NCC Land Stewardship Activities F20

FWCP Project No. COL-F20-W-3146-DCA

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Executive Summary

The purpose of the agreement "NCC Land Stewardship Activities F20" (FWCP Project No. COL-F20-W-3146-DCA) is to provide resources to enable the Nature Conservancy of Canada (NCC) to continue restoring habitat on conservation properties in the East Kootenay region of the Columbia Basin. This project addresses two Fish and Wildlife Compensation Program (FWCP) Action Plans: the "Upland and Dryland Action Plan" (FWCP 2019) and the "Species of Interest Action Plan" (FWCP 2014). The specific actions addressed are:

1. Prevent and manage invasive species on, or adjacent to, conservation properties, restoration sites, and other ecologically sensitive areas – P1; and

2. Restore dry forest and grassland to improve conditions for Columbian ground squirrels, the main prey species for badger – P2.

Two projects were undertaken as part of the "NCC Land Stewardship Activities F20" agreement, which took place between 01 May, 2019 and 31 March, 2020. Funding in the amount of $15,000 was allocated towards invasive plant treatments on NCC properties in the Canadian Rocky Mountain program area, and $15,000 was designated for ecosystem restoration activities, specifically restoration of degraded open forest and grassland communities on NCC's Kootenay River Ranch property.

From the removal and management of invasive species on several NCC properties in the Canadian Rockies ecoregion to the restoration of grassland/open forest ecosystems, the funding provided by FWCP has allowed NCC to undertake a series of tasks and measures that seek to mitigate these and other threats to the local ecology, and the Columbia Basin as a whole.

Nature Conservancy of Canada

NCC is a leading national, non-profit, private land conservation organization. We protect and care for ecologically significant lands and waters and the species that they sustain. Our science-based conservation planning process drives our work. We partner with individuals, governments, Indigenous communities, foundations, corporations and others to achieve durable conservation solutions. We secure properties through donation, purchase, conservation agreements and the relinquishment of other legal interests, and manage them for the long term. Since 1962, NCC and our partners have helped conserve more than 14 million hectares (35 million acres) from coast to coast to coast.

Within the Columbia Basin, NCC provides protection for over 190,000 acres of land, including landscapes such as: at-risk grasslands, unusual geological formations, montane regions and precious valley bottom habitat. NCC's properties in the Basin conserve vital habitat for several species at risk (e.g. Badger, Grizzly Gear, Mountain Caribou, Bull Trout and Rocky Mountain Bighorn Sheep).

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Introduction

The invasion of noxious weeds has numerous negative impacts on natural ecosystems. Invasive plants threaten the health of Canada's limited native grasslands, displace endangered plant and animal species, negatively impact wildlife habitats, reduce productivity in forestry, agriculture and fisheries, and generally impede the natural functioning of ecosystems.

Invasive plants pose the second largest threat to native biodiversity after the threat of habitat loss (IUCN Council 2000). With the assistance of our partners, NCC – having removed the primary threat of development – is placing a priority on the management of invasive species on private conservation lands.

This component of the project addresses the FWCP's "Upland and Dryland Action Plan (2019)", and aligns with the following specific action:

- Prevent and manage invasive species on, or adjacent to, conservation properties, restoration sites, and other ecologically sensitive areas – P1

Goals & Objectives

The funding provided by the FWCP was for invasive plant treatments on NCC properties in the Canadian Rocky Mountain Program Area. The treatments would directly address the priorities outlined in the Invasive Plant Management Plan developed by NCC for the Canadian Rocky Mountain Program Area and by regional invasive plant councils/committees (e.g. East Kootenay Invasive Species Council).

The project's intent was to address the threat posed by invasive species to biodiversity targets on NCC's conservation lands. The Invasive Species Council (ISC) of BC defines the term invasive species as any non-native organism that causes economic or environmental harm and can spread quickly to new areas of BC. The ISC defines an invasive plant as any invasive plant that has the potential to pose undesirable or detrimental impacts on people, animals, or ecosystems. Invasive plants can establish quickly and easily on both disturbed and un-disturbed sites, causing widespread negative economic, social, and environmental impacts. At a regional level, high priority invasive plants (Early Detection Rapid Response [EDRR]) have been identified by the East Kootenay Invasive Species Council (EKISC) for survey and treatment (Figure 1).

a. Spotted knapweed (*Centaurea maculosa*)

b. Blueweed (*Echium vulgare*)

Figure 1. Examples of high priority invasive plant species in the Columbia Basin.

Study Area

The Canadian Rocky Mountains ecoregion extends over a large portion of the Rocky Mountains in southeastern British Columbia, and includes NCC's Elk Flathead, Rocky Mountain Trench, and West Kootenay Natural Areas. NCC conservation lands that were the subject of 2019 invasive species treatments and surveys using funding from this FWCP grant include: Cherry Meadows, Columbia Lake Lot 48, Dutch Creek Hoodoos, Elk Valley Heritage Conservation Area, Flathead River Ranch, Kootenay River Ranch, Luxor Linkage, Marion Creek Benchlands, Morrissey Meadows and Mount Broadwood.

Methods

All invasive plant management activities were conducted as per the guidelines established by the Invasive Alien Plant Program (IAPP) Reference Guide (BC MFR 2011) and the Invasive Plant Pest Management Plan for the Southern Interior of British Columbia (BC MFLNRO 2016). All inventories, mechanical, and chemical treatment data collected in 2019 have been entered into the IAPP database (see treatment details as recorded in IAPP in the attached spreadsheet).

Priority areas and target invasive plants were identified in collaboration with NCC's Stewardship Coordinator, Canadian Rocky Mountains program. Additional stakeholders, private landowners, NCC staff, and invasive species specialists were also consulted as required. See Table 1 for a detailed summary of invasive plant management activities.

Table 1. Summary of invasive plant management activities in 2019.

Objectives	Status	Comments
Meet with EKISC/CKISS and other conservation land management partners (e.g. The Nature Trust of BC [NTBC], Ministry of Forest, Lands and Natural Resource Operations &	Complete	NCC staff met with EKISC/CKISS, NTBC, MFLNRORD, and other interested partners in spring 2019 to

Rural Development [MFLNRORD]) to discuss current year invasive species management priorities on conservation lands.		discuss management priorities.
Conduct invasive plant management and control activities on high priority sites on NCC's properties, including: Cherry Meadows, Columbia Lake Lot 48, Dutch Creek Hoodoos, Elk Valley Heritage Conservation Area, Flathead River Ranch, Kootenay River Ranch, Luxor Linkage, Marion Creek Benchlands, Morrissey Meadows and Mount Broadwood.	Complete	All priority management actions were completed by EKISC and NCC in 2019.
Enter all treatment records and survey data completely and accurately into the IAPP system by December 31st, 2019.	Complete	All data entered into IAPP by EKISC and NCC staff in 2019.
In partnership with EKISC, run a volunteer event at Cherry Meadows to mechanically treat Spotted Knapweed (*Centaurea maculosa*) over ~20 ha of open forest communities.	Complete	NCC staff and EKISC collaborated to deliver an educational weed pull event on Cherry Meadows. 15 volunteers and two staff pulled 10 bags of spotted knapweed over 20 ha of open forest.
Based on inventories and regional priorities, the EKISC shall implement an integrated management approach to treat high priority invasive plants and/or sites applying the most suitable tools for the particular situation.	Complete	See Appendix 1 for the East Kootenay Invasive Plant Management 2019 report.

Results

Priority areas and target invasive plant species were identified in collaboration with EKISC, as well as additional stakeholders, conservation land trusts, and MFLNRORD staff. NCC staff attend annual conservation land manager meetings to determine regional priorities for invasive management prior to the start of each field season.

Cherry Meadows

Mechanical treatments of Spotted Knapweed were carried out on the Cherry Meadows property in 2019. Over the past decade, a previous landowner has been hand-pulling Spotted Knapweed over a 20 ha area which has resulted in a significant decline in the density of the plants. Mechanical treatment was chosen over chemical treatment because the limited density and sporadic nature of the plants makes hand-pulling feasible. NCC and EKISC staff collaborated on delivering an educational weed pull event, where 15 volunteers attended and removed 10 bags of Spotted Knapweed over the entire 20 hectare (ha) site.

Columbia Lake Lot 48

Chemical treatments on the Columbia Lake Lot 48 property were focused on high priority Spotted and Diffuse Knapweed (*C. diffusa*) infestations. All known plants were targeted with herbicide, which generally occur around trails and old roads.

Dutch Creek Hoodoos

In partnership with the NTBC, NCC contributed to the purchase and installation of a boot brush and educational signage that will be installed at the trailhead of the Dutch Creek Hoodoos trail in spring 2020. The sign and boot brush will encourage visitors to clean their shoes prior to hiking to limit the spread of Spotted Knapweed along the trail. NCC staff also surveyed the entire length of the trail (~2.5 km) for Spotted Knapweed outbreaks but did not find any.

Elk Valley Heritage Conservation Area

Several sites on the Elk Valley Heritage Conservation Area were treated with herbicides, and 11 invasive plant species were targeted including Spotted Knapweed, Common St. John's-wort (*Hypericum perforatum*) and Sulphur Cinquefoil (*Potentilla recta*). Areas treated include along forestry roads, around two restored wetland sites, and in two rehabilitated recreation sites, which complemented other treatments completed on the property by partners such as the FWCP, B.C. Hydro and the Ministry of Transportation (MOTI).

Flathead River Ranch

Spotted Knapweed was treated with herbicide at the Flathead River Ranch along the road at the north end of the property, as well as at the south end where the road meets the Flathead River.

Kootenay River Ranch

High priority sites of Spotted Knapweed and Diffuse Knapweed along with two other invasive species were treated with herbicide at the Kootenay River Ranch property. Areas that were targeted include old roads and slash landings that are relics of past forestry activities on the property.

Luxor Linkage

Chemical treatments on the Luxor Linkage property were a collaborative effort between NCC and the FWCP, and were facilitated by EKISC. Leafy Spurge (*Euphorbia esula*) was the priority target species, however many other species, such as Spotted Knapweed, were also targeted.

Marion Creek Benchlands

Mechanical treatments of Spotted Knapweed occurred on the Marion Creek Benchlands property, as chemical treatments cannot be used due to the close proximity of a wetland. On two separate days, staff from EKISC and NCC hand-pulled knapweed from on top of the Frocklage Dam as well as areas surrounding the dam. Approximately five large bags were filled, and the area was seeded with a native grass seed mix following the plant removal.

Morrissey Meadows

Chemical treatments on the Morrissey Meadows property targeted seven invasive species including Common Tansy (*Tanacetum vulgare*), Spotted Knapweed and Common Caraway (*Carum carvi*). Treatments were focused around high disturbance areas such as the old farmstead and along the riverbank where cattle have caused significant ground disturbance.

Mount Broadwood

An external contractor was hired by NCC to chemically treat invasive plants on NCC's Mount Broadwood Conservation Area. Crabbe Contracting treated species such as Burdock, Spotted Knapweed and Common St. John's-wort just east of the Ram Creek Bridge, covering a 4 ha area and ~1.5 km of roadway.

a. Volunteers at Cherry Meadows following the Spotted Knapweed pull event.

b. Spotted Knapweed infestation covering the hillside at the north entrance to the Flathead River Ranch property. *Photo courtesy of EKISC.*

c. Successful Leafy Spurge treatment showing healthy grass cover competing with any new germinating invasive plants. *Photo courtesy of EKISC.*

d. Frocklage Dam on the Marion Creek Benchlands property showing significant reduction of Spotted Knapweed.

Figure 2. Images of invasive management and monitoring on NCC conservation properties in 2019.

Discussion

Annual invasive species management and monitoring funds have significantly improved NCC's ability to track and treat invasive species on conservation lands. With funding from the FWCP (FWCP Project No. COL-F20-W-3146-DCA), treatments occurred on NCC conservation lands throughout the summer and fall of 2019, and targeted high priority invasive plant species over 86 sites. Both chemical and mechanical treatment methods were employed where necessary.

Cherry Meadows

Over a decade of hand-pulling on the Cherry Meadows property has caused a significant decline in the abundance of Spotted Knapweed over a 20 hectare area. Extensive surveys completed by EKISC in 2018 resulted in the detailed mapping of all the patches of Spotted Knapweed left on the property. Knowing the exact locations of remaining plants will improve the effectiveness of annual mechanical treatments going forward.

Site-specific recommendations:

- Complete annual hand-pulling over the entire 20 hectare area on an annual basis; and
- Work with neighbors to manage Spotted Knapweed infestations on adjacent private land.

Columbia Lake Lot 48

Ongoing chemical treatment of known Spotted and Diffuse knapweed patches over the past several years have been effective at limiting the spread of plants along roads and trails. Additionally, ongoing treatments of knapweed by land management partners on the Columbia Lake Provincial Park lands to the north have prevented invasive plants from spreading southward onto the Columbia Lake Lot 48 property and adjacent Crown conservation lands, and so far has kept new outbreaks to a minimum.

Site-specific recommendations:

- Continue annual chemical treatments, and collaborate with staff from MFLNRORD to control knapweed plants along the road north of the property;
- Increase funding on this property to expand treatment efforts to include the small Canada Thistle (*Cirsium arvense*) patches in the fields; and
- Seed treated areas with a native grass/forb seed mix to prevent continued germination of existing invasive plants.

Dutch Creek Hoodoos

Spotted Knapweed infestations on the Dutch Creek Hoodoos property have been low historically, however NCC staff has been hand-pulling individual plants along the Dutch Creek Hoodoos trail over the last several years. Monitoring in 2019 showed that consistent hand-pulling efforts on this property are working as no plants were found. The installation of a boot brush and educational signage at the trailhead on the neighbouring NTBC conservation lands will help to limit future outbreaks on this popular hiking trail.

Site-specific recommendation:

- Continue surveying the trail annually and pull Spotted Knapweed as necessary; and
- Continue managing the trail in partnership with the NTBC to limit the spread of invasive species from neighbouring conservation lands.

Elk Valley Heritage Conservation Area

Several partners contributed to treatments at the Elk Valley Heritage Conservation Area (EVHCA), including NCC, the FWCP, B.C. Hydro and the MOTI. Chemical treatments at the EVHCA continued on the success of the 2018 treatments, and specifically significant reductions of Sulphur Cinquefoil were observed on sites treated in 2018. NCC also hired an external contractor to treat invasive plants that became established following the restoration of two wetlands (FWCP funded projects), and following rehabilitation work done on several roads to manage motorized vehicle access. Treating invasive plants on this property is challenging as there are many factors that produce new invasions and contribute to the spread of existing infestations, such as active gravel mining, a B.C. Hydro right-of-way, the Elk Valley Trail, as well as multiple roads and public access points.

Site-specific recommendations:

- Continue chemical treatments on all sites, and target the smaller priority sites of Scentless Chamomile (*Tripleurospermum perforata*), Spotted Knapweed and Common St. John's-wort that did not receive treatments in 2019;
- Re-treat infestations of Sulphur Cinquefoil that showed decreases in density since 2018;
- Consider using biocontrol agent *Cyphocleonus* to target larger (>2 ha) infestations of Spotted Knapweed; and
- Collaborate with B.C. Hydro and MOTI to increase their invasive plant management efforts and continue to leverage funds from NCC and the FWCP to increase invasive management on the property.

Flathead River Ranch

While the Flathead River Ranch is a difficult property to access given its remote location, EKISC already conducts invasive treatments in the area for other land management partners which greatly improves the efficiency of invasive management activities on this property. Chemical treatments are focused just to the north of the property boundary where Spotted Knapweed infestation is dense, which helps to limit the spread of seeds southwards onto NCC lands. Treatment efforts on the south end of the property near the Flathead River have produced a marked decrease of Spotted Knapweed, and if further introductions can be prevented then a significant decrease in the overall invasive plant population on the property is expected within the next five years.

Site-specific recommendations:

- Continue annual treatments of Spotted Knapweed at the north and south ends of the property; and

- Continue working with other land management partners to reduce the large patch beyond the north property boundary.

Kootenay River Ranch

Treatments on the Kootenay River Ranch property were very successful in 2019 due to the collaboration between NCC, FWCP, MFLNRORD Wildfire Branch and MOTI, however this property has many risk areas for the perpetuation and further spread of large patches due to ongoing grazing and past forestry practices. In 2019, old slash landings, roads and skid trails were treated with herbicide, however some of the well-used roads continue to see spread of Spotted Knapweed. Additionally, some patches of Yellow Hawkweed (*Hieracium glomeratum*) may become too large to realistically manage if they are not prioritized in 2020.

Site-specific recommendations:

- Increase funding on this property and collaborate with all land managers to address the high priority Spotted Knapweed sites as well as the Yellow Hawkweed patches if feasible;
- Complete thorough invasive plant surveys of two adjacent conservation properties that were purchased by NCC early in 2020 (FWCP funded), which are being incorporated into the Kootenay River Ranch conservation lands;
- Invasive plant surveys should be completed by NCC staff in early summer 2020 in the five slash landings that were restored in fall 2019, with any new invasive outbreaks resulting from restoration efforts being documented and managed accordingly; and
- Continue to work with grazing lease holder to manage rangelands sustainably to avoid perpetuating existing invasive populations.

Luxor Linkage

Both the west and east side of the Luxor linkage property were thoroughly treated in 2019, which is a significant increase in treatment activities for the property since 2018. While Leafy Spurge was the primary target, many Spotted Knapweed sites were also treated. The primary source of spread of invasive plants is via the old highway on the west side of the current Highway 95, which has been the focus of chemical treatments for the past several years. Monitoring of this area concluded that the number of "old" plants has been significantly reduced due to past treatments, and only young rosettes were present in 2019.

Property-specific recommendations:

- Continue treating Spotted Knapweed along the old coach road to exhaust the seed bank;
- Spread native grass seed post-treatment over areas that had dense infestations. Patches of bare ground are susceptible to seed spread, and native grasses can provide competition to germinating invasive plants; and
- Get in contact with the Recreation and Control Services Officer of the Regional District of East Kootenay to discuss invasive plant management on adjacent private lands. There are several invasive infestations on neighboring properties that threaten to spread onto Luxor Linkage.

Marion Creek Benchlands

Consistent hand-pulling of Spotted Knapweed around the Frocklage Dam has resulted in a notable decrease in the infestation of plants on the Marion Creek Benchlands. These gains occurred in large part due to chemical treatments with glyphosate that occurred in 2017, which significantly reduced the number of plants in areas greater than 1 metre away from the wetland and thus reduced the number of plants that require ongoing hand pulling. Native grass seed has been spread onsite for several years in a row which helps reduce further germination in the bare ground created by the removal of knapweed plants. In 2020, NCC staff received permission from the neighbouring landowner to treat Spotted Knapweed on their side of the dam, which will help eliminate a persistent source of new knapweed seeds. Continued efforts with both mechanical control and seeding are critically important for preventing the spread of knapweed onto other areas of the property that are currently weed-free.

Site-specific recommendations:

- Continue with annual mechanical treatment and seeding with native grass. Look for a grass mix that is unpalatable to geese so that grass germination can occur in subsequent years; and
- Continue collaborating with the neighboring landowner to help reduce Spotted Knapweed sources on adjacent private lands.

Morrissey Meadows

Chemical treatments in 2019 marked the second year of invasive plant management on the Morrissey Meadows property, as NCC acquired the property in 2018. The treatments done in 2018 have already caused extensive reduction of burdock (*Arctium* sp.) around the old homestead area. Higher priority species next to the river were treated with glyphosate in 2019 due to the higher water levels. With the current level of funding, the invasive plants on these sites will be manageable.

Site-specific recommendations:

- Continue annual treatment of the two high priority sites;
- Spread native grass seeds in the following spring in the areas that were treated with glyphosate; and
- Work with grazing lease holder to manage the extensive infestation of Canada Thistle and Caraway in the pastures.

Mount Broadwood

Chemical treatments of Common St. John's-wort that were done on the Mount Broadwood Conservation Area in 2018 were highly successful, as post-treatment monitoring showed a drastic decline in plants in that treatment area. In 2019, NCC staff expanded on the treatment area to include a roadway that acts as a vector for spread of several invasive plant species.

Site-specific recommendations:

- Increase the invasive plant management budget in 2020 to complete follow-up treatments on the 2018 and 2019 treatment areas as well as to expand the size of those areas; and

- Continue working with partners such as TC Energy to complete treatments on easements and rights-of-way.

General Recommendations

Collaborating with the EKISC has allowed NCC to deliver efficient invasive plant management on priority conservation lands in the Columbia Basin. The following are recommendations to ensure even more effective invasive control in the long-term:

1. Continue working with the EKISC & CKISS on invasive plant management strategies each year. Annual monitoring and treatments should continue in order to achieve lasting results.

2. Increase the budget for invasive plant inventory and treatment on select NCC conservation lands.

3. Implement invasive plant management contracts in spring of 2020 to improve planning and timing of treatments. As well, continue collaborating with other conservation land managers to prioritize treatments across the landscape.

4. Sites that received detailed invasive inventories prior to treatment have seen more effective control in the past, and inventories assist with creating work plans, save on contractor treatment costs, and increase treatment effectiveness. NCC should build on these successes by requesting inventories on more conservation lands in 2020, and by using this information to develop a more strategic invasive species management plan for each property. This should be done for any new properties (e.g. Kootenay River Ranch expansion).

5. NCC staff and summer Conservation Technicians should receive invasive plant identification training to assist with inventory, and so that invasive plants can be treated incidentally as they are encountered.

6. NCC staff should take necessary precautions when working on conservation lands to limit the spread of invasive species, such as by cleaning boots/pants, cleaning work vehicles, seeding immediately following any soil disturbances, and staying on roads/trails as much as possible.

8. The development of Best Management Practices when working on NCC lands continues to be developed in consultation with local Invasive Plant Councils. NCC will participate in invasive plant treatment planning meetings with the EKISC & CKISS in spring 2020 to further develop strategic plans for invasive plants on NCC priority properties.

9. NCC should continue to strategically manage invasive plants prior to undertaking restoration activities that result in soil disturbance.

Task 2: Kootenay River Ranch – Restoration of Historic Forestry Landings

Introduction

Prior to NCC ownership the Kootenay River Ranch property had been extensively logged. These past forestry practices left behind a network of landing areas that had been used for loading logs onto trucks and piling and burning of residual slash. Over time the soils in these landings became heavily compacted and non-native invasive plant species began to proliferate. Today the landings remain in much the same state and have filled in with invasive plants and other weedy species. These sites act as "source" populations for the invasive plants to continue spreading throughout the conservation property. Due to the compacted soils, native species of shrubs, trees and grass have not been able to thrive in these areas and are routinely out-competed by invasive species. Additionally, these compacted areas reduce the amount of functional habitat for species such as American Badger (*Taxidea taxus*) and Rocky Mountain Elk (*Cervus elaphus*), which are both known to occur on the property.

This component of the project addresses the FWCP's "Upland and Dryland Action Plan" and "Species of Interest Action Plan" and aligns with the following specific actions:

- Restore dry forest and grassland to improve conditions for Columbian ground squirrels, the main prey species for badger – P2
- Prevent and manage invasive species on, or adjacent to, conservation properties, restoration sites, and other ecologically sensitive areas - P1

Goals & Objectives

The primary goal of the forestry landing restoration project was to implement activities that would restore five of these degraded landings, and return them to a state that encourages the development of a healthy, functioning plant community that supports habitat for wildlife (e.g. Columbian Ground Squirrel [*Urocitellus columbianus*]). Simultaneously, the project would also contribute to limiting the further spread of invasive plants over time.

To achieve these goals, NCC planned to use machinery to de-compact the soils in the landings, remove existing invasive plants, and then re-plant the areas with native plant species. Additionally, slash material salvaged from forest thinning activities in winter 2018/19 would be spread over the restored areas, effectively cutting off access to motorized vehicles and limiting cattle. As opportunities allowed, NCC also planned to strategically remove short sections of old roadbeds that are redundant in the context of the larger network of roads on the property. The intention of the project was not only to improve habitat for the prey of American Badger, but also to initiate a long-term plan of eliminating source populations of invasive plants as well as their vectors of spread on the Kootenay River Ranch. Eventually this project will evolve into a larger goal of restoring all the historic landing sites on the property as well as some of the redundant roadbeds that connect them.

Study Area

All activities took place on the Kootenay River Ranch (KRR) property, which is owned and managed by NCC (Figure 3). The KRR property is 1,350 ha in size and is located in the Rocky Mountain Trench and lies between the village of Canal Flats to the north and the hamlet of Skookumchuck to the south within the Kootenay Dry-Mild Interior Douglas-fir biogeoclimatic subzone (IDFdm2).

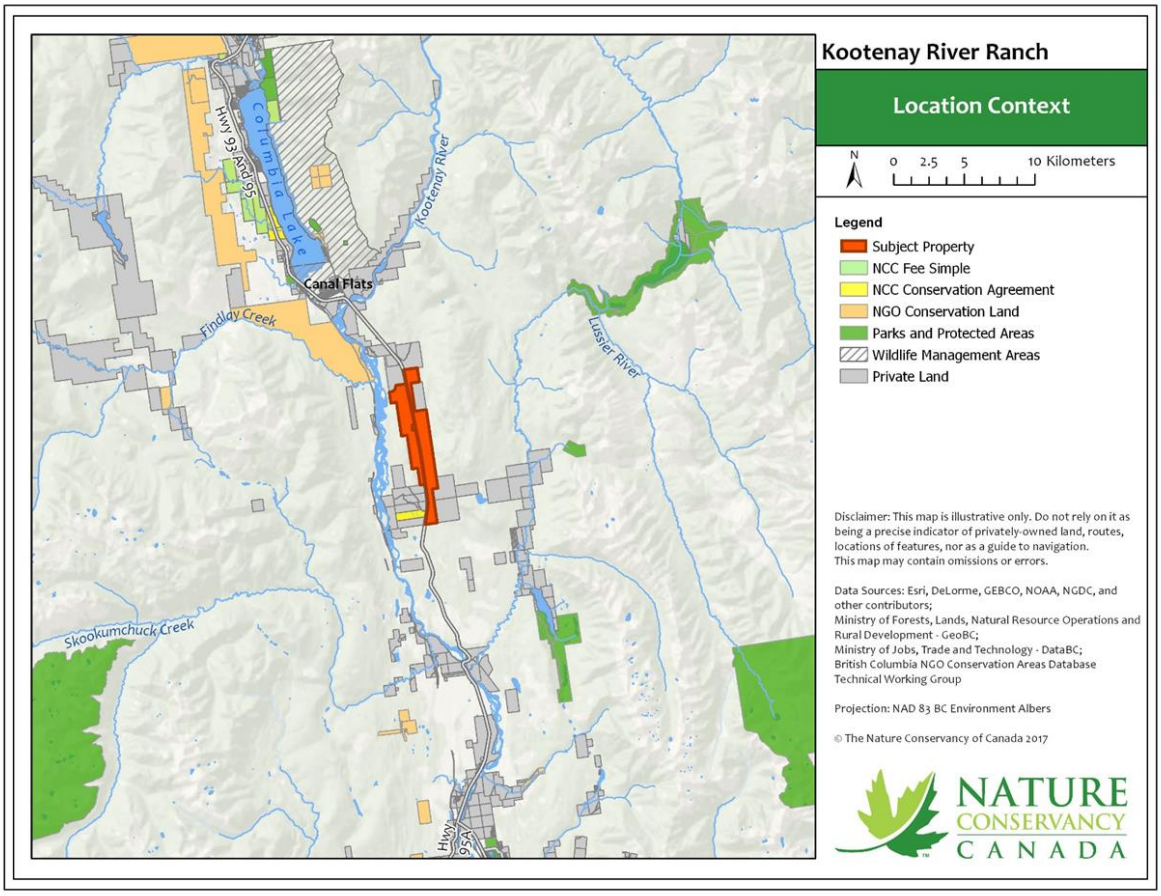

Figure 3. Location of the Kootenay River Ranch property (highlighted in red).

Methods

All restoration treatments were carried out by a local contractor in the fall of 2019. Restoration work was focused around loosening and roughenin the top layer of the soil of five landings and two short road segments on the east side of Highway 95 and north of Island Pond (Figure 4). An excavator with a digging bucket was used to rough and loosen the soil while also re-contouring the ground to provide more topographical diversity. Finally, the restoration areas were then covered with fallen trees and slash material sourced on-site and seeded with a native grass mix.

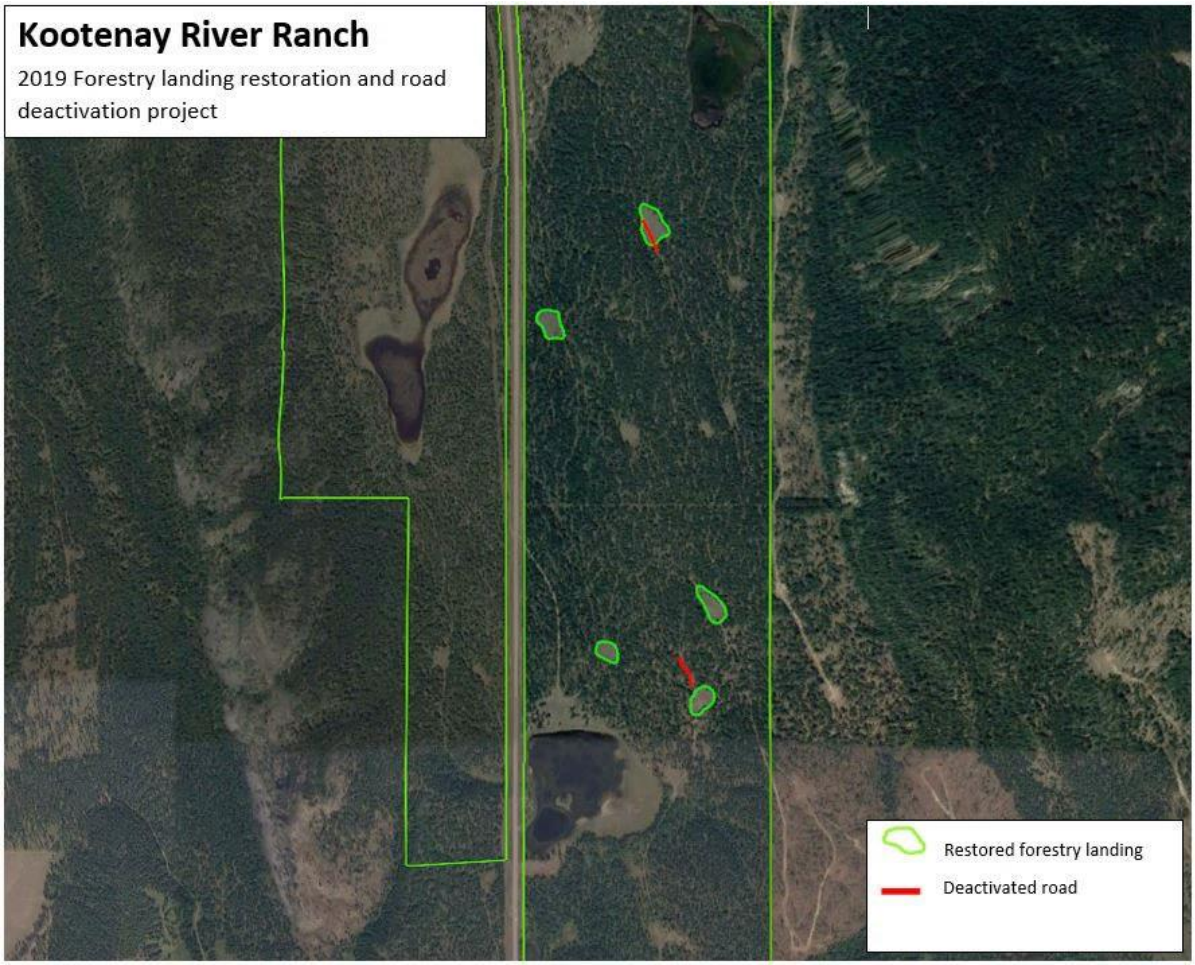

Figure 4. Location of landings sites restored on Kootenay River Ranch outlined in green, and road segments that were deactivated in red.

Results

Prior to commencement of earthmoving activities that would result in ground disturbance, NCC collaborated with the East Kootenay Invasive Species Council (EKISC) to treat invasive Spotted Knapweed infestations along road segments and on the landings that were slated for restoration. Invasive species contractors treated Spotted Knapweed using the herbicide Milestone in July 2019.

Restoration activities were carried out by local contractors in October 2019, focusing on five landings and two sections of road. In total, 3 ha of forestry landings were restored and ~230 m of redundant road segments were deactivated. Additionally, an old crushed car that had been dumped on the property was also hauled off site to a metal recycling centre.

Contractors restored landings by using an excavator with a digging bucket attachment to loosen and "roughen" the top 15 - 45 cm (up to 60 cm) of soil. This action worked to de-compact the soil, while at the same time allowed the machine operators to re-contour the landscape and smooth out steep edges. The depth that the soil was loosened to was variable in order to add structural diversity over the ground surface. Several pit and mound formations were also created to improve the availability of

sandy banks for use by Columbian Ground Squirrel. Machine operators avoided any patches that had well-established trees or shrub communities. All equipment was cleaned prior to being brought onto the work site and also travelling between landings to reduce the spread of invasive plant seeds.

Following the ground de-compaction, large woody debris and slash material sourced on-site was scattered over the loose and roughened soil. There was residual slash material available for this project due to forest thinning work that had been completed in the areas surrounding the landings in 2018/19. Once the slash material was spread out on the landings and the deactivated road segments, NCC staff and a volunteer heavily seeded all disturbed soil with a cover crop of rye grass as well as a blend of native grass seed that was customized for this project. Upon consultation with EKISC and other restoration experts NCC staff decided not to plant any woody vegetation (i.e. pots, plugs) at this stage because spreading additional grass seed is a more cost-effective way to establish a high density of native vegetation that can outcompete invasive species.

a. View of landing pre-restoration showing lack of vegetation development.

b. View of landing pre-restoration showing lack of vegetation development and abundant invasive plants.

c. Post-restoration view of one of the two redundant side roads that was also deactivated as part of this project.

d. Post-restoration view showing leftover logs from previous forest thinning restoration work being used as woody debris.

e. Post-restoration photo of a landing and one of two side roads that were deactivated.

f. Post-restoration photo of a landing showing good use of on-site woody debris to create a more natural landscape.

g. Photo of volunteer seeding a restored landing with a native grass mix.

h. Post-restoration photo showing pit and mound structures with variable depth, as well as pockets of shrubs left in place.

Discussion

Restoration of the old forestry landings on the Kootenay River Ranch conservation area was successful with five landings restored in total (3 ha) as well as 230 m of side roads that connected the landings to other well-used roads on the property. This restoration project complements forest restoration treatments from 2018/19 that were done on 38 hectares of the surrounding landscape, as it will provide additional habitat for wildlife species such as Columbian Ground Squirrel and thus attract American Badger back onto the landscape. De-compacting these landings and adding coarse woody debris will also deter cattle from lingering in these areas, reduce source populations of invasive plant species, and allow the re-growth of shrubs such as Saskatoon (*Amelanchier alnifolia*), which is an important forage for ungulates such as Elk and Mule Deer.

Recommendations

Several recommendations can be derived from this project:

1. Follow-up monitoring of treated areas should be an annual priority for NCC staff to determine effectiveness of restoration work.

2. 2020 invasive plant treatments on the property should be focused around these restored areas so that any outbreaks that occur as a result of the soil disturbance can be dealt with immediately.

3. NCC staff should monitor the restored landings regularly for signs of use by Columbia Ground Squirrel. Pre-treatment ground squirrel survey transects that overlap with this project will be monitored for increased ground squirrel use in subsequent years.

4. If treatment methods are deemed to be effective, NCC staff should continue to identify additional high priority areas for forest landing restoration that coincides with other management activities on the property such as forest thinning treatments and prescribed fire.

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Acknowledgements

The Nature Conservancy of Canada would like to acknowledge the financial support of the Fish and Wildlife Compensation Program on behalf of its program partners BC Hydro, the Province of BC, Fisheries and Oceans Canada, First Nations and public stakeholders.

Appendix 1 – East Kootenay Invasive Species Council final report

Nature Conservancy of Canada Invasive Plant Management in the East Kootenay Region

Annual Report 2019

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Introduction

The East Kootenay Invasive Species Council (EKISC) is a regional non-profit organization that strives to mitigate the negative environmental, social, and economic impacts of invasive species within the East Kootenay Region. Part of this work includes coordinating the inventory and treatment of invasive species on different land jurisdictions and fostering increased support for invasive species management. As such, EKISC worked with The Nature Conservancy of Canada (NCC) in 2019 to provide noxious and invasive plant control activities on eight NCC conservation properties, with treatment activities focusing primarily on high priority invasive plants, and secondarily on lower priority invasive plants as funding permitted to meet land management objectives. This report will provide information on areas that received treatments for noxious invasive plants in 2019, a summary of species treated and types of treatments performed, treatment monitoring notes, and a summary of recommendations for NCC invasive plant management in the East Kootenay's moving forward.

Management/Study Area

Invasive plant treatments occurred within the Regional District of East Kootenay (RDEK), which has been divided by EKISC into five primary Invasive Plant Management Areas (IPMAs), as shown in Figure 1. Each IPMA may be further divided into sub-IPMAs. The intent of delineating these units is to provide a more localized approach to prioritizing invasive plant species. For example, a certain species may be a Priority 1 in one sub-IPMA due to its extremely limited distribution (where the goal is to eradicate the species), whereas it may be considered a Priority 2 or 3 in another sub-IPMA if it has a much broader distribution (and it may be treated for annual control or containment purposes).

Properties that were targeted for invasive species management under this agreement were: Cherry Meadows, Columbia Lake Lot 48, Elk Valley Heritage Conservation Area, Flathead River Ranch, Kootenay River Ranch, Luxor Linkage, Marion Creek Benchlands and Morrissey Meadows.

Treatment Summary

EKISC combines available information from the Provincial Invasive Alien Plant Program (IAPP) database, previous treatments completed, site objectives, species priority status, existing funding, and adjacent land manager plant management efforts to allocate treatment dollars within each IPMA. Treatments are typically completed at the same time as nearby treatments to increase efficiency and better utilize a landscape level approach.

Treatments for noxious and invasive plants on NCC conservation properties commenced on July 3rd, 2019, and continued throughout the field season, ending on September 25th, 2019. A total of 85 sites were treated across the RDEK, using 6.69 L and 0.37 kg of undiluted herbicide, and covering an area of 11.27 ha. Tables 1-13 and Figures 2-15 summarize the invasive plant management that occurred on each property.

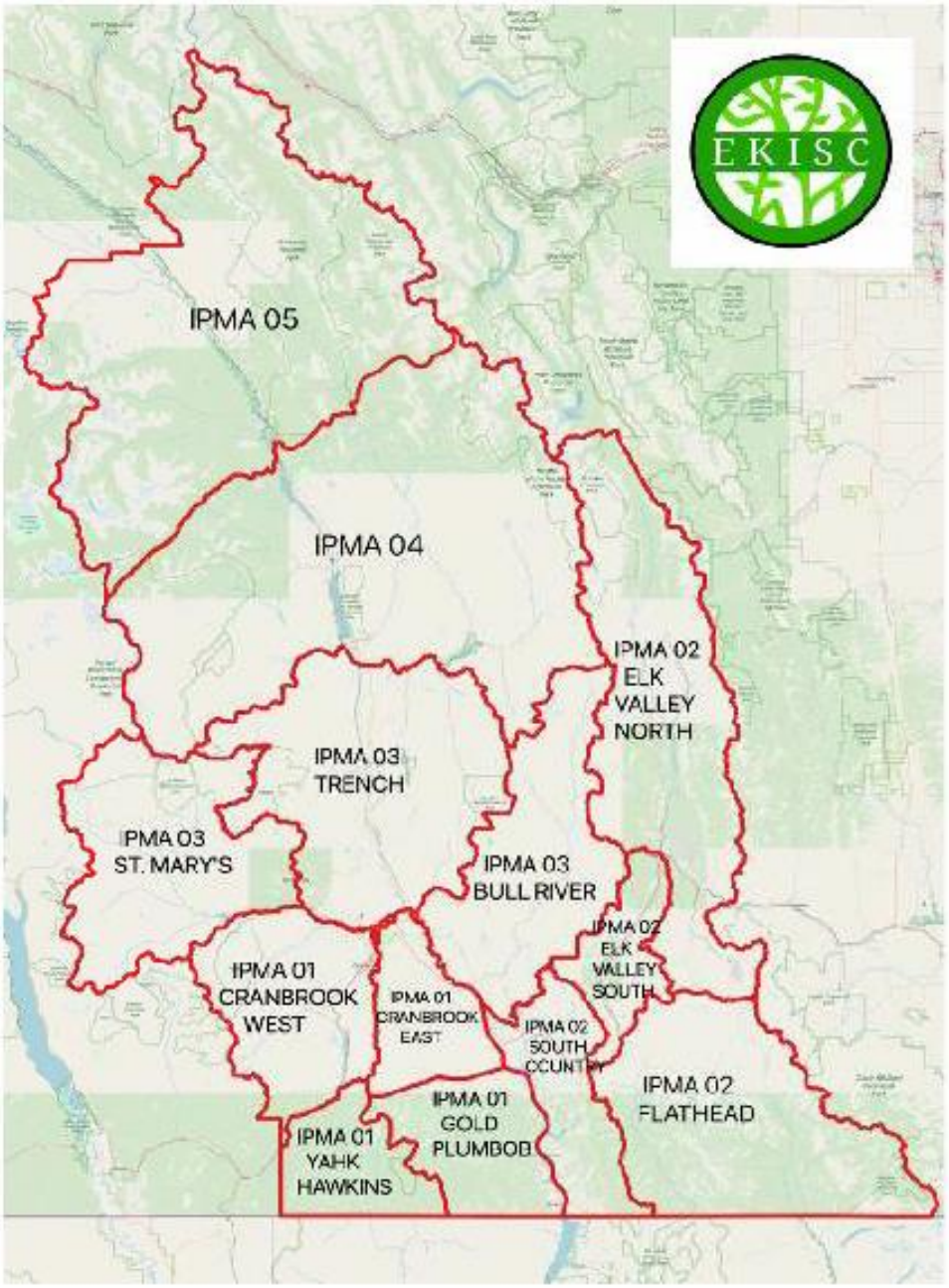

Figure 1. Invasive Plant Management Areas (IPMAs) within the Regional District of East Kootenay. Note that IPMA's 1 through 3 are further divided into sub-IPMAs.

Cherry Meadows

Mechanical invasive plant treatments on the NCC Cherry Meadows property was conducted on August 17th, 2019. The invasive plant treatment was a collaboration between EKISC, NCC, and several volunteers. Over 10 bags of Spotted Knapweed were pulled, covering an area close to 20 hectares. Figure 2 and Table 1 provide details of the treatments that occurred.

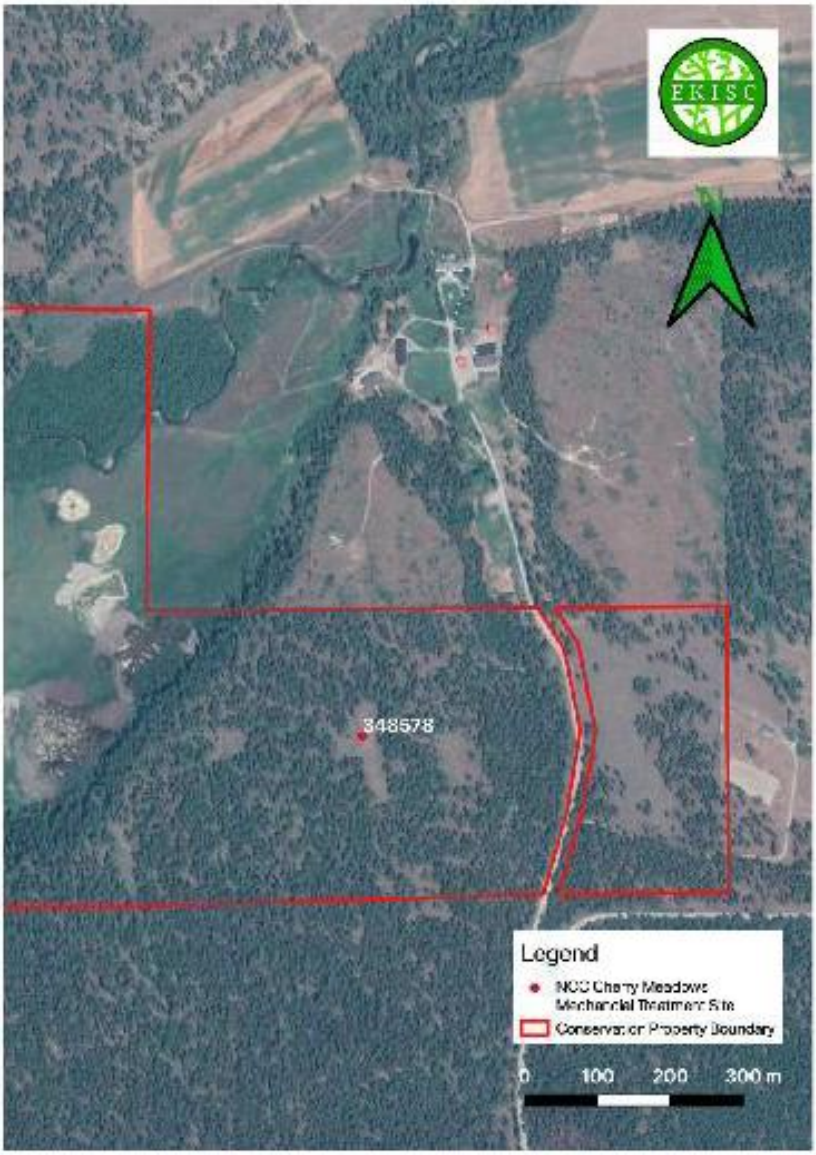

Figure 2. Map of the 2019 invasive plant mechanical treatment site at the NCC Cherry Meadows conservation property.

Table 1. Details of the mechanical invasive plant treatment that occurred on the NCC Cherry Meadows conservation property.

Site #	Invasive Plants Found	Treatment Method	Area Treated (ha)
348578	Spotted Knapweed	Hand pulling	0.5000

Figure 3. The team of volunteers and staff stand for a photo after a day of pulling Spotted Knapweed at the NCC Cherry Meadows conservation property.

Monitoring and Site-Specific Recommendations for the NCC Cherry Meadows Conservation Property

The NCC Cherry Meadows property is a good candidate site for ongoing mechanical treatments for Spotted Knapweed, as the previous landowner has been successfully managing the infestation and remaining plants are sporadic. Treatments should occur annually to continue suppressing the Spotted Knapweed and to keep informed of any new infestations that may arise.

Columbia Lake Lot 48

Invasive plant treatments on the NCC Columbia Lake Lot 48 property was completed on July 22nd, 2019. Figure 4 and Table 2 provide details of the treatments that occurred.

Figure 4. Map of the 2019 invasive plant treatment sites at the NCC Columbia Lake Lot 48 conservation property.

Table 2. Details of the invasive plant treatments that occurred on NCC Columbia Lake Lot 48 conservation property.

Site #	Invasive Plants Found	Treatment Method	Herbicide Used	Amount of Undiluted Herbicide Used (L)	Area Treated (ha)
303130	Diffuse Knapweed	Chemical - Boomless Nozzle	Lontrel XC	0.0070	0.0100
303131	Diffuse Knapweed	Chemical - Boomless Nozzle	Lontrel XC	0.0280	0.0400
324034	Spotted Knapweed	Chemical - Boomless Nozzle	Lontrel XC	0.0070	0.0100
			Total	0.0420	0.0600

Monitoring and Site-Specific Recommendations for the NCC Columbia Lake Lot 48 Conservation Property

The focus of chemical treatments at the NCC Columbia Lake Lot 48 property in 2019 was on higher priority Diffuse and Spotted Knapweed infestations. These infestations are found near the entrance of the property, or along main trails, and have a greater chance of spreading and contributing to new site establishment from hikers and recreationalists.

Figure 5. Photo of the small patches of Canada Thistle found on the NCC Columbia Lake Lot 48 property.

If funding permits, the limited Canada Thistle patches should be targeted for treatment in 2020. Canada Thistle sites are found mainly in areas where ground disturbance has occurred and bare ground has been left, and native vegetation has not recovered (Figure 5). It is recommended to chemically treat the Canada Thistle sites, along with the Diffuse and Spotted Knapweed sites, for consecutive years, and to follow up treatments with the seeding of native grasses. In order to ensure the success of effective invasive plant management strategies, treated invasive plant sites need to be seeded and fertilized with native grasses and forbs. Any bare ground areas are susceptible to further invasion of invasive plants from the seed bank that is already present.

Elk Valley Heritage Conservation Area

Invasive plant treatments on the NCC Elk Valley Heritage Conservation Area were completed on July 3rd, August 7th, August 9th, August 12th, August 15th, and August 28th, 2019 and was a collaborative effort from NCC, the Fish and Wildlife Compensation Program (FWCP), BC Hydro and the Ministry of Transportation (MOTI). Figure 6, Table 3 and Table 4 provide details of the treatments that occurred.

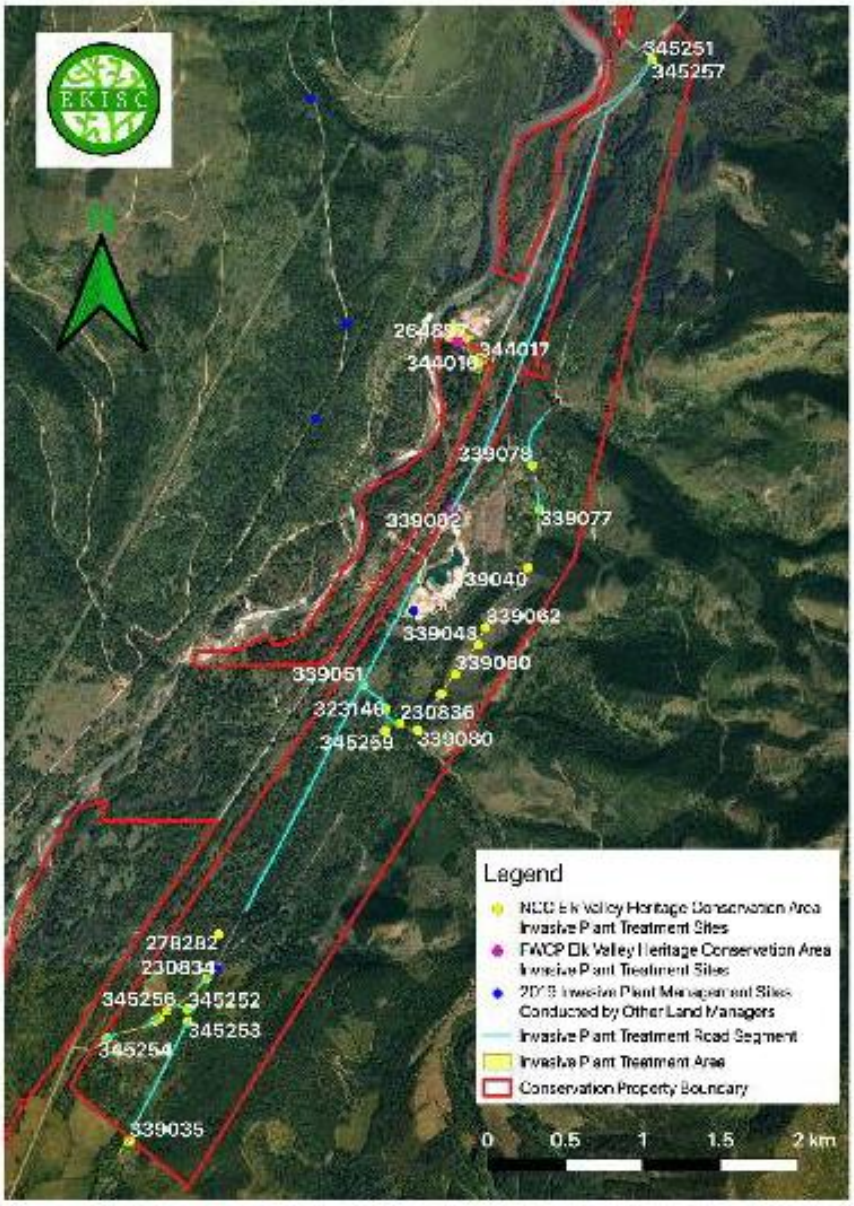

Figure 6. Map of the 2019 invasive plant treatment sites at the NCC Elk Valley Heritage Conservation Area.

Table 3. Details of the invasive plant treatments on Elk Valley Heritage Conservation Area funded by NCC.

Site #	Invasive Plants Found	Treatment Method	Herbicide Used	Amount of Undiluted Herbicide Used (L or Kg)	Area Treated (ha)
230834	Canada Thistle, St. John's wort	Chemical - Boomless Nozzle	Clearview	0.0027	0.3123
	Scentless Chamomile, Spotted Knapweed		Milestone	0.1493	
230836	Spotted Knapweed, Sulphur Cinquefoil	Chemical - Hand Gun	Clearview	0.0014	0.0068
278282	Scentless Chamomile, Spotted Knapweed	Chemical - Hand Gun	Clearview	0.0008	0.0041
323146	Sulphur Cinquefoil	Chemical - Hand Gun	Clearview	0.0005	0.0027
339035	Spotted Knapweed	Chemical - Hand Gun	Clearview	0.0247	0.1233
339040	Canada Thistle, Sulphur Cinquefoil	Chemical - Hand Gun	Clearview	0.0008	0.0041
339043	Canada Thistle, Scentless Chamomile, St. John's wort	Chemical - Hand Gun	Clearview	0.0006	0.0027
339051	Canada Thistle, Sulphur Cinquefoil, Wormwood	Chemical - Hand Gun	Clearview	0.0085	0.0425
339060	Canada Thistle	Chemical - Hand Gun	Clearview	0.0005	0.0027
339062	Canada Thistle, Scentless Chamomile, St. John's wort	Chemical - Hand Gun	Clearview	0.0014	0.0069
339077	Canada Thistle, Spotted Knapweed, Yellow/common Toadflax	Chemical - Hand Gun	Clearview	0.0044	0.0220
339078	Canada Thistle, Yellow/common Toadflax	Chemical - Hand Gun	Clearview	0.0069	0.0342
339079	Canada Thistle, Scentless Chamomile	Chemical - Boomless Nozzle	Clearview	0.0004	0.0060
	Canada Thistle, Scentless Chamomile	Chemical - Back Pack	Milestone	0.0020	
339080	Burdock species, Canada Thistle	Chemical - Back Pack	Milestone	0.0010	0.0020
344016	Canada Thistle, Spotted Knapweed, Yellow/common Toadflax	Chemical - Hand Gun	Clearview	0.0219	0.1097
344017	Canada Thistle, Spotted Knapweed, Yellow/common Toadflax	Chemical - Back Pack	Milestone	0.0150	0.0300
345251	Canada Thistle, Spotted Knapweed	Chemical - Boomless Nozzle	Clearview	0.2384	1.1918
345252	Spotted Knapweed, St. John's wort, Sulphur Cinquefoil	Chemical - Hand Gun	Clearview	0.0011	0.0054
345253	Scentless Chamomile, Spotted Knapweed, Sulphur Cinquefoil	Chemical - Boomless Nozzle	Clearview	0.0208	0.1041
345254	Scentless Chamomile, Spotted Knapweed	Chemical - Hand Gun	Clearview	0.0011	0.0055
345255	Scentless Chamomile, Spotted Knapweed	Chemical - Hand Gun	Clearview	0.0005	0.0028
345256	Spotted Knapweed	Chemical - Hand Gun	Clearview	0.0014	0.0068
345257	Spotted Knapweed	Chemical - Back Pack	Milestone	0.0065	0.0130
345258	Canada Thistle, Sulphur Cinquefoil	Chemical - Hand Gun	Clearview	0.0019	0.0096
345259	Common Tansy	Chemical - Hand Gun	Clearview	0.0003	0.0014
			Total	0.5148	2.0524

Table 4. Details of the invasive plant treatments that occurred on NCC Elk Valley Heritage Conservation Area funded by FWCP.

Site #	Invasive Plants Found	Treatment Method	Herbicide Used	Amount of Undiluted Herbicide Used (L or Kg)	Area Treated (ha)
264897	Blueweed, Canada Thistle, Spotted Knapweed	Chemical - Hand Gun	Clearview	0.0249	0.1247
264897	Scentless Chamomile, Spotted Knapweed	Chemical - Back Pack	Milestone	0.0060	0.0120
339082	Canada Thistle, Spotted Knapweed, Sulphur Cinquefoil	Chemical - Hand Gun	Milestone	0.1623	0.3247
339082	Canada Thistle, Spotted Knapweed	Chemical - Boomless Nozzle	Milestone	0.1767	0.3534
			Total	0.3699	0.8148

Monitoring and Site-Specific Recommendations for the NCC Elk Valley Heritage Conservation Property

Invasive plant treatments at the NCC Elk Valley Heritage Conservation area focused along the main roads throughout the property, treating higher priority Blueweed, Common Tansy, Scentless Chamomile and Spotted Knapweed sites. Additional lower priority species (i.e., Canada Thistle, Sulphur Cinquefoil, Yellow/Common Toadflax) were also treated when observed in the vicinity of the high priority species.
The NCC Elk Valley Heritage Conservation Area has many factors that contribute to the introduction and spread of invasive plant infestations on the property, for example: various points of public access; an active quarry causing disturbance and creating many invasive plant sites along it's perimeter; a BC Hydro right-of-way; its location adjacent to a weedy MOTI highway; its location adjacent to a weedy gravel pit; the Trans-Canada Trail passes through it; various land disturbances along the properties roadways; and it is used by various recreationalist groups (e.g., campers/hunters, ATV's).

It is recommended to continue invasive plant treatments in 2020, targeting the smaller high priority sites of Scentless Chamomile, Spotted Knapweed and St. John's Wort that were not treated in 2019, as well as to re-treat infestations (mainly large areas of Sulphur Cinquefoil) that were observed to be significantly decreased in size from successful 2018 treatments. The larger (over 2 ha) Spotted Knapweed infestations should also be prioritized to receive the biocontrol agent *Cyphocleonus* to assist with limiting their spread. This weevil overwinters as larvae in the root, stunting plant growth, and feeds on the seed head in the peak of summer, decreasing seed dispersal. EKISC will also provide recommendations to BC Hydro and MOTI to increase their invasive plant management efforts throughout and adjacent to this conservation property in 2020, citing the invasive plant management efforts and contributions by NCC and FWCP.

It is necessary that a collaboration between all land users in this area both contribute to invasive plant treatments and ensure invasive plant 'Best Management Practices' are implemented to limit the further introduction and spread of invasive plants on the conservation area. The limited BC Hydro funding allocated to the Elk Valley area was used to leverage invasive plant treatments throughout this property.

Flathead River Ranch

Invasive plant treatments on the NCC Flathead River Ranch property was completed on September 4th, 2019. Figure 7 and Table 5 provide details of the treatments that occurred.

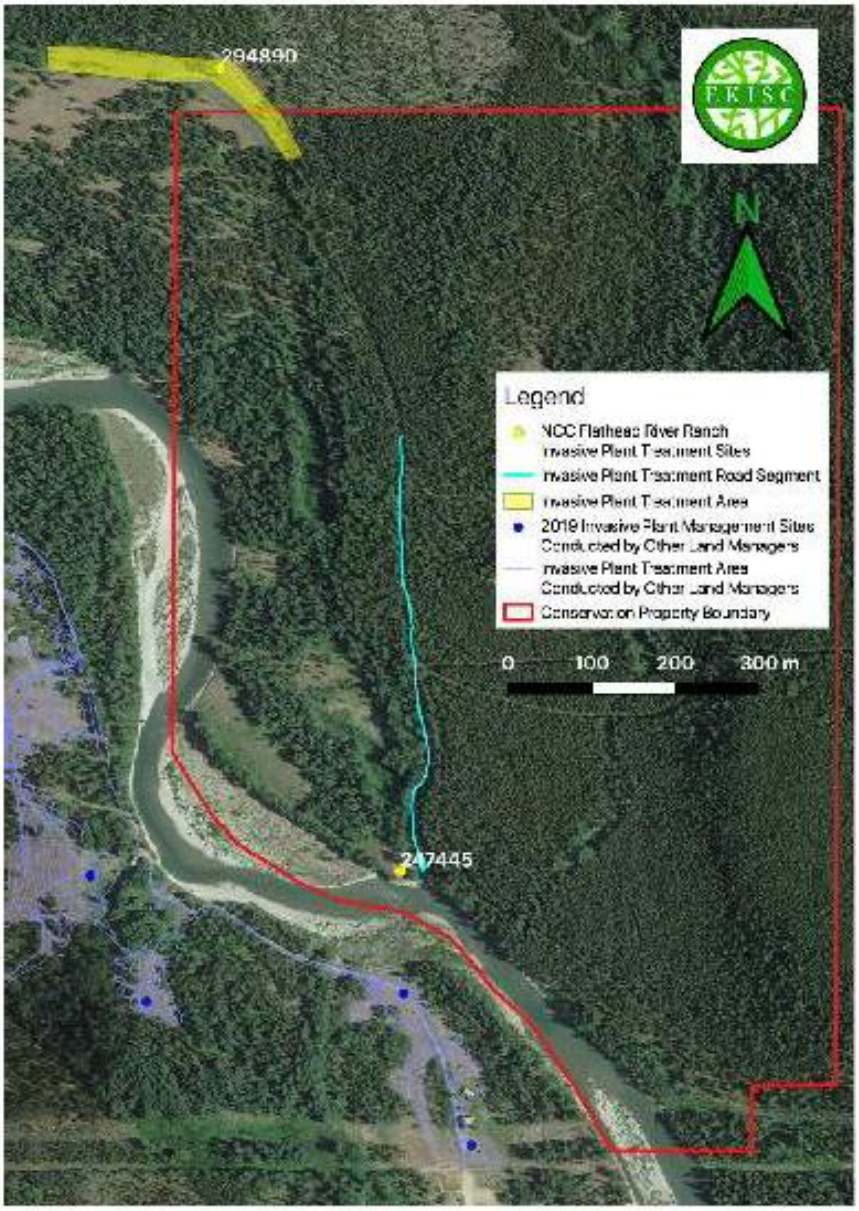

Figure 7. Map of the 2019 invasive plant treatment sites at the NCC Flathead River Ranch property.

Table 5. Details of the invasive plant treatments that occurred on NCC Flathead River Ranch property.

Site #	Invasive Plants Found	Treatment Method	Herbicide Used	Amount of Undiluted Herbicide Used (L)	Area Treated (ha)
247445	Spotted Knapweed	Chemical - Boomless Nozzle	Milestone	0.0967	0.3333
294890	Spotted Knapweed	Chemical – Hand Gun	Milestone	0.3866	1.3333
			Total	0.4833	1.6666

Monitoring and Site-Specific Recommendations for the NCC Flathead River Ranch Property

Flathead River Ranch is located at the very south end of IPMA 02 Flathead, adjacent to the United States border, which is a difficult and time-consuming area to access. EKISC is already conducting treatments along the Canada/US border for Crown-Indigenous Relations and Northern Affairs (CIRNA), and on BC Crown land in the vicinity of Flathead River Ranch for MFLNRORD, which creates the opportunity for efficient delivery of invasive plant treatments at the Flathead River Ranch, which otherwise may not be possible due to the cost of accessing the area.

Plant management efforts at Flathead River Ranch in 2019 were focused on a large Spotted Knapweed infestation located at the entrance of the property (Figures 8 and 9), as well as the east access road into the property. Without addressing this large, hillside infestation, it will continuously be the source for further Spotted Knapweed spread onto the conservation property.

As EKISC intends to continue invasive plant management with CIRNA and MFLNRORD in this area, it is recommended to continue invasive plant management at the Flathead River Ranch. It is recommended in 2020 to manage the Spotted Knapweed sites that are below the main hillside infestation, and sporadically along the west access trail into the property. These sporadic sites are at a very manageable size, and if addressed before the seed bank increases, we would expect to observe a significant decrease in the invasive plant population throughout the property over a short time period (approximately 5 years).

Figure 8. Photo of the dense Spotted Knapweed infestation covering the hillside at the entrance to the NCC Flathead River Ranch property.

Figure 9. Photo of the Spotted Knapweed infestation along the hillside and field at the entrance to the NCC Flathead River Ranch property. UTV travelled areas are observed from where the contractor boom sprayed the invasive plant infestation below the hillside and into the field.

Kootenay River Ranch

Invasive plant treatments on the NCC Kootenay River Ranch property were completed on July 13th, July 21st, July 22nd, and July 30th, 2019 and was a joint effort from NCC, FWCP, MFLNRORD "Wildfire Funding" and MOTI. Figure 10, Table 6, Table 7, and Table 8 provide details of the treatments that occurred.

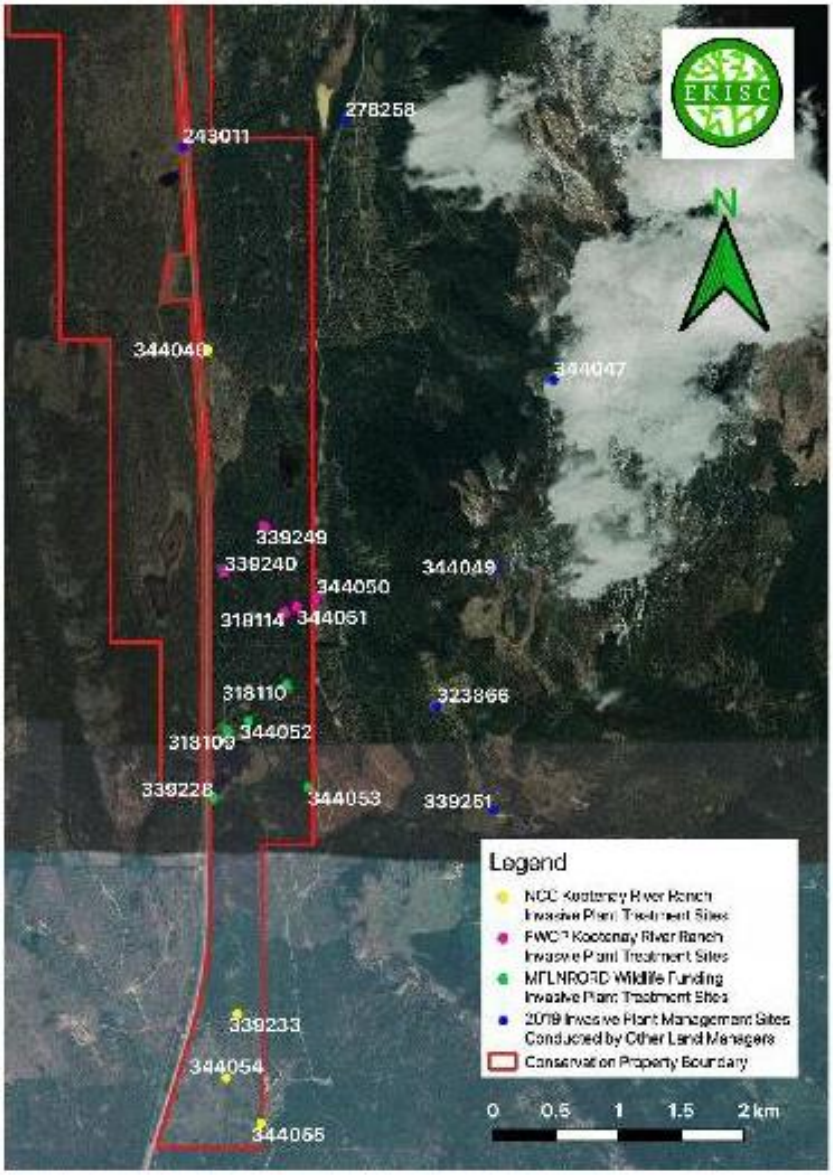

Figure 10. Map of the 2019 invasive plant treatment sites at the NCC Kootenay River Ranch Property.

Table 6. Details of the invasive plant treatments that occurred on NCC Kootenay River Ranch property funded by NCC.

Site #	Invasive Plants Found	Treatment Method	Herbicide Used	Amount of Undiluted Herbicide Used (L)	Area Treated (ha)
339233	Spotted Knapweed	Chemical - Boomless Nozzle	Milestone	0.1420	0.3550
344046	Spotted Knapweed, Yellow Hawkweed	Chemical - Boomless Nozzle	Milestone	0.3100	0.7751
344054	Spotted Knapweed	Chemical - Boomless Nozzle	Milestone	0.0340	0.0850
344055	Spotted Knapweed	Chemical - Boomless Nozzle	Milestone	0.0140	0.0350
			Total	0.5000	1.2501

Table 7. Details of the invasive plant treatments that occurred on NCC Kootenay River Ranch property funded by FWCP.

Site #	Invasive Plants Found	Treatment Method	Herbicide Used	Amount of Undiluted Herbicide Used (L)	Area Treated
318114	Spotted Knapweed	Chemical - Boomless Nozzle	Milestone	0.0600	0.1500
339249	Spotted Knapweed	Chemical - Boomless Nozzle	Milestone	0.2300	0.5750
344050	Spotted Knapweed, St. John's wort, Yellow Hawkweed	Chemical - Boomless Nozzle	Milestone	0.2500	0.6251
344051	Spotted Knapweed	Chemical - Boomless Nozzle	Milestone	0.0600	0.1500
339240	Spotted Knapweed, Yellow Hawkweed	Chemical - Boomless Nozzle	Milestone	0.5200	1.3000
			Total	1.1200	2.8001

Table 8. Details of the invasive plant treatments that occurred on NCC Kootenay River Ranch property funded by MFLNRORD Wildfire funding.

Site #	Invasive Plants Found	Treatment Method	Herbicide Used	Amount of Undiluted Herbicide Used (kg)	Area Treated (ha)
318109	Diffuse Knapweed	Chemical - Boomless Nozzle	Clearview	0.02	0.1
318110	Spotted Knapweed	Chemical - Boomless Nozzle	Clearview	0.03	0.15
339228	Diffuse Knapweed, Spotted Knapweed	Chemical - Boomless Nozzle	Clearview	0.02	0.1
344052	Diffuse Knapweed	Chemical - Boomless Nozzle	Clearview	0.1	0.5
344053	Spotted Knapweed	Chemical - Boomless Nozzle	Clearview	0.03	0.15
			Total	0.2	1

Monitoring and Site-Specific Recommendations for the NCC Kootenay River Ranch Property

Kootenay River Ranch had a very successful year of invasive plant treatments, with the collaboration of NCC, FWCP, MFLNRORD Wildfire, and MOTI. However, even with the leveraged funding, only higher priority Diffuse and Spotted Knapweed sites were addressed for herbicide treatment. Many skid trails are still seeing an increase in Knapweed spread. The Yellow Hawkweed infestations are becoming too vast across the landscape to manage. Grazing in the area is still a concern for the spread of Knapweed but appears to be better managed than it was in the past. If possible, it is recommended to increase invasive plant management efforts from all land managers to address all higher priority Knapweed sites, especially along main access pathways throughout the property.

Luxor Linkage

Invasive plant treatments on the NCC Luxor Linkage property were completed on August 8th and August 9th, 2019 and was a joint effort from NCC and FWCP. Figure 11, Table 9, and Table 10 provide details of the treatments that occurred.

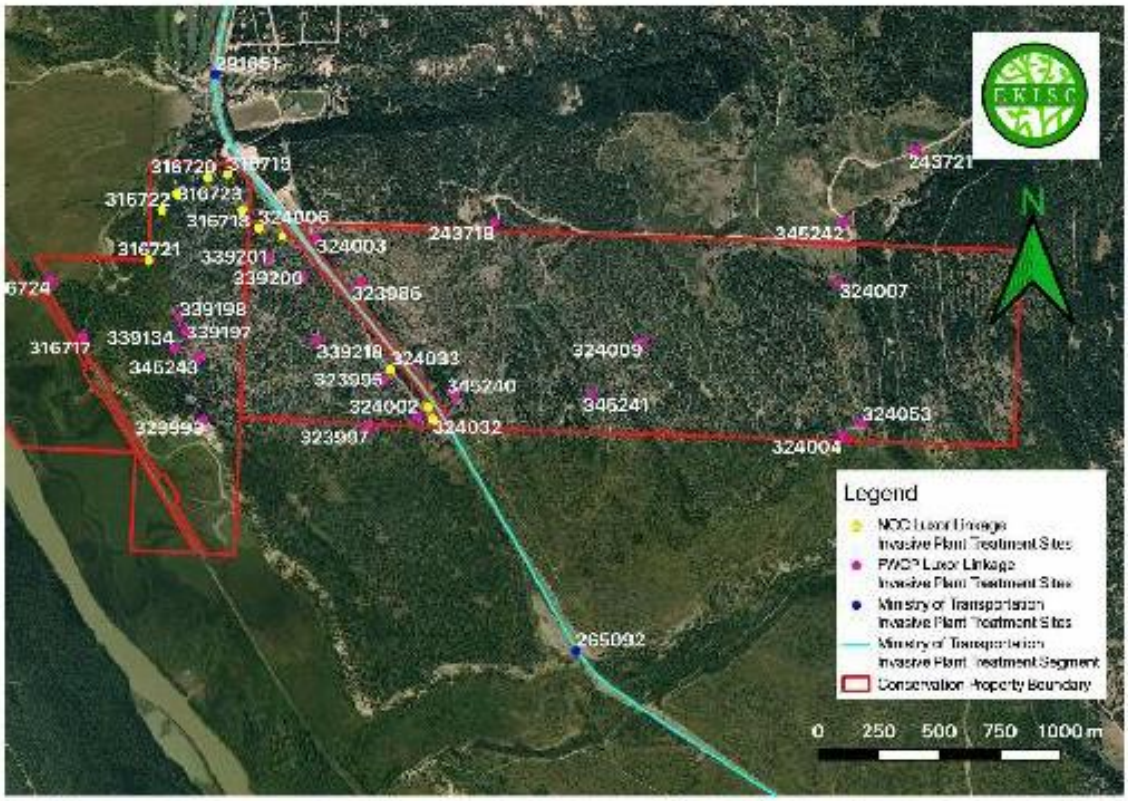

Figure 11. Map of the 2019 invasive plant treatment sites at the NCC Luxor Linkage Property.

Table 9. Details of invasive plant treatments that occurred on NCC Luxor Linkage property funded by NCC.

Site #	Invasive Plants Found	Treatment Method	Herbicide Used	Amount of Undiluted Herbicide Used (L)	Area Treated (ha)
316718	Spotted Knapweed	Chemical - Boomless Nozzle	Lontrel XC	0.0175	0.0250
316719	Spotted Knapweed	Chemical - Boomless Nozzle	Lontrel XC	0.0420	0.0600
316720	Spotted Knapweed	Chemical - Boomless Nozzle	Lontrel XC	0.0140	0.0200
316721	Spotted Knapweed	Chemical - Boomless Nozzle	Lontrel XC	0.0070	0.0100
316722	Spotted Knapweed	Chemical - Boomless Nozzle	Lontrel XC	0.0070	0.0100
316723	Spotted Knapweed	Chemical - Boomless Nozzle	Lontrel XC	0.0105	0.0150
324006	Spotted Knapweed	Chemical - Boomless Nozzle	Lontrel XC	0.0245	0.0350
324031	Spotted Knapweed	Chemical - Boomless Nozzle	Lontrel XC	0.1330	0.1900
324032	Spotted Knapweed	Chemical - Boomless Nozzle	Lontrel XC	0.0210	0.0300
324033	Spotted Knapweed	Chemical - Boomless Nozzle	Lontrel XC	0.2800	0.4000
324041	Spotted Knapweed	Chemical - Boomless Nozzle	Lontrel XC	0.0910	0.1300
			Total	0.6475	0.9250

Table 10. Details of invasive plant treatments that occurred at Luxor Linkage funded by FWCP.

Site #	Invasive Plants Found	Treatment Method	Herbicide Used	Amount of Undiluted Herbicide Used (L)	Area Treated (ha)
243718	Burdock species	Chemical - Hand Gun	Aspect	0.0225	0.0050
243721	Diffuse Knapweed	Chemical - Boomless Nozzle	Aspect	0.0225	0.0050
316717	Spotted Knapweed	Chemical - Boomless Nozzle	Lontrel XC	0.0560	0.0800
316724	Spotted Knapweed	Chemical - Hand Gun	Lontrel XC	0.1050	0.1500
323986	Leafy spurge	Chemical - Boomless Nozzle	Aspect	0.4725	0.1050
323993	Spotted Knapweed	Chemical - Boomless Nozzle	Lontrel XC	0.0035	0.0050
323995	Spotted Knapweed	Chemical - Boomless Nozzle	Lontrel XC	0.0105	0.0150
323997	Spotted Knapweed	Chemical - Boomless Nozzle	Lontrel XC	0.0035	0.0050
324002	Spotted Knapweed	Chemical - Boomless Nozzle	Lontrel XC	0.0105	0.0150
324003	Spotted Knapweed	Chemical - Boomless Nozzle	Aspect	0.0675	0.0150
324004	Spotted Knapweed	Chemical - Boomless Nozzle	Aspect	0.1800	0.0400
324007	Yellow Hawkweed	Chemical - Boomless Nozzle	Aspect	0.1125	0.0250
324009	Spotted Knapweed	Chemical - Boomless Nozzle	Aspect	0.0450	0.0100
324053	Spotted Knapweed	Chemical - Boomless Nozzle	Aspect	0.0675	0.0150
339119	Spotted Knapweed	Chemical - Boomless Nozzle	Lontrel XC	0.0070	0.0100
339134	Leafy spurge	Chemical - Hand Gun	Aspect	0.4950	0.1100
339197	Leafy spurge	Chemical - Boomless Nozzle	Aspect	0.2025	0.0450
339198	Spotted Knapweed	Chemical - Boomless Nozzle	Lontrel XC	0.0070	0.0100
339200	Leafy spurge	Chemical - Hand Gun	Aspect	0.1125	0.0250
339201	Spotted Knapweed	Chemical - Boomless Nozzle	Lontrel XC	0.0035	0.0050
339218	Spotted Knapweed	Chemical - Boomless Nozzle	Lontrel XC	0.0175	0.0250
345240	Spotted Knapweed	Chemical - Boomless Nozzle	Aspect	0.0675	0.0150
345241	Spotted Knapweed	Chemical - Boomless Nozzle	Aspect	0.0450	0.0100
345242	Spotted Knapweed	Chemical - Boomless Nozzle	Aspect	0.1125	0.0250
345243	Leafy spurge	Chemical - Hand Gun	Aspect	0.6683	0.1485
345243	Spotted Knapweed	Chemical - Hand Gun	Aspect	0.0743	0.0165
			Total	2.9915	0.9350

Monitoring and Site-Specific Recommendations for the NCC Luxor Linkage Conservation Property

Both the west and east side of the Luxor Linkage property received successful invasive plant treatments from funding provided by NCC and FWCP. Leafy Spurge is the priority for treatment on this property, but many Spotted Knapweed sites were targeted for treatment as well. Unfortunately, Leafy spurge is sometimes observed under the 'dripline' of trees, and with the herbicide that is used to effectively treat Leafy spurge, it is expected to see some degree of herbicide damage to a few of the trees on the property.

Figure 12. Photo of successful Leafy Spurge treatment leaving behind healthy grass cover to provide competition to any new germinating invasive plants

The old highway that runs through Luxor Linkage is the main infestation site of Spotted Knapweed, and the main source of spread into the property (presumably by wildlife walking and grazing through the infestation and onto the property transporting seeds). This site has been the focus for chemical treatments in the past, and very few 'old' plants were observed in 2019; only an abundance of young rosettes were present, indicating past treatments have been successful. Continued treatment of this area is necessary to eradicate germinating plants from the existing seed bank and prevent new seeds from setting.

Figure 13. Photo of successful Leafy Spurge treatments that encroach under the dripline of surrounding trees.

EKISC also recommends seeding densely infested areas after herbicide treatments, as there are often patches of bare ground left behind which are susceptible to further invasive plant establishment from the existing seed bank. Seeding native grasses and forbs can provide competition to germinating invasive plants and assist in decreasing the overall invasive plant populations.

Finally, it is recommended to meet with the Recreation and Control Services Officer ("Weed Officer") of the East Kootenay Regional District to discuss invasive plant management enforcement on the surrounding private properties. There are many private properties that are directly adjacent to the Luxor Linkage property that have invasive plant infestations which are spreading onto Luxor Linkage, or have high potential to spread onto the conservation property. These infestations will need to be addressed in order to support the long-term ecosystem health of the Luxor Linkage property.

Marion Creek

Mechanical invasive plant treatments on the NCC Marion Creek Benchland conservation property was conducted on August 7th, 2019. Only 1 bag of Spotted Knapweed was pulled at the Frocklage damn site, and the site was seeded with a native grass mix. Figure 14 and Table 11 provide details of the treatments that occurred.

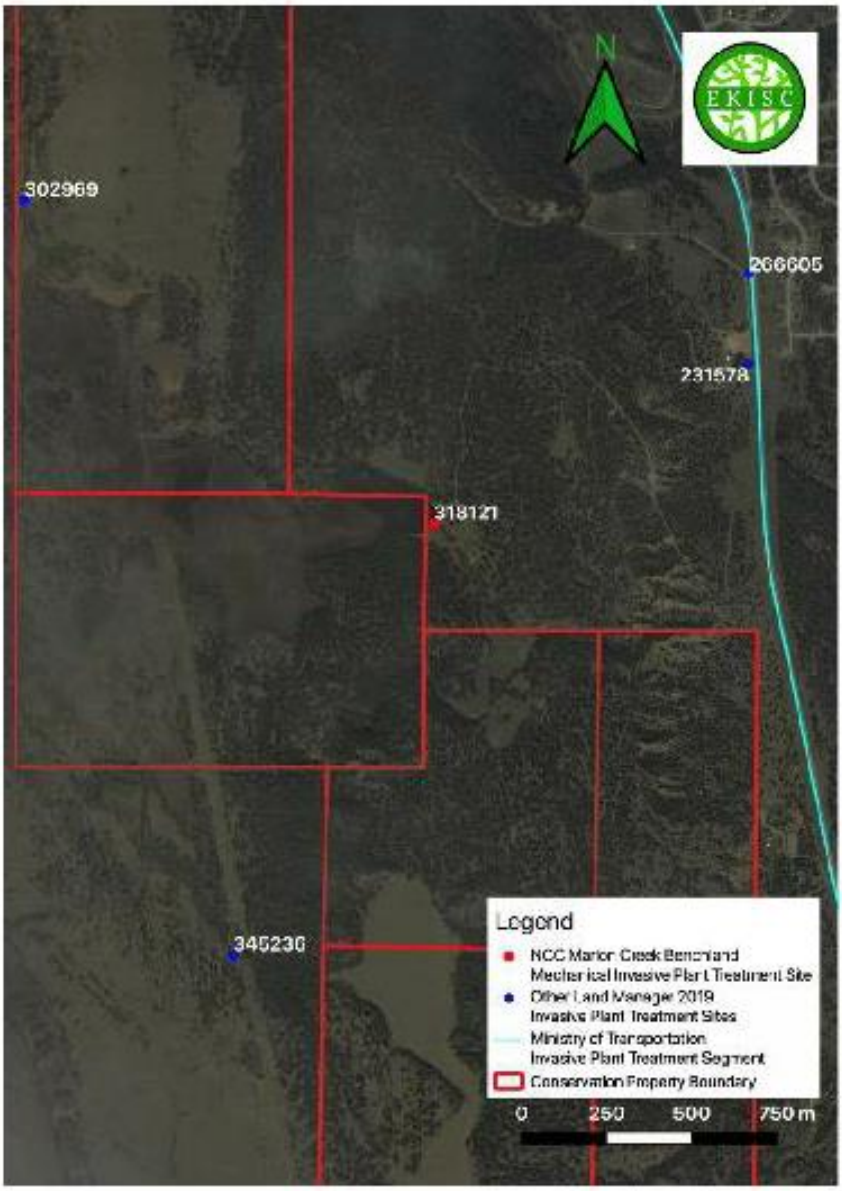

Figure 14. Map of the 2019 invasive plant mechanical treatment site at the NCC Marion Creek Benchland conservation property.

Table 11. Details of the mechanical invasive plant treatment that occurred on the NCC Marion Creek Benchland conservation property.

Site #	Invasive Plants Found	Treatment Method	Area Treated (ha)
318121	Spotted Knapweed	Hand pulling	0.01

Monitoring and Site-Specific Recommendations for the NCC Marion Creek Benchland Conservation Property

NCC has prioritized efforts to mechanically hand pull the Spotted Knapweed and Canada Thistle infestation at Frocklage dam for a few years. Although it may seem to be a slow process to see results, a decrease in infestation along the dam has been observed. Efforts from 2017, where a combined treatment of glyphosate spot treatment (from 1 m distance away of the high-water mark to the 10-m point) and hand pulling all plants within 1 m from the high-water mark, were decreased in 2019 to only pulling one bag of Spotted Knapweed. Native grass seed has been spread at this site for consecutive years, and is germinating in some areas, but not covering as much bare ground as needed to provide adequate competition for the germinating Spotted Knapweed plants. The grass seed may be vulnerable to the local waterfowl and adding fertilizer to the seeded areas to assist the germinating native grasses may improve grass seed response. It is strongly recommended to continue invasive plant management at this site (mechanically pulling and grass seeding) as the surrounding area is very limited in Spotted Knapweed and continued treatment at the Frocklage dam would reduce any chance of invasive plant spread onto the property.

Morrissey Meadows

Invasive plant treatments on the NCC Morrissey Meadows property was completed on September 17th, and September 25th, 2019. Figure 15 and Table 12 provide details of the treatments that occurred.

Table 12. Details of the invasive plant treatments that occurred on NCC Morrissey Meadows conservation property.

Site #	Invasive Plants Found	Treatment Method	Herbicide Used	Amount of Undiluted Herbicide Used (L)	Area Treated (ha)
252945	Burdock species, Canada Thistle, Caraway	Chemical - Boomless Nozzle	Milestone	0.1007	0.2014
339047	Common Tansy, Wormwood, Yellow/common Toadflax	Chemical - Hand Gun	Tordon 22K	0.1286	0.0286
345591	Spotted Knapweed, Wormwood	Chemical - Back Pack	Vantage XRT	0.0960	0.0160
345619	Yellow/common Toadflax	Chemical - Hand Gun	Tordon 22K	0.0643	0.0143
			Total	0.3896	0.2603

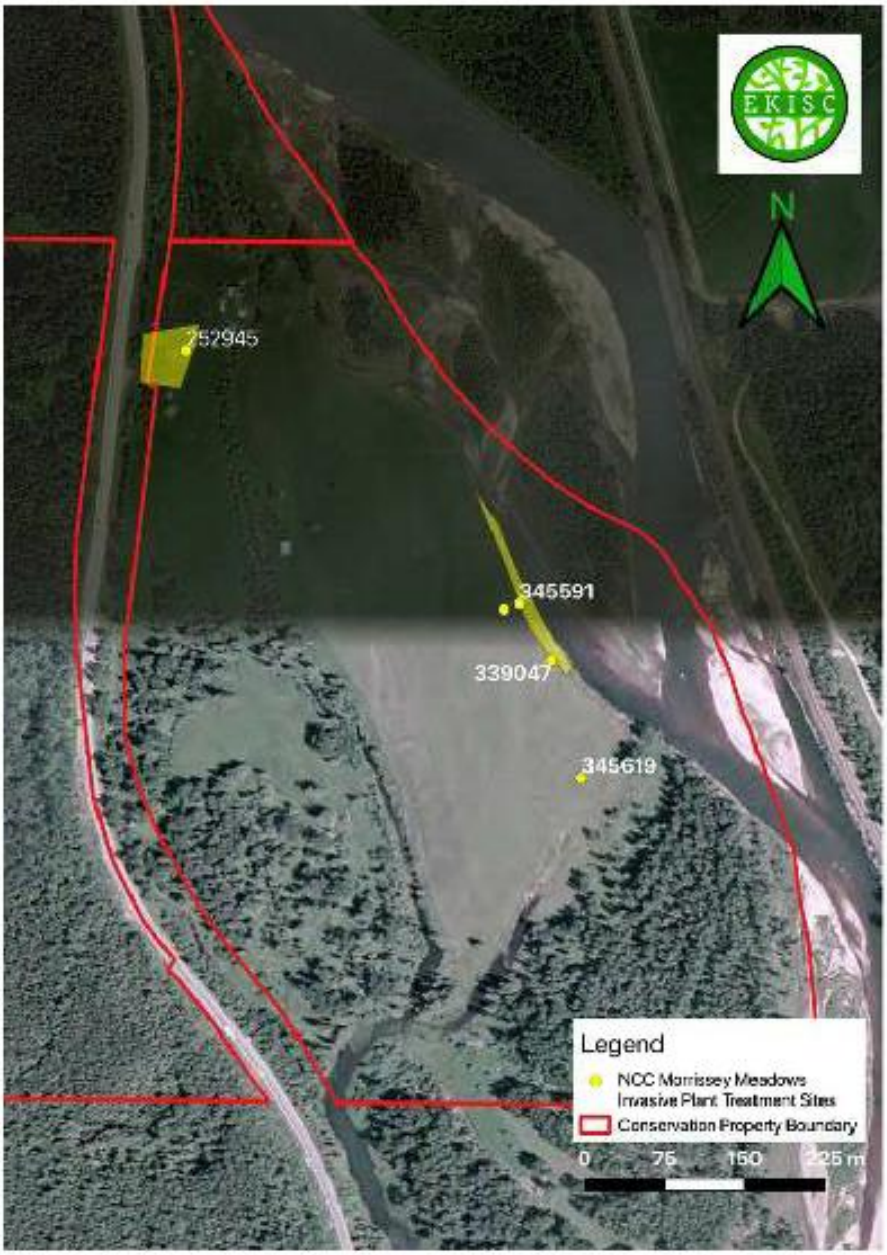

Figure 15. Map of the 2019 invasive plant treatment sites at the NCC Morrissey Meadows conservation property.

Monitoring and Site-Specific Recommendations for the NCC Morrissey Meadows Conservation Property

This is the second year that EKISC has been involved in invasive plant management at the NCC Morrissey Meadows property. There has been an extensive reduction in Burdock Species around the front farmyard from successful herbicide treatments. Higher priority species found around the haybarn, and adjacent to

the river (Burdock, Common Tansy, Spotted Knapweed, Wormwood and Yellow/common Toadflax) were targeted for treatment in 2019. However; due the vicinity to the river and the flooded backwater channel, glyphosate was the only option for herbicide control in this area as it is now considered riparian. In 2018, this area was dry and vegetated and a selective herbicide (Milestone) was used. Glyphosate use will result in bare ground, and it is recommended that native grasses are seeded in the early spring of 2020. These sites are all manageable with the current level of funding, and continued treatment is recommended for successful management of invasive plant infestations.

All the fields at Morrissey Meadows contain extensive Canada Thistle and Caraway infestation, and appear to be heavily grazed, which is a main contributor to the invasive plant infestation. The fields have yet to be targeted for treatment as it would require a significant increase in funding. If the area is to be intensely grazed in the future, it is not recommended to allocate invasive plant treatment efforts to the fields. If at some point the area is not to be grazed for a few years, restoration is possible with herbicide application using an UTV boom sprayer.

Funding

Table 13 lists the funders that participated in invasive plant treatments at NCC Conservation properties in 2019. Treatments at all eight properties were funded by NCC, with FWCP, MFLNRORD and BC Hydro contributing additional funds at Elk Valley Heritage Conservation Area, Kootenay River Ranch, and Luxor Linkage.

Table 13. Summary of the financial contributions from the different funding partners that contributed to invasive plant treatments on NCC properties in 2019.

Funding Source / Property	NCC	FWCP	MFLNRORD	BC Hydro
Cherry Meadows	$700.00			
Columbia Lake Lot 48	$1,000.00			
Elk Valley Heritage Conservation Area	$3,500.00			$1,900.00
Flathead River Ranch	$1,000.00			
Kootenay River Ranch	$2,000.00	$1,500.00	$2,500.00	
Luxor Linkage	$1,000.00	$1,500.00		
Marion Creek	$700.00			
Morrissey Meadows	$1,500.00			
Sub-Total	$11,400.00	$3,000.00	$2,500.00	$1,900.00
Total	$18,800.00			

Table 14. Breakdown of funding for invasive plant treatments funded by NTBC in 2019.

Property	Cost
Cherry Meadows	$188.28
Columbia Lake Lot 48	$649.52
Elk Valley Heritage Conservation Area	$2,206.50
Flathead River Ranch	$598.56
Kootenay River Ranch	$1,249.76
Luxor Linkage	$650.00
Marion Creek	$696.74
Morrissey Meadows	$942.90
Herbicide	$1,710.00
Monitoring and Data Entry	$1,140.00
Treatment Subtotal	**$10,032.26**
Administration	$1,367.74
Total	**$11,400.00**