing under cottonwood stands is viable. More still, by excluding cattle from a relatively narrow, yet critical 10-20m riparian zone, benefits to aquatic habitat, erosion reduction and flood resilience can be realized while allowing for grazing on the majority of properties.

Survey effort and results are adequate. Given the high rate of desktop accuracy no survey for extent is needed. Understanding of cottonwood forest to site-series (detailed vegetation type) was not completed, so understanding of the extent of the two site-series in the elk valley are not known. For purposes of program not vital as planting appropriate species for area should allow suitable species complement to evolve over time.

Vegetation condition assessment

As condition assessments were not feasible on the majority of cottonwood stands, there is little to discuss here. Understanding the condition of cottonwood stands in the valley could be extremely valuable, particularly as the effects of cattle grazing can drastically depress wildlife value and erosion resilience in riparian zones. Given the difficulties in accessing sites, the feasibility of widescale on the ground condition assessments is debatable.

Site inspections

Preliminary site inspections indicate potential for restoration, but require further analysis, criteria and prioritization before further analysis.

Restoration Prescriptions

The three restoration prescriptions have been reviewed improved upon by several vegetation and wildlife experts. These are considered to be good 'baseline' prescriptions for 'bare' pasture sites. See prescriptions for additional information.

Community Engagement, Resident surveys and site selection prioritization criteria

Support for the project was almost universal among community respondents, as well as subject matter expert and Yaq̓it ʔa·knuqƛi 'it representatives, indicating broad community reception for meaningful restoration in the area. Several landowners also responded either via survey or verbally, indicating strong interest in restoration work on their properties.

While all areas of the project were considered a high priority, improving aquatic habitat was considered the highest priority, followed by terrestrial habitat, then flood resilience.

Respondents were likely heavily biased towards those with environmental values. However, a very small number of individuals both supported the goals of the project, and clearly did not support the Elk River Alliance judging by responses (eg: 'GTFO', 'Too many granola Fernie people' etc). Further evidence of broad community support for project (and a need for ERA outreach).

While restoration and site selection prioritization criteria was not completed, the following site characteristics have been identified as high priority:

- Land between Elkford and Fernie, preferably on areas with suspected pre-existing cottonwood forest
- Inside river bends with no protection (eg: bare pasture where erosion is highest)
- Sites where habitat fragmentation can be reversed
- Sites with high animal utilization
- High longevity (ie: sites that can be secured, without risk of future development.
- High change of restoration success

Recommendations

While the bulk of survey, community consultation and site inspections were completed, due to funding losses and cost overruns, several items are outstanding.

There are several upcoming funding opportunities, including a $58m environmental damages fund slated to open in late 2023. Most items below are well aligned with the stated priorities of this fund, and it is expected that an application will have a strong likelihood of success. The Elk River Alliance plans to apply for funding to complete the outstanding items and expand the program to include a significant amount of private land restoration in the coming years.

Vegetation Condition and Site Series Mapping

Condition mapping would allow for targeted vegetation enhancement for sites with an existing cottonwood overstory and degraded understory/structure. While complete, in-person condition mapping of the valley is perhaps not feasible, selected sites could be assessed with relative ease.

Granularizing cottonwood forest to the site series level (LM1 & LM2) would be extremely helpful to understand the relative and absolute coverage of the two series. Conducting site series assessment runs int similar access issues as condition mapping.

Drone based mapping using lidar or other sensory imagery to identify vegetation species. It is possible this could be utilized to conduct remote mapping to site series level and could also allow for the understanding of many of the factors contributing to vegetation degradation, including invasive species dominance, bare ground and structural change. This is beyond the original scope of this project; however the wider program may consider this in the future. The SAIT drone lab has indicated some or all of the above is feasible at least in theory and may be willing to partner on understanding landscape processes.

As this program is largely focused on remediating impacts to the riparian zone, another lower tech option would be to map the riparian fringe of the mainstem via raft survey. This poses an attractive option for community support and several raft operators have expressed an interest. The time and effort required for a survey of this nature could place it beyond cost effective, depending on the level of support, however.

Prioritization Criteria and site selection

While the prioritization criteria report is currently incomplete, however the bulk of the background data and information required has been collected, and site selection is possible using the information gained. It would be moderately useful to complete this work in order to allow for more effective transfer of knowledge, as well as communicating with landowners to understand the importance of restoration on their property.

Conservation and Restoration

Restoration on two conservation sites and a private property (pending appropriate securement) are slated to commence in summer 2023. The sites were selected ahead of the completion of prioritization criteria as they were considered ‘no brainers’ by subject matter experts: Bare pasture experiencing significant erosion, high wildlife usage with relatively simple restoration options and a high likelihood of long term benefits. Funding for conservation land restoration has been partially secured, while private property funds are being explored.

These sites will act as proof of feasibility for the development of a dedicated restoration team in the Elk Valley.

Additional sites will be selected pending reassessment of selection criteria and landowner consultation.

Restoration Prescriptions, monitoring and Maintenance

Additional prescriptions will be required following site selections. The current prescriptions will be reviewed and updated following learnings from currently selected properties. The three chosen properties are very similar in terms of site conditions (bare pasture adjacent the Elk River main stem), with the only difference being slight differences in understory diversity as a result of biogeoclimatic region. Future restoration or enhancement sites should take into account site conditions and avoid the temptation to simple replicate the current plans.

Likewise, monitoring and maintenance are critical to improving restoration success, and should be provided for in future plans.

Landowner and Community outreach

Continued landowner and community outreach is planned as an integral program component. Engaging in meaningful collaboration with landowners is the only pathway for land securement, particularly given the private land ownership dynamics in the Elk Valley.

Community engagement is required to generate the volunteer support needed for cost effective largescale restoration work over many years. Given the success of the workshop held earlier in 2023, additional events are planned to better educate elk valley residents and visitors.

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- Elk Valley Community members

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