Kicking Horse Canyon Habitat Enhancement Project – Project COL-F24-W-3934 Final Report

PREPARED FOR: FISH AND WILDLIFE COMPENSATION PROGRAM

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FWCP Fish & Wildlife COMPENSATION PROGRAM

Columbia Basin trust

GOLDEN DISTRICT ROD & GUN CLUB

FESBC
Forest Enhancement Society of British Columbia

HABITAT CONSERVATION TRUST FOUNDATION

Executive Summary

The Kicking Horse Canyon Habitat Enhancement Project funding provided by the Fish and Wildlife Compensation Program was put towards the on the ground treatment phase to move forward on FWCP Upland and Dryland Action Plan priority action - COLUPD.SOI.HB.30.01 Ungulate habitat enhancements-P1, Upland and Dryland Action Plan priority action - COLUPD.SOI.ME.32.01 Monitor wildlife use of created/restored habitats-P1. Treatment began in October 2022, and was continued in October 2023, with a total of 36 ha treated to date. A baseline of habitat use data has been collected through pellet plot surveys in the project area. These surveys are ongoing to quantify habitat use changes as treatment moves forward, with three years of pellet count data completed. To mitigate concerns of invasive weed spread, a survey and treatment planning has occurred to address current infestations and potential points of weed spread in the project area. The Golden District Rod and Gun Club (GDRGC) has worked with stakeholders including government ministries, First Nations, local NGOs, and industry to collaboratively progress this project. Growth in costs, post covid, and an unstable labour work force have resulted in project setbacks and decreased productivity. An increase in funding was requested for this next season to reflect these inflated costs.

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Introduction

This project is progressively enhancing Ungulate Winter Range (UWR) habitat near the Yoho National Park boundary. The area of focus for this project is the south facing winter range habitat on the benches north of the TransCanada Highway, which have been previously treated for habitat enhancement (1985). Planned enhancement works includes spacing immature forest, brushing forest ingrowth, limbing trees and burning waste. The goal of this project is to maintain previously treated UWR for Rocky Mountain elk (*Cervus canadensis*) and support habitat connectivity on a landscape scale. We aim to enhance approximately 112ha of habitat increasing the availability of quality elk winter range on the landscape. This habitat enhancement will also benefit mule deer (*Odocoileus hemionus*), white tailed deer (*Odocoileus virginianus)*, and mountain goat (*Oreamnos americanus)*. Additionally, we have the goal of building meaningful working relationships with local First Nations.

This area of ungulate winter range was identified through 2020 FWCP project seed funding Golden Area Ungulate Winter Range Project Development (Gustafson, 2021) and moved forward to address project recommendations. The 2021 Project initiated an effectiveness monitoring program, identified project treatment unit boundaries, developed treatment unit prescriptions, conducted stakeholder engagement, and received approval to move forward with on-the-ground enhancement works. May 2021 saw the beginning of habitat use monitoring through annual pellet counts, with the fourth season set to be completed May 2024. Pellet plot data has been summarized in Appendix A and will be updated with each spring data collection. Treatment began in October 2022 and has continued in October 2023, with a total of 35 ha completed as of April 2024.

This report is largely a reproduction of last year's technical report with updates to include this past year's effectiveness monitoring results, provide details on the progress of treatments, detail public outreach and engagements, and highlight lessons learned and the challenges faced by the project.

Goals and Objectives

The goal of the Kicking Horse Canyon Ungulate Habitat Enhancement Project is to enhance previously treated ungulate winter range for Rocky Mountain elk and support habitat connectivity on a landscape scale. We aim to treat 112ha of habitat to increase the availability of elk winter range between the Town of Golden and Yoho National Park. The long-term goal of this project is to enhance winter range habitats for Rocky Mountain elk in the Kicking Horse Canyon.

Long-term project objectives:

1) Establish an effectiveness monitoring protocol to compare habitat use prior to treatment and post treatment;

2) Treat habitats to improve forage availability, sightlines, and habitat connectivity.

These objectives align with the FWCP habitat-based actions COLUPD.SOI.HB.30.01 Ungulate habitat enhancements-P1 and COLUPD.ECO.HB.13.01 Improvement of connectivity habitats-P1. This project will implement enhancement in transitional and winter habitats, with the outcome of improved habitat for ungulates. Completion of this project will result in improvement of connectivity as well. Through enhancement of this area for optimal ungulate winter range, connectivity between seasonal ranges. This site is located at the edge of Yoho National Park, and this general area is an important buffer for both the park and the TransCanada Highway.

Study Area

Vacation Creek

The Project site is located 25 kms east of the town of Golden and 6 kms west of the Yoho National Park boundary. This area is predominantly south facing and is within the Dry Cool Montane Spruce (MSdk) ecosystem which is suggested to provide areas of high value elk winter range habitats (MacKillop, D.J., A.J. Ehman, K.E. Iverson, 2018). The area targeted by this project was previously treated for habitat enhancement in the mid-80s by the GDRGC. Tree planting followed up the previous slash and burn treatment resulting in a stem density (1125-4600 stems/ ha) that prevents understory forage growth, predator detection and the movement of animals across the landscape (Klafki and Pezderic, 2005; J.B. Nyberg, 1990). The target areas for treatment are immediately uphill of the TransCanada Highway (figure 1).

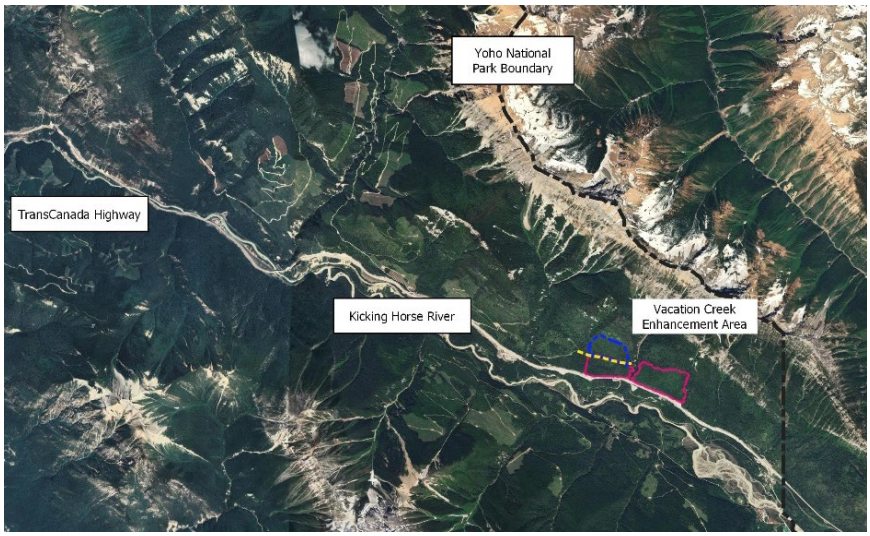

Figure 1: Vacation Creek Project Area in relation to the TCH, Kicking Horse River and Yoho National Park.

Methods

Effectiveness Monitoring

One of the project objectives is to monitor the relative populations and habitat use of ungulates within the project area pre and post-treatment, to understand ungulate responses to the habitat enhancement treatments. Ungulate species that may be present in the project area include: mountain goat *(Oreamnos americanus)*, Rocky Mountain elk, white-tailed deer *(Odocoileus virginianus),* mule deer *(O. hemionus),* and moose *(Alces alces).* Figure 2 shows the grid pattern used to space out pellet count plots in the treatment area. Details of the Effectiveness Monitoring Plan are presented in Appendix A.

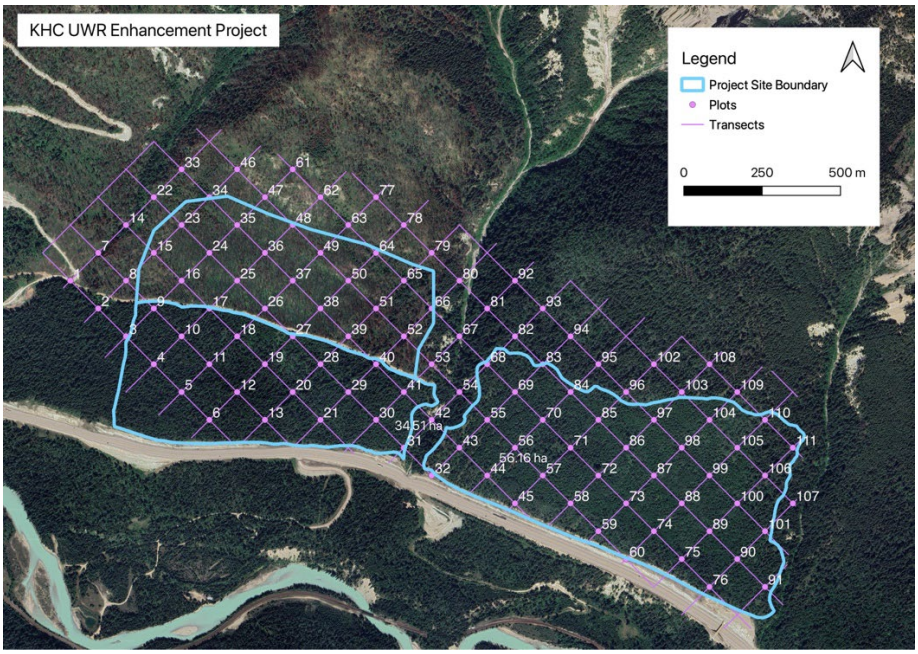

Figure 2: Grid for pellet count data collection

Data Collection

Fecal pellet group counts were determined to be a suitable, reliable, and economical monitoring method for the project area. The interior Douglas fir IDFdk5, and montane spruce MSdk biogeoclimatic zones are relatively dry ecosystems (Mackillop et al., 2018), in which the decomposition rate of fecal pellets is greater than the annual sampling intervals. This method is commonly used to estimate relative abundance (or absolute abundance with greater margins of error), based on assumptions of a defecation rate and total days of occupancy on a winter range (Resources Inventory Committee, 1998). Bounded circular plots, as described by (Rogers et al., 1958) were chosen as the most suitable sampling design for the project area, as this method is known to balance cost and effort with precision and accuracy (Resources Inventory Committee, 1998). See Appendix A for detailed description of data collection methods.

Habitat Treatment

Plots were established that sampled the forest structure in the planned treatment units. These plots measured stem density, species composition and collected site data used for ecosystem classification. These data in conjunction with professional judgement assisted in the development of the treatment prescriptions. Brian Amies, RPF, worked with the GDRGC to complete treatment prescriptions

for the project. The treatment area is within the Pacific Woodtech forest tenure area in the Golden Timber Supply Area, prescription development considered PWTs interest in harvesting in the areas.

Following the completion of treatment prescription development, these were forwarded to the Shuswap Band and the Ktunaxa Nation Council for review and comment. After adjustments, the final agreed upon prescriptions were then appended to a timber cash sale through the MOF. Approval was granted and enhancement works began in October 2022. A new cash sale permit was approved for the 2023-2024 treatment season and will need to be renewed for 2024-2025.

The development of treatment prescriptions for the Project Site considered current forest structure and long-term goals for the area that would balance the need for forage production and snow interception. Snow depth is one of the most limiting factors in ungulate winter range habitats (Poole and Mowat, 2005). The goal in prescription development is to open the forest enough to allow for light penetration to stimulate forage growth while maintaining enough crown cover for snow interception. The primarily immature forest in the Project Site is very dense in areas (up to 4200 stems/ha) and has a diversity of tree species including Douglas fir *(Pseudotsuga menziesii),* trembling aspen *(Populus tremuloides),* paper birch *(Betula papyrifera),* and Engelmann spruce *(Picea engelmannii).*

A wildfire burned through a portion of the Project Site in the summer of 2021, delaying some field works and the development of prescriptions for a portion of the original planned treatment area. The GDRGC plans to work in collaboration with PWT and the MoF to find a suitable approach to enhancement in the burned portion of the planned enhancement area. Potential treatment options in the burned area include tree planting, native grass seeding, brushing of patches of dense residual burned stems and potentially, no treatment. Treatment requirements in the burned portion of the project area will be determined in the later stages of the project.

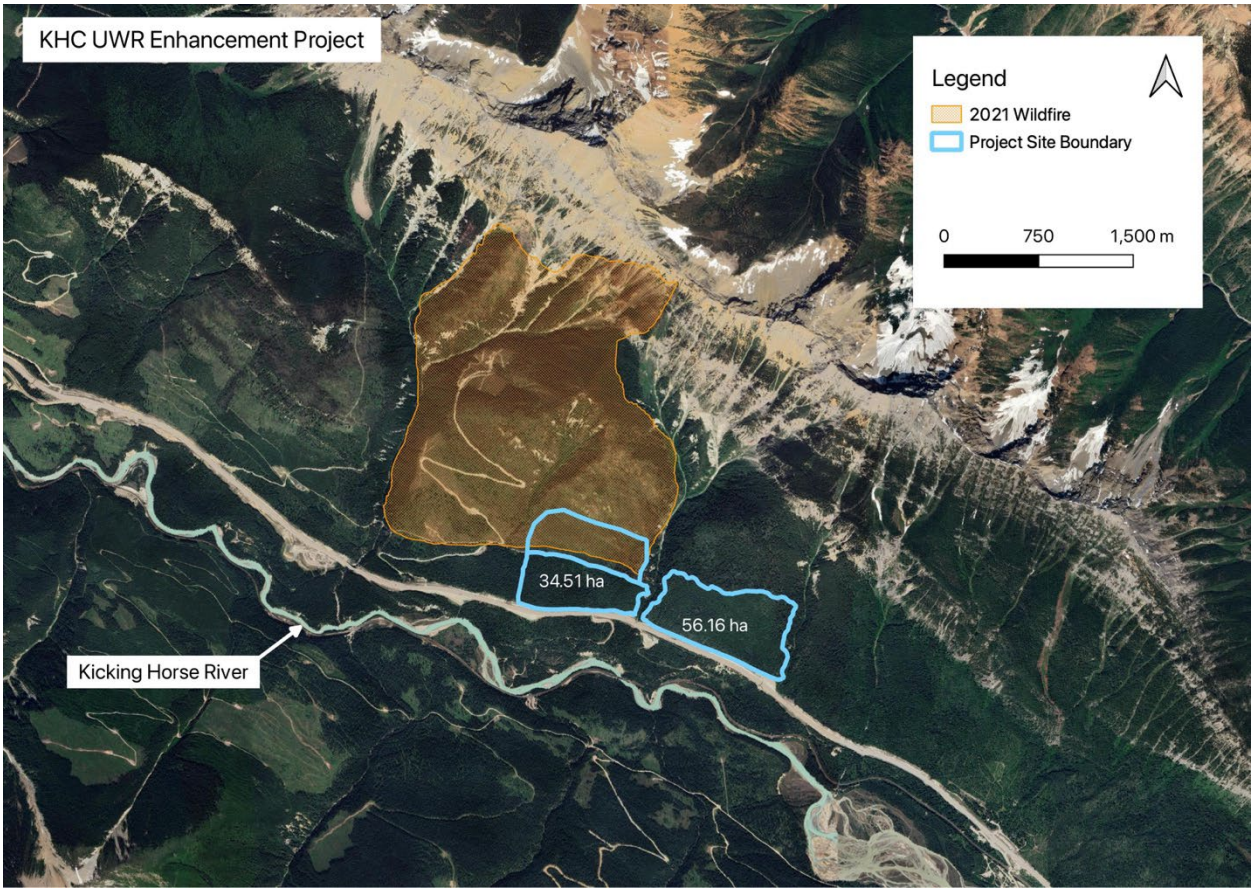

Figure 3: The Vacation Creek Project Site with the 2021 wildfire boundary

Noxious and Invasive Weeds

The identification of areas of with established noxious or invasive species was a priority in the initial planning of the project. Understanding that disturbance work, such as forest thinning, and the moving of personnel and equipment can contribute to the spread of weeds we worked with The Columbia Shuswap Invasive Species Council to conduct surveys of key areas in the project area that could have infestations of species of concern. No areas of concern were encountered or disturbed in the 2023 treatment season. And a proactive approach to combat the establishment of invasive species was taken by seeding burned areas with a regionally approve grass seed mixture. This approach will continue following the completion of 2023-2024 treatments. We will continue to monitor for the establishment of invasive species and take action as needed if concerns arise.

Results and Outcomes

Habitat Treatment

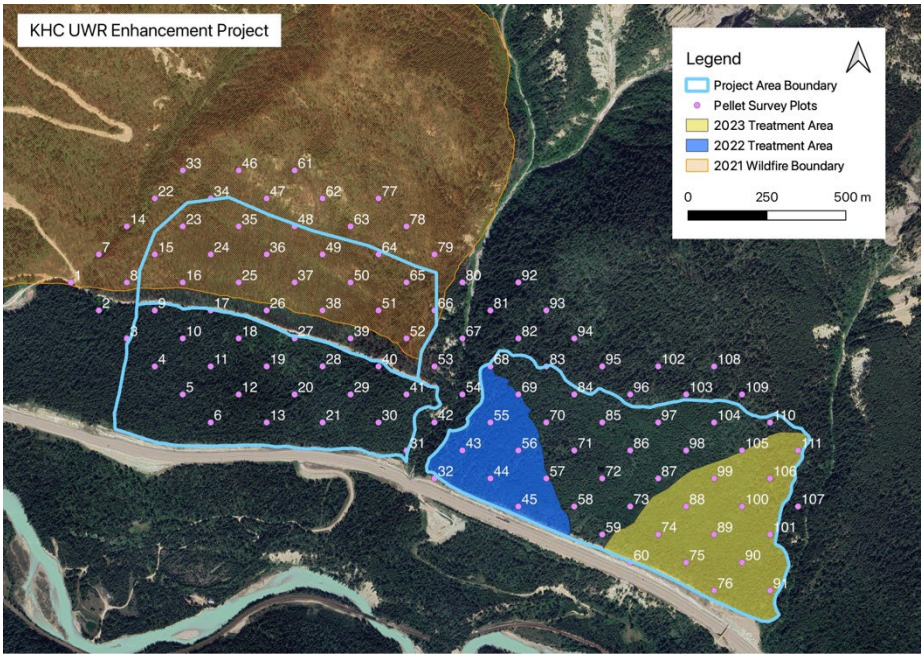

Figure 4: Map showing areas of treatment from 2022 and 2023 seasons

In the 2023 treatment season, the Golden Fire Jumpers were contracted to complete the work. They have carried out exemplary brushing work in approximately 21 ha of habitat along the southeastern portion of the project site (figure 4). This brings the total treated area up to 36 ha. Post and Pre-treatment photos are displayed in figure 5 and 6.

Figure 5: Photos taken during treatment in fall 2023 showing open forest conditions resultant of the prescribed treatment.

Figure 6: Pre-treatment conditions with thick immature forest.

Ongoing Monitoring

Plot sampling for pellet groups is conducted each spring in the treatment area. Two years of pre-treatment data have been collected (2021, 2022), as well as one year of post-treatment data (2023), with May 2024 coming up as the second pellet survey collecting post-treatment data. For detailed results of effectiveness monitoring, see Appendix A.

Motion activated cameras (5) were deployed in the project area to assist in determining herd demographic and habitat use where were effective in capturing movements in the spring of 2024. These photos will continue to supplement the data that we are collecting though the project life.

The figures below are examples of the photos collected in the project area.

Figure 7: Bull elk captured by motion activated camera in the Vacation Creek treatment area.

Figure 8: Bull elk captured by motion activated camera, spring 2024.

Community Engagement

This project has gone through many stages of development and funding applications, engaging government, First Nations, local NGOs, industry, and other land users has been a top priority throughout the process. Government and stakeholders engaged include:

- Shuswap Band
- Ktunaxa Nation Council
- Ministry of Transportation and Infrastructure
- Pacific Woodtech
- Ministry of Forests
- Wildsight Golden

GDRGC has prioritized a collaborative atmosphere with this project and has put substantial effort into public outreach as well. Two short films (figure 9), produced in September 2021 and December 2022, have highlighted the benefits of this project to local wildlife. The Kicking Horse Habitat Enhancement Project was also presented at the annual GDRGC open house and BBQ, as well as the 2023 and 2024 AGM meetings. The project will again be presented at the 2024 open house and BBQ in June, as the GDRGC is very proud of the work we have done on this project. We continue to provide project updates through social media, shared across the conservation community and local pages tagging and acknowledging project funders.

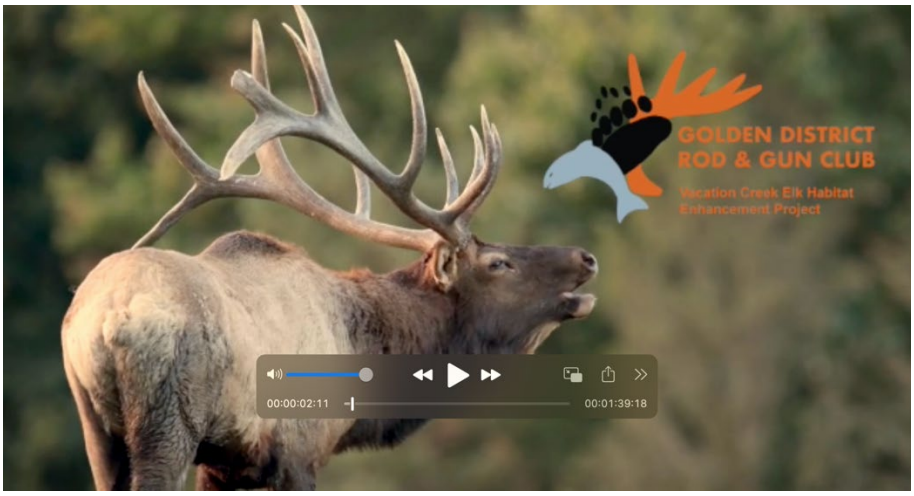

Figure 9: Short film describing the project and benefits produced in December 2022 and shared on GDRGC social media.

Challenges and Lessons Learned

Project work is not without unforeseen complications, the impacts of natural disasters, inflation of costs, and staffing shortages. To date, this project has experienced it's share of complications.

A wildfire swept through the northeastern corner of the planned project in 2021 requiring a pivot in project treatment planning. A positive light can also be shone on this event as this wildfire will allow for a side-by-side comparison of the effectiveness of wildfire versus mechanical treatment in enhancing elk winter range habitats.

2022, saw the first year of on the ground treatment works. We had originally worked with and priced this project proposal with quotes provided, during covid, by a regional First Nation's contractor who was not able to staff the project when clearing was to commence. With a short window to secure a contractor to complete the planned work for 2022 and increased costs associated with post-covid inflation, our costs far exceeded what we had planned to be completed. Our cost override in 2022 was realized in the winter of 2022, past the applications submission deadlines for 2023 so the change in cost were not reflected in this year's (2023-2024) work, putting the project behind in production for the second year in a row. Our approved funding for 2024-2025 reflects the increase of costs and future applications will be more inclusive of inflation as a result of this learned lesson.

The 2023 treatment was very productive producing high-quality treatments, but staffing was the challenge for the year. Treatments progressed through the entire winter concluding in April 2024 because of periods of reduced availability of workers. The Golden Fire Jumpers pushed to meet project goals for the year working to the edge of seasonal elevated risk windows for wildfire and nesting bird hazards. Staffing will likely continue to be a factor to consider moving forward with this and other projects. We will look to separate treatment areas into smaller contracts and will reach out to more contractors in the area in the future to combat this issue.

Discussion

Funding provided by the FWCP under project COL-F23-W-3723 and previous projects has supported the development of treatment prescriptions, the delineation and surveying of treatment area boundaries, the surveying and planning for the management of invasive and noxious weeds, the engagement of important project partners, government and stakeholders and on the ground treatments.

Funding for the Kicking Horse Canyon Habitat Enhancement Project has also been provided by the Columbia Basin Trust Ecosystem Enhancement Program which is planned to be spread over five years for a total of $550,000. Further funding has been provided through the Fish and Wildlife Compensation Program to continue with the progress of this portion of The Project. The coming year will consist of mostly field-based work, including spring 2024 pellet counts and fall to winter 2024 treatments, followed by data analysis of habitat use, reporting and continued application for funding. The Habitat Conservation Trust Foundation and Forest Enhancement Society of British Columbia have also been contributing to the project with a $63580 contribution in 2023-2024.

Due to rising costs in many sectors, the past two treatment seasons have not been able to meet the goal of 30 ha treated per year. Unfortunately, we have had to adjust our expectations until an updated budget could be requested for the 2024-2025 project year. Originally, 112 ha was to be thinned, however the 2021 wildfire burned 24 ha which will need a different prescription as it grows in (2-3 years). With 35ha now treated, 77 hectares for the remaining three field seasons (26ha/year).

Recommendations

This project will require additional data collection to support effectiveness monitoring and habitat use. Spring pellet counts should continue annually for several years after treatment is complete to understand how animals are using the treated area.

Additional work is required to plan enhancement in the area that burned in the summer of 2021. Developing a plan for treatment of this burned area should include PWT and their plans for development in the area. Road deactivation to remove the fireguard built to fight this fire should be considered in future treatments. Temporary fireguard access roads were removed by MOF contractors in the fall of 2022.

In the more distant future (10+ years), this area will need to be maintained to prevent the heavy conifer ingrowth that occurred after treatment in the 1980's. A critical aspect of good ungulate habitat is adequate sightline. Elk and deer are hesitant to use habitat where their natural predator avoidance behaviour is hindered by overly dense vegetation. Sightlines are directly related to vegetation density. Measuring sightlines through an established method will inform future maintenance schedules for habitats that have been enhanced in this area.

Low intensity spot fires could be used to assist in maintaining habitats into the future. The GDRGC will work on consulting experts to determine the possibility of using fire for future maintenance of these habitats.

Figure 10: Vacation Creek treatment area- Post Treatment, 1985 – Photo from GDRGC Archives

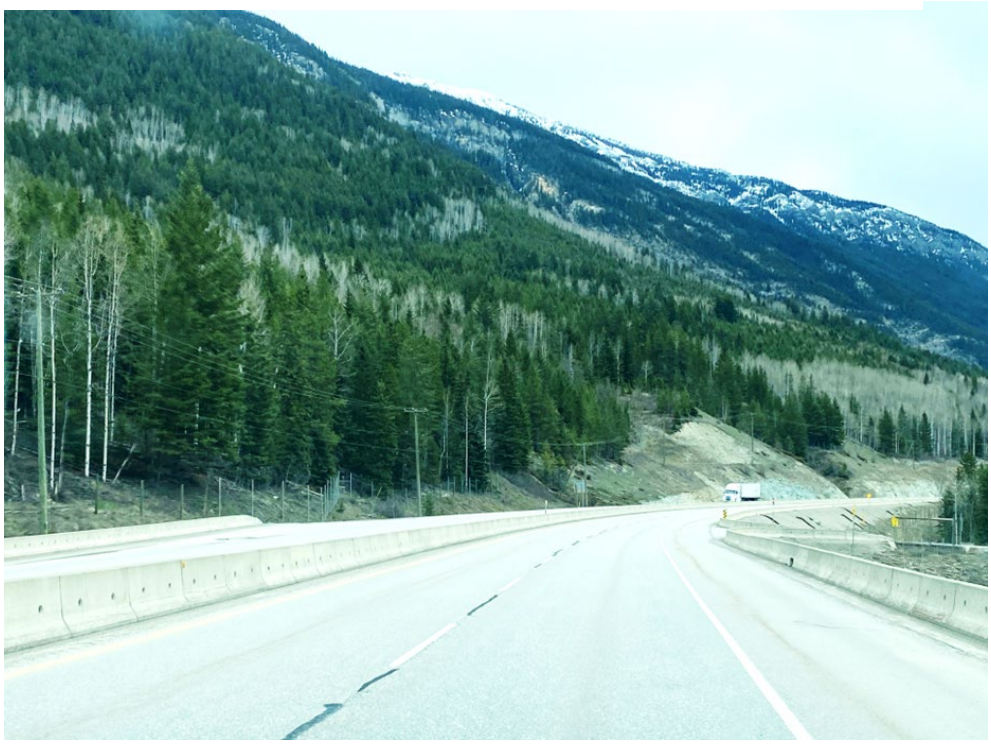

Figure 11: Vacation Creek treatment area- during treatment 2024 – Photo – Brian Gustafson

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Appendix A

Habitat Use Monitoring

Pellet Group Sampling

Plot sampling for pellet groups is conducted each spring in the treatment area. Data from pre-treatment in 2021 and 2022 has been collected, and May 2023 was the first year of data collection post-treatment. Although only a small number of plots have been affected by the treatment to date, each spring will see more plots designated as “post-treatment”.

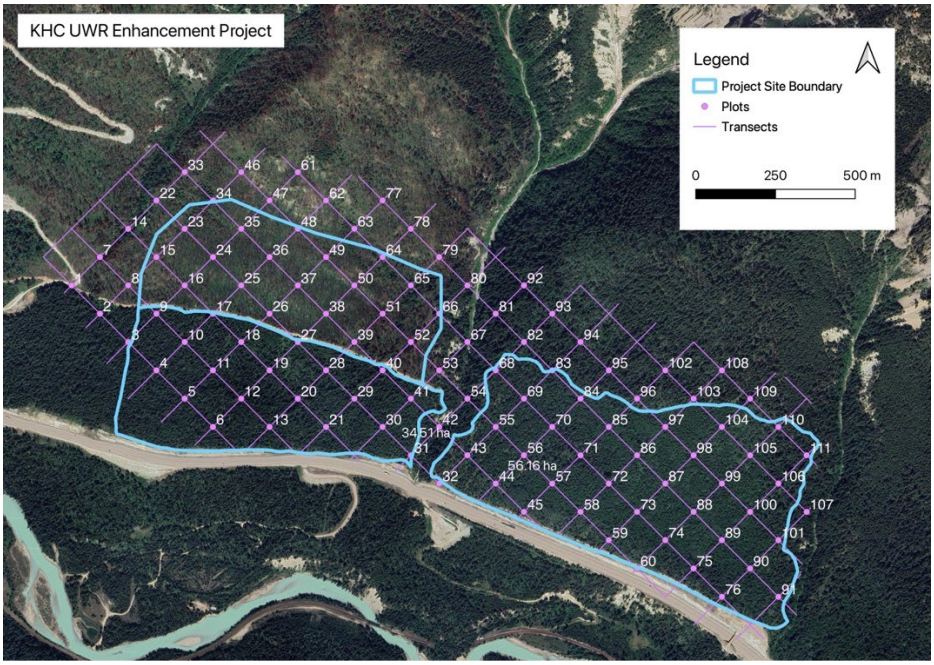

Figure 12: Sampling plots in the project area

Data Collection

Fecal pellet group counts were determined to be a suitable, reliable, and economical monitoring method for the project area. The interior Douglas fir IDFdk5, and montane spruce MSdk biogeoclimatic zones are relatively dry ecosystems (MacKillop et al. 2018), in which the decomposition rate of fecal pellets is greater than the annual sampling intervals. This method is commonly used to estimate relative abundance (or absolute abundance with greater margins of error), based on assumptions of a defecation rate and total days of occupancy on a winter range (Resources Inventory Committee, 1998). Bounded circular plots, as described by (Robinette et al., 1958), were chosen as the most suitable

sampling design for the project area, as this method is known to balance cost and effort with precision and accuracy (Resources Inventory Committee, 1998).

For the current project, plot spacing was determined by applying the methodology used by Klafki (2001), as per the Resources Inventory Committee (1998) recommendation to use this methodology in British Columbia. The size of circular plot is dependent upon the density of pellet groups and the spacing of plots is dependent upon the primary species within the respective area being studied. We considered scaling the plot size and spacing based on biologically meaningful spatial extents in relation to the primary species within the project area, elk, as compared to the study by Klafki (2001) which focused on deer.

Errors associated with the pellet group count method have been documented by Van Etten and Bennett (1965), Neff (1968), Smith et. al. (1969), White and Eberhardt (1980) and Fuller (1991), among others. Common sources of error include pellet groups being missed by the observer, or pellet groups not being counted due to the observer incorrectly classifying the groups as having occurred prior to the count period. The former is minimized by the sub-plot sampling units, as they are clearly defined, marked for the duration of the project, relatively small areas and cleared after each count. The latter source of error is minimized by undertaking data collection prior to green-up from May to June, and by specifying to observers that all pellet groups lying on top of dead vegetation are to be counted. Reliability and precision of the method is documented by DeCalesta (2013).

Sample design overview:

- Linear transects with circular plots, spaced at regular intervals of 100-200 m along the transect, depending upon forest type as described by Klafki (2001).
- 100 m spacing was used in dense, aspen dominated, forest stands. This smaller spacing was used to maintain statistically comparable data between habitat types while accounting for a smaller spatial extent within the project area covered by this habitat type.
- 200 m spacing was used in open, Douglas fir dominated, forest stands.
- Each plot is comprised of five circular sub-plots (sampling units), each with a radius of 1.78 m and an area of 10 m2, arranged with a sub-plot in the centre (marked with a stake) and four surrounding that sub-plot at 10 m spacing in each of the cardinal directions, as indicated in the diagram by Klafki (2001), Figure 5.
- Klafki (2001) used the sub-plot methodology to balance an increased sampling efficiency (Neff, 1968) while minimizing the variance of estimates (Ryel, 1971).

Each grouping of fecal pellets within a sub-plot is counted and classified by species, or potential species if it is indiscernible due to similarities in fecal pellet appearance between species.

- A pellet group is defined as five or more pellets in a group.
- If five or more pellets of group is within the respective boundary, it was counted.
- Plots are counted and cleared each year.
- The data is preferably collected in April or May, depending on snowmelt, prior to vegetation green-up obscuring observation of pellet groups.
- All pellet groups lying on top of dead vegetation are counted.

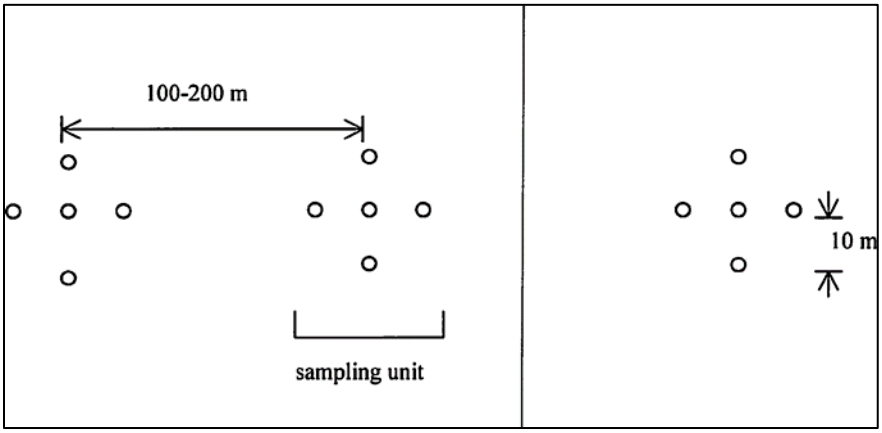

Figure 13: Configuration of sub-plots within each pellet group count plot. Figure taken from Klafki (2001), Figure 3, p. 9.

As recommended by the Resources Inventory Committee (1998), transect lines were oriented to cross drainages diagonally, and cross varying slope aspects and altitudinal zones in order to encompass the topographical variation within the project area.

Data Analysis

Habitat use is estimated by the mean of pellet group counts per plot. This is then used to compare burned/unburned habitat, habitat use in different forest types, and eventually habitat use pre and post treatment.

Results

The project site contains 111 sampling plots. Total pellet groups counted in 2021, 2022, and 2023 were 53, 35, and 181 respectively. In 2021 our data showed preference for mixed forest types, but in 2022 there was no clear preference among forest types. The results from 2023 show a strong

preference for the burned plots, which are now 2 years post fire. The plots that were treated likely represent too small an area to show an effect. As more of the plots undergo treatment, data will be able to be sorted into Pre-Treatment and Post-Treatment categories to compare data.

Table 2: Number of pellet groups in each forest type

Forest Type	**2021**	**2022**	**2023**
Immature Coniferous	1	1	2
Immature Deciduous	1	1	2
Immature Mixed	26	10	19
Mature Coniferous	5	7	13
Mature Deciduous	0	1	0
Mature Mixed	5	1	5
Burn	14	14	140
Post-Treatment	NA	NA	0

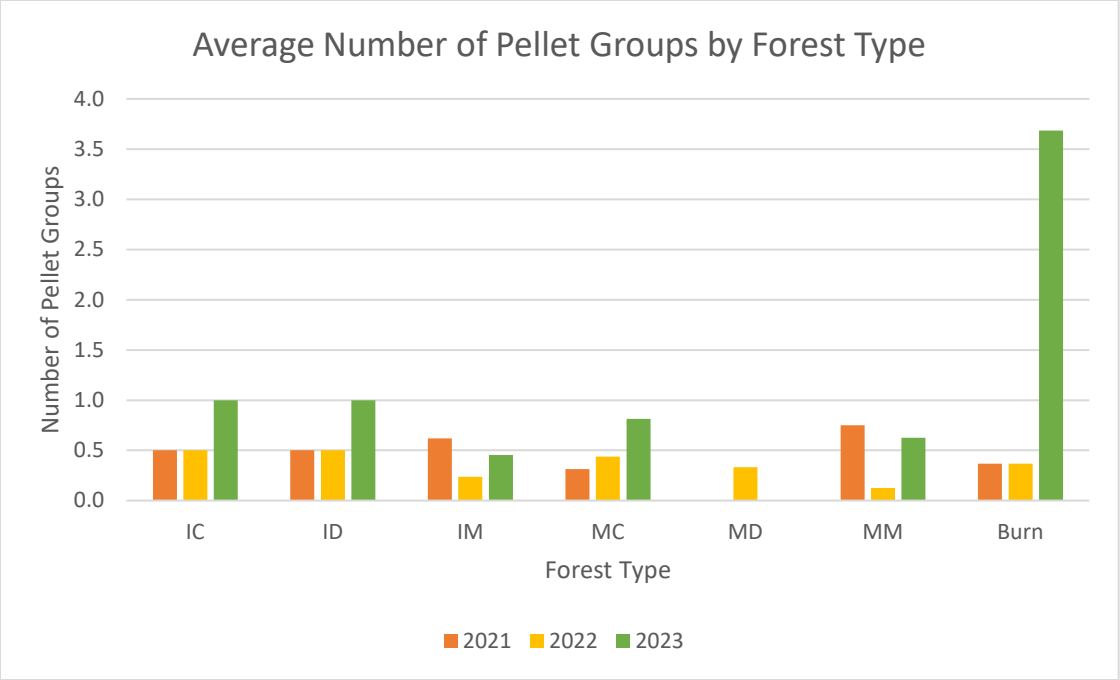

Figure 14: Pellet data from 2021, 2022, and 2023 indicating forest type preference

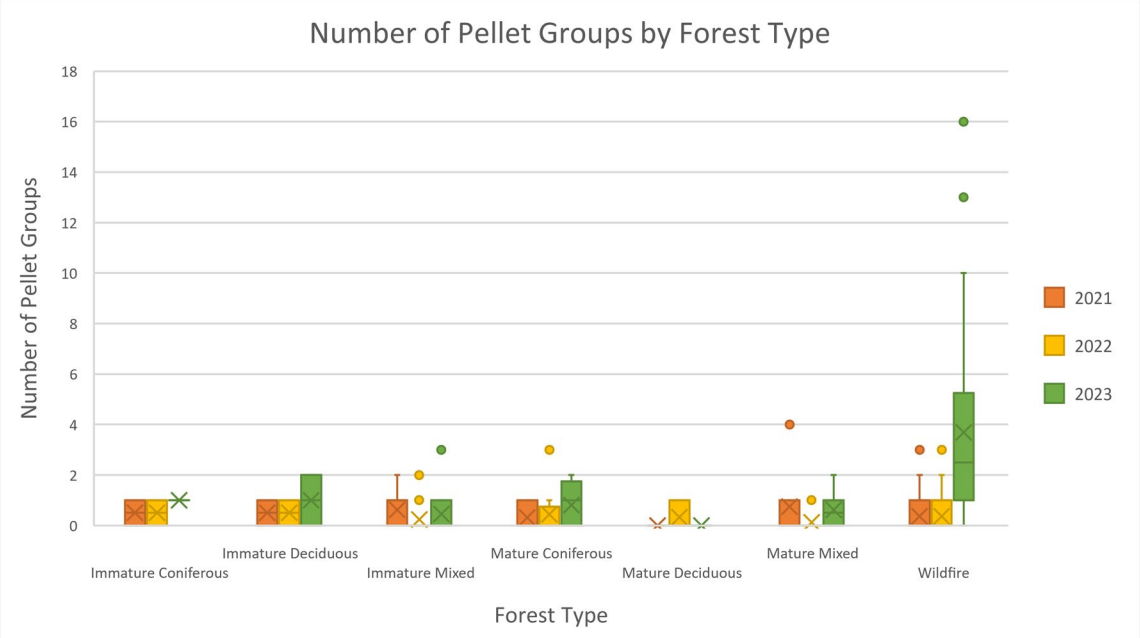

Figure 15: Number of pellet groups by forest type, including outliers.

The majority of plots (57.7%) consist of Immature Mixed Forest type. Plots could not be set to have comparable amounts of each forest type represented, as a significant reason for the enhancement work in this area is an overrepresentation of Immature Mixed Forest which is usually heavily ingrown.

Mature Mixed is the preferred forest type, consisting of both shelter and forage species, with more space between mature trees. In spring 2023, 9% of plots were post-treatment, and 34.2% were burned.

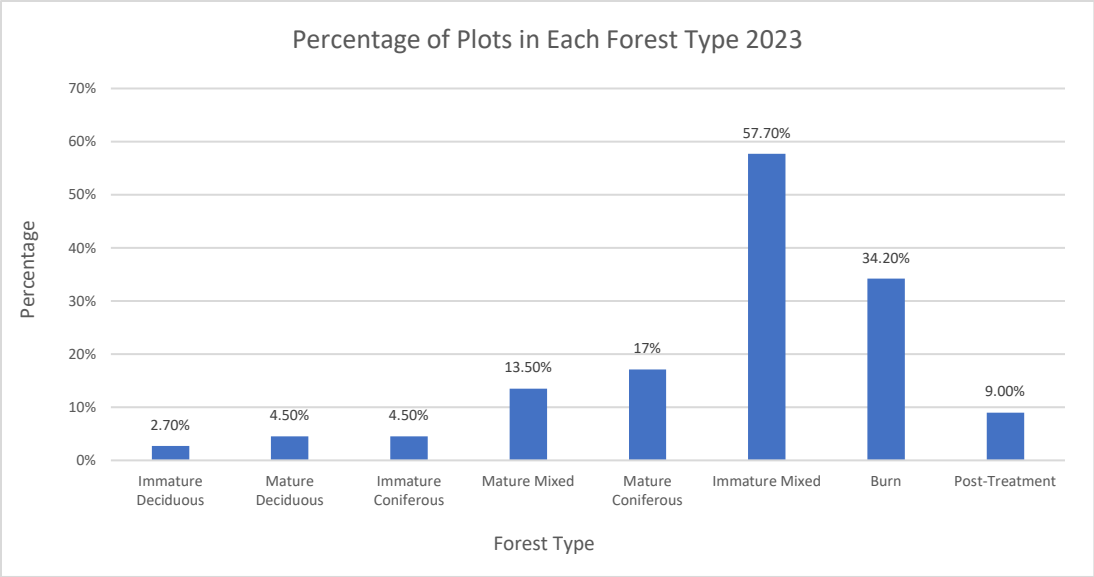

Figure 16: Forest type representation - Proportion of plots in each forest type.

Wildfire in the summer of 2021 burned an area (38 plots) on the west side of the project area, giving us an opportunity to measure habitat use before and after natural fires (Figure 6). In the first year after fire, there was not an increased amount of use in the burned plots, however 2 years post-fire there was an explosion of habitat use by elk. This illustrates the natural dynamics of wildfire, forage availability, and habitat use. Over time, we will be able to record these dynamics in burned, manually thinned, and ingrown forest types in this one area. Typically, habitat changes are reflected 2-3 years after augmentation as new forage doesn't grow immediately.

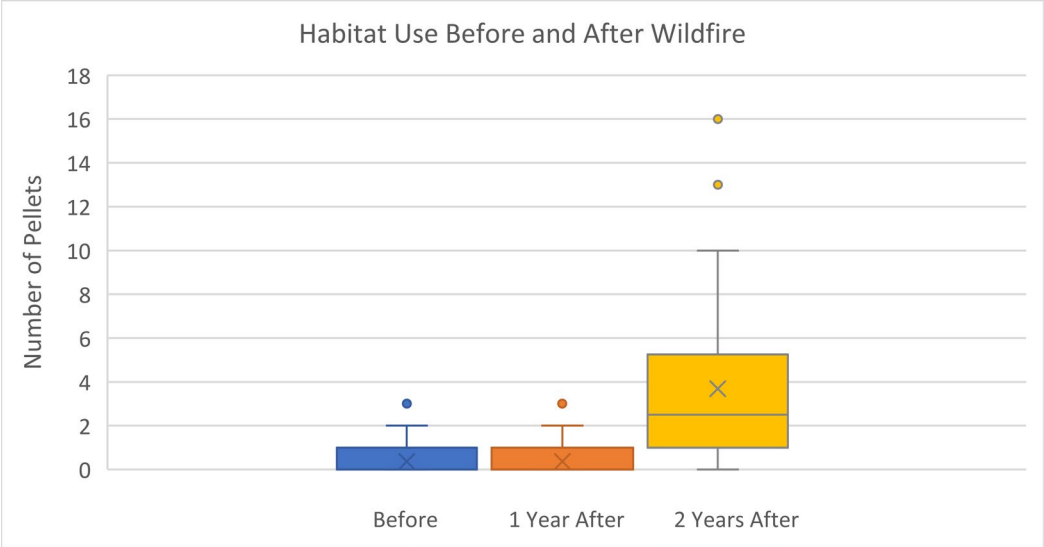

Figure 17: Pellet groups in plots that burned between sampling years.

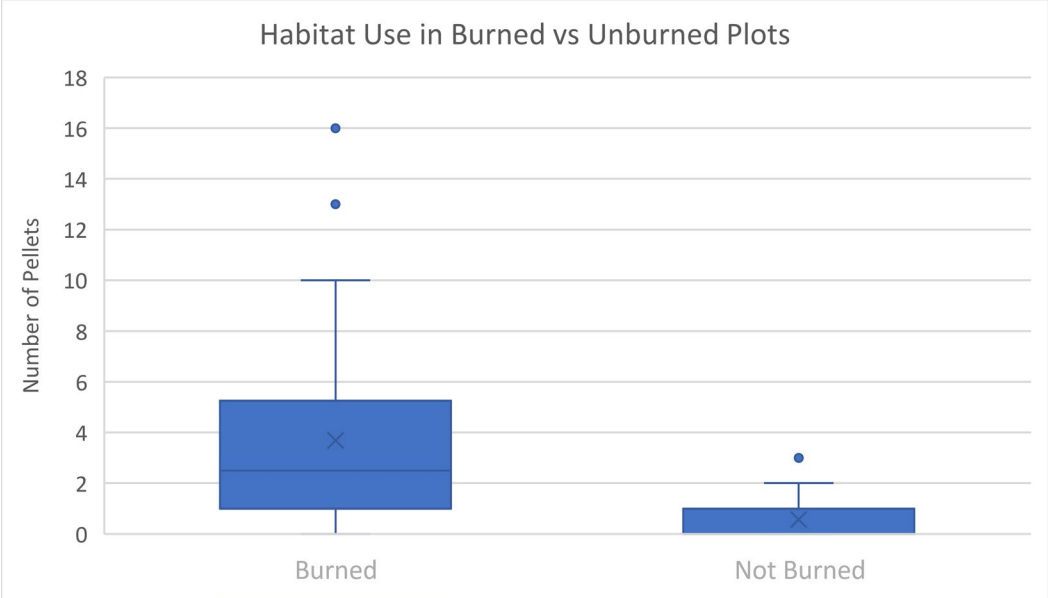

Figure 18: Comparative boxplot of plots that were burned in the 2021 wildfire, and plots that haven't burned recently. Habitat use is higher in the burned plots.

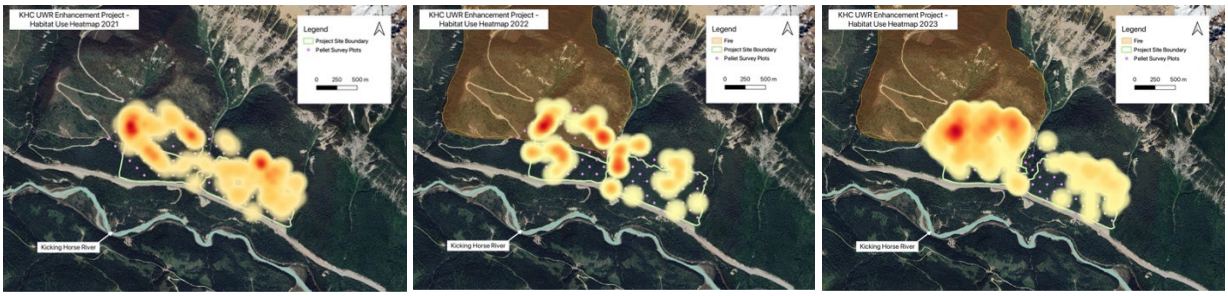

Figure 15: Habitat Use Heatmaps from a) 2021 (before wildfire), b) 2022, and c) 2023.

Habitat use heat maps show the northwest corner of the project site has been a habitat use hot spot since before the 2021 wildfire (Figure 8a). The northeast area was also used in 2021 (Figure 8a). In 2022, the habitat use was heaviest use areas were along the creek, as well as the northern and western areas (Figure 8b). In 2023, habitat use increased dramatically in the 2-year-old burn, as this is the optimal time for forage growth after fire (Figure 8c). There was also much more apparent habitat use by elk in 2023 compared to the 2 previous years, with 181 pellet groups counted (2021 = 53, 2022 = 35).

Discussion

Pellet counts were overall lower during the 2021 and 2022 surveys, which can be attributed to the very deep snowpack in the 2020/2021 and 2021/2022 winters, as deep snowpacks deter elk from an area (Ungulate Winter Range Advisory Team, 2005).

Only 10 plots fall within the treatment area from fall 2022, and with such recent disturbance, this hasn't had a chance to increase any forage availability yet. No pellet groups were found in these plots during 2023 surveys, likely due to how recent the disturbance is. Similar to the burned plots, which didn't see an increase in habitat use until 2 years after the disturbance.

The overall high pellet group counts in 2023 can be explained by two main variables. First, the past winter had some of the lowest snowpack in years, which provides optimal conditions for elk to thrive (Ungulate Winter Range Advisory Team, 2005). Second, the forage availability in the second and third years after a wildfire provide the highest quality forage for elk (Snobl et al., 2022). The combination of these two factors appears to have led to a higher than previously recorded concentration of elk on the landscape. The 2023/2024 winter has also had a very low snowpack, so the 2024 pellet surveys are likely to show an abundance of elk use as well. However, treatment continued throughout the winter this year, so the human impact of that will potentially result in elk avoiding the eastern portion of the project site.

Habitat Integrity Monitoring

In addition to habitat use data, we will be conducting ongoing monitoring of habitat quality independent of animal use variables. This will include empirical measurements of adequate sightlines, as well as routine monitoring of invasive plants in the project area.

Sightlines

A critical aspect of good ungulate habitat is adequate sightline. Elk and deer are hesitant to use habitat where their natural predator avoidance behaviour is hindered by overly dense vegetation. Both sightlines and escape terrain are aspects of this and are directly related to vegetation density. Measuring sightlines through an established method will inform future maintenance schedules for habitats that have been enhanced in this area.

We will be using a method established by Sweanor et al. (1996) when measuring vegetation density for bighorn sheep habitat suitability. Ideal ungulate habitat must have >55% visibility, as defined by the mean percentage of squares visible on a $1m^2$ target, divided into 36 equal squares, 14m from an observer viewing N, S, E, W, from a height of 90cm along a 10 point 280m transect (Sweanor et al., 1996).

If visibility becomes <55%, that is the threshold where we plan for maintenance treatment to the areas exhibiting ingrowth. This will be on an as-needed basis, however an estimated timeline of approximately 10 years is a likely scenario.

Invasive Species Monitoring

In addition to sightline measurements, invasive plants will be monitored in the sampling plots. Columbia Shuswap Invasive Species Society has agreed to collaborate with the GDRGC on invasive species identification and management. Availability of preferred forage species relies on these species not being outcompeted by invasive plants. Eradication of harmful invasive plants relies on regular monitoring as well as well-timed and effective eradication action.

Key species that will be monitored include:

1. Common Burdock (*Arctium minus*)
2. Spotted knapweed (*Centaurea biebersteinii*)

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