Targeted Grazing

for Wildfire Risk Reduction

Site Selection Guide v.1.0

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Sustainable Canadian Agricultural Partnership

BCCA

British Columbia

Canada

Preface

This report was prepared for the British Columbia Cattlemen's Association and project partners by Amanda J. Miller, Andrew Pantel and Reg Newman. Project implementation was made possible by the efforts of the Project Working Group (Lisa Zabek, Kevin Boon, Mike Pritchard, Rob Dinwoodie, Reg Newman, Francis Njenga, Laura Code, Clayton Bradley, Andrew Pantel and Amanda J. Miller) and the hard work of Shawna Larade, Rangeland Stewardship Officer Range Branch (also currently part of Project Working Group), Kyra Witt and Melissa Graydon, Range Officer and temporary Range Officer (respectively), and Rob Dinwoodie, former Range Officer for the Okanagan Shuswap District. Special thanks to tenure holders Jordy Thibeault, Keith Manders, Dave Casorso, Harvey Bombardier, and Colin Thompson for volunteering to participate in this pilot project. The level of management and flexibility in approach across years of the pilot study is reflective of these excellent rancher partners and has resulted in valuable research outcomes.

Funding support was provided through the Sustainable Canadian Agricultural Partnership, a federal-provincial-territorial initiative, BC Ministry of Forests, and BC Wildfire Service.

Many individuals have provided input, direction, and guidance to this project; thank you to everyone involved in the project committees, for your expertise, time and efforts.

Disclaimer

Acknowledgement

We would like to acknowledge that this research, learnings, and report development took place on the ancestral and traditional territories of many First Nations Peoples, which have always been lands of teaching, learning and research.

This report is developed using primarily western methods, concepts, and theories. The principles and practices of rangeland science are widely accepted by professionals around the world, forming the international body of the Society for Range Management. When braided together, modern western science and traditional ecological knowledge can provide the basis for ecological and cultural reconciliation.

We would like to pay respect to the First Nations people past, present, and future while recognizing and respecting their cultural heritage, beliefs, and relationship to the land.

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1 Background

This document outlines a decision aid for assessing the suitability and ranking of locations in British Columbia for targeted grazing treatments to reduce wildfire risk. The objective of this work is to create a planning tool supporting the effective implementation of targeted grazing to reduce wildfire risk in B.C.'s wildland/urban interface and other vulnerable areas. It is anticipated that the tool will be useful for integrated wildfire risk reduction planning activities where targeted grazing can address fine fuel loading in areas adjacent to communities/infrastructure in coordination with other land uses, while maintaining or enhancing desired ecological goods and services.

Targeted grazing is defined as:

> '…the application of a specific kind of livestock at a determined season, duration, and intensity to accomplish defined vegetation or landscape goals.' (Launchbaugh & Walker, 2006):

As a practice targeted grazing uses the timing, frequency, intensity, and selectivity of grazing/browsing to apply herbivory pressure on specified plant species or sections of the landscape (Bailey et al., 2019; Rinella & Bellows, 2016). This concept is also known as prescribed grazing or managed herbivory, and provides managers with an alternative to mechanical, chemical, or prescribed fire treatments to manipulate vegetation (Bailey et al., 2019; Frost et al., 2012; Launchbaugh & Walker, 2006). Livestock are focused on the area of interest through fencing, herding, or the placement of supplements to defoliate and/or trample the species or area of interest to achieve vegetation management objectives (Bailey et al., 2019; Rinella & Bellows, 2016). Targeted grazing can be highly effective as a fuel management tool if the application is precise (Launchbaugh & Walker, 2006; Popay & Field, 1996). Effective targeted grazing treatments require a knowledge of plant ecology, livestock nutrition, livestock foraging behaviour, livestock handling/management, and site-specific ecological attributes (Bailey et al., 2019; Launchbaugh & Walker, 2006; Rinella & Bellows, 2016).

Targeted grazing for fine fuel reduction can be successfully integrated as a complementary practice to other fuel management techniques, however, there are currently no B.C. based tools to assist producers and resource managers with this process.

2 Targeted Grazing Site Selection Tool Framework

The site selection tool is intended to provide a guide for individuals, groups, or programs considering implementing a targeted grazing treatment for the reduction of fine fuels. It provides the user with support during the early planning phase and can be useful for selecting among a list of candidate sites or for verifying the suitability of a single pre-selected site.

Targeted grazing prescriptions within the context of wildfire risk reduction are intended to mitigate the risk of wildfire in the Wildland Urban Interface (WUI), an area defined by BC Wildfire as a two-kilometer buffer from the edge of developed areas with six or more structures per square kilometer. The WUI is inclusive of ranch interfaces (areas surrounding developed ranch structures), utilities and other significant infrastructure.

The tool is comprised of two main components, an **Urgency Rating** and **Suitability Screening** each with multiple considerations further detailed in the following sections.

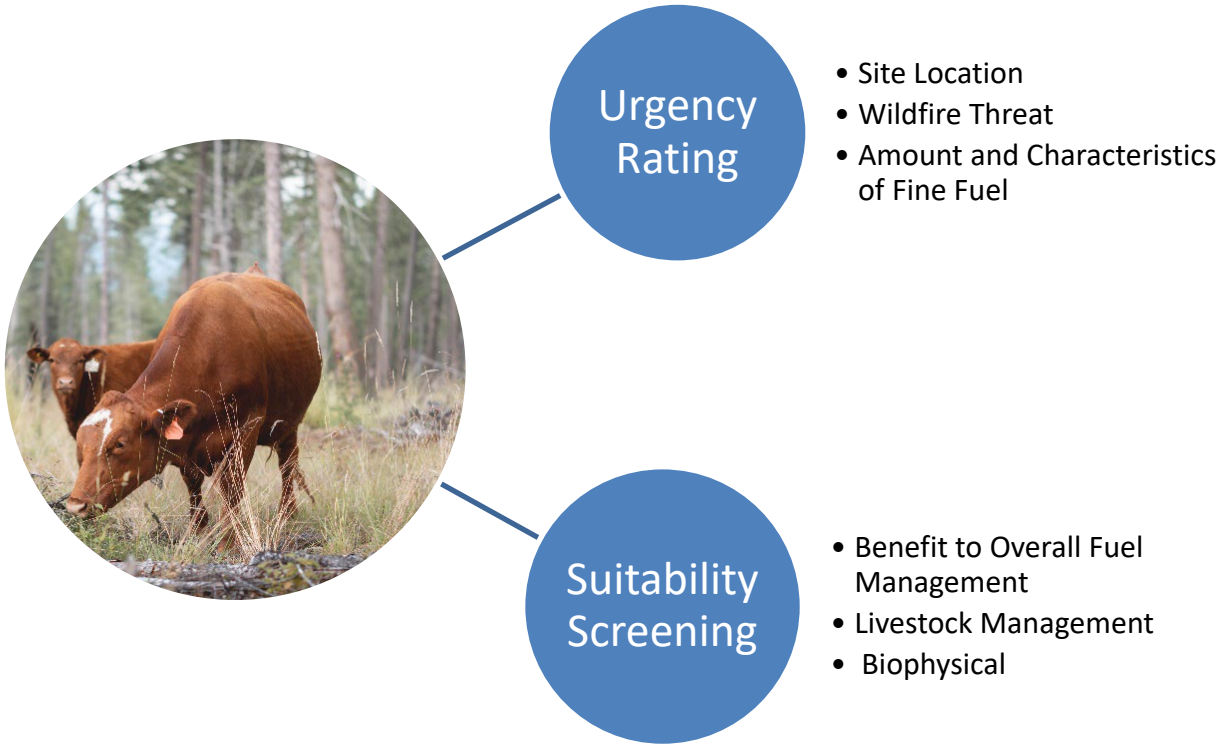

Figure 1. Targeted grazing site selection overview.

2.1 Urgency Rating

Developing an urgency rating provides a way to prioritize sites based on vulnerability of infrastructure to wildfire. The rating relies heavily on the wildfire threat rating provided by the Province of British Columbia's Provincial Strategic Threat Analysis[1], and adds a component that considers the amount and characteristics of fine fuel on the site. For the purposes of the tool, fine fuel is defined as grasses, forbs, and shrubs. To varying degrees, these components of the plant community can be consumed by grazing cattle.

The urgency rating provides a scoring value for sites that are highly suitable, moderately suitable, and less suitable for targeted grazing treatments.

[1] The Provincial Strategic Threat Analysis is maintained by the province and is available on the provincial website: https://www2.gov.bc.ca/gov/content/safety/wildfire-status/prevention/fire-fuel-management/psta

2.1.1 Site Location and Wildfire Threat

Assessing the urgency rating for a given location requires an understanding of wildfire threat so that areas with the greatest risk can be prioritized. Map layers provided by the Provincial Strategic Threat Analysis (Province of British Columbia, 2021) can be used to determine both the wildland urban interface area and the wildfire threat rating for a particular location (Fig. 2, Appendix 1).

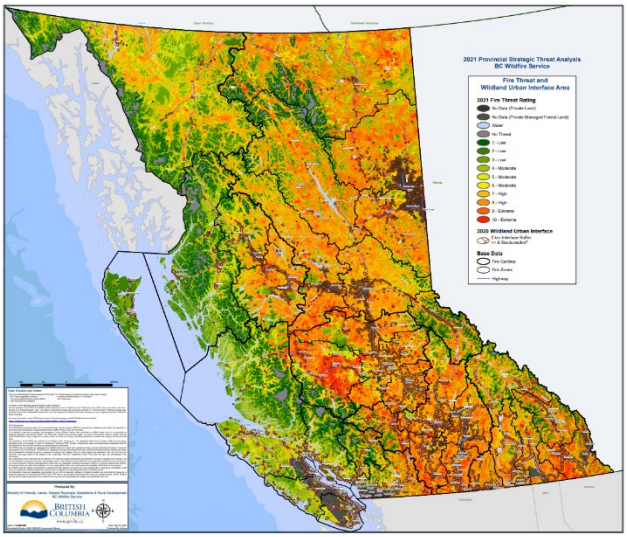

Figure 2. Map of fire threat and wildland urban interface areas developed by the Provincial Strategic Threat Analysis (See Appendix 1 for higher resolution map).

2.1.2 Amount and Characteristics of Fine Fuel

The BC Provincial Strategic Threat rating is mainly based on woody fuel factors and also includes an assessment of surface fuel composition (e.g., pinegrass, sagebrush, or bunchgrass) (BC Wildfire Service, 2020). However, surface fuel amount (biomass) and other characteristics can also be factors in fire behaviour in grass-dominated systems. For example, the total amount of herbaceous and shrub biomass is an important factor in determining fireline intensity (Alexander & Cruz, 2018). For the purposes of the Urgency rating, the amount and characteristics of fine fuels are defined by the following factors.

a. Fine fuel biomass

The biomass of fine fuel on a site provides the available fuel energy (MJ/m^2) and is an indication of the maximum potential heat produced by a fire. Surface fireline intensity in grassland- and open forest-wildfires is directly affected by the quantity of fine fuel biomass (e.g., Alexander & Cruz, 2018).

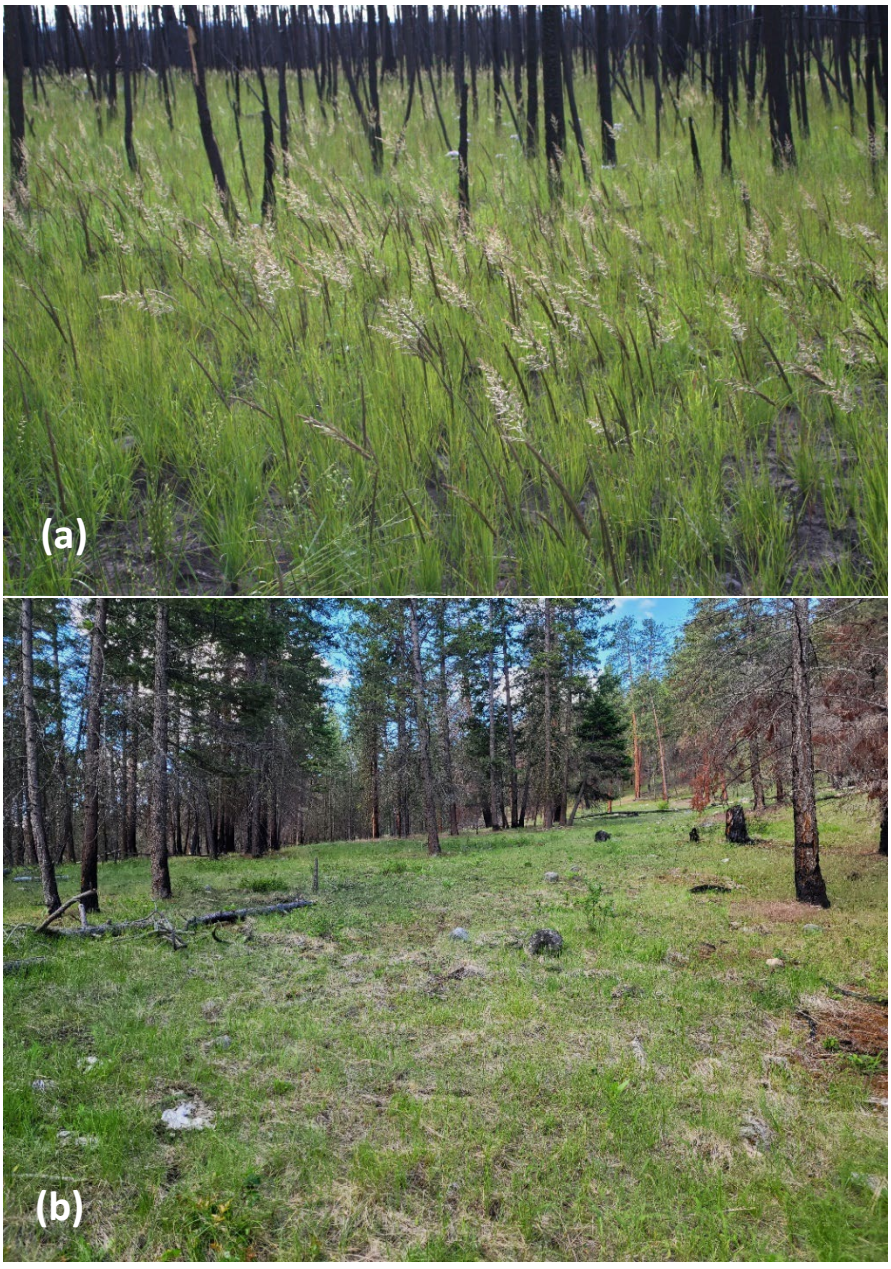

Figure 3. Variation of fine fuel biomass of pinegrass; (a) 1100 kg/ha (b) 450 kg/ha.

b. Fine fuel continuity

A continuous surface fine fuel bed provides one of the key conditions for uninterrupted fire spread and has implications on rate of spread (Figs. 4, 5a). A discontinuous surface fine fuel bed will slow or stop the spread of fire (Fig. 5b).

Figure 4. Continuity of fuel determines continuity of the fireline. Surface fine fuel can carry the fire front to heavier fuels.

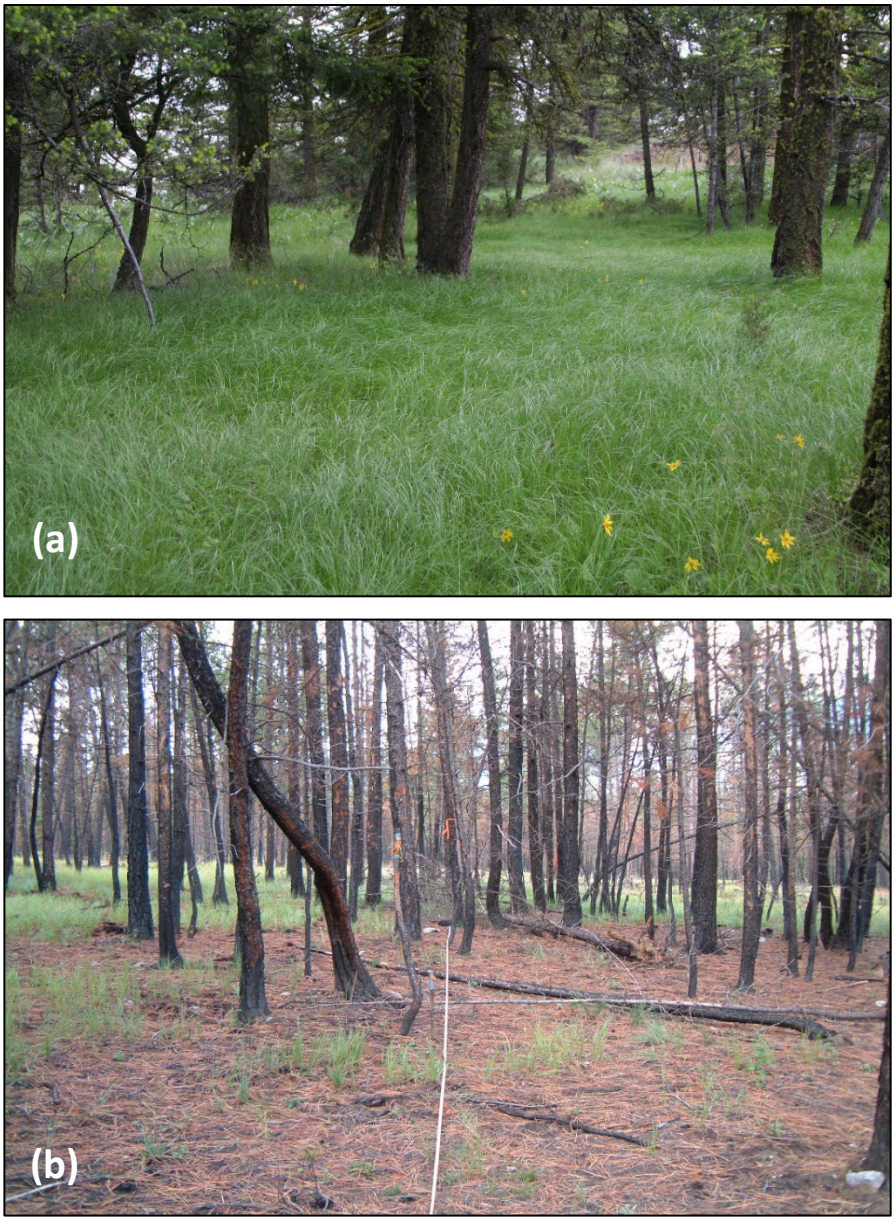

Figure 5. Natural variation of fine fuel continuity for pinegrass (a) continuous (b) discontinuous.

c. Fine fuel growth form

For the purposes of the Urgency rating, growth form is based on general plant structure and includes grasses, forbs, and shrubs. Forbs are herbaceous flowering plants that are not grasses (Fig. 6a). Grasses are generally more flammable than forbs, especially when cured (dried). Shrubs, especially sagebrush and juniper, can be highly flammable due to volatile oils, have greater fuel height, and have higher fuel content due to woody growth (Fig. 6b).

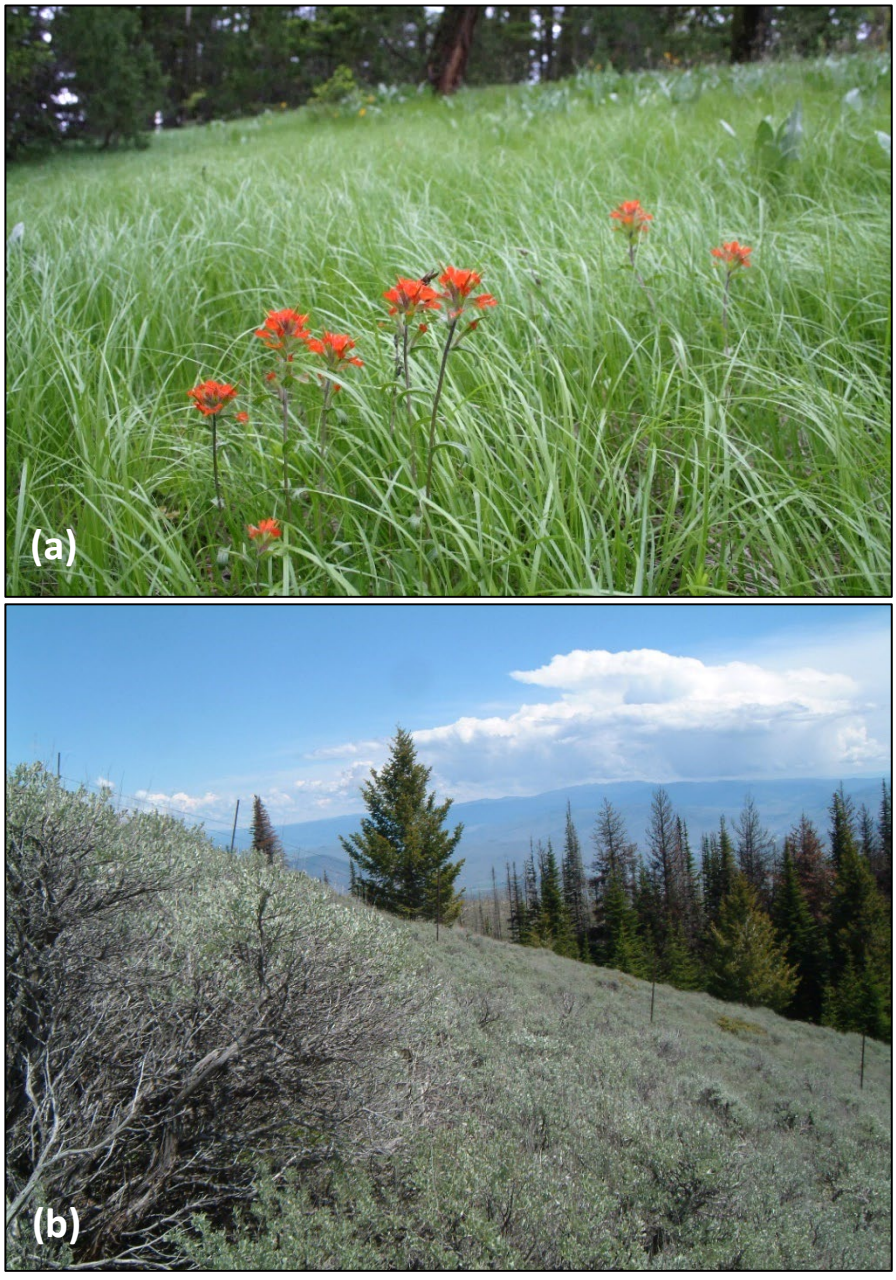

Figure 6. Growth-form differences (a) forbs (scarlet paintbrush) and grass (pinegrass); (b) shrubs (big sagebrush).

2.2 Suitability Screening

In addition to reducing fine fuels and subsequent wildfire risk, targeted grazing prescriptions can provide a cost-effective forage resource and maintain or enhance desired ecological goods and services. Assessing the suitability for a given location requires consideration of multiple factors, some of which determine overall fuel management benefit, while others have an impact on management difficulty, cost, and site health (Table 1).

Table 1. Major suitability screening considerations.

Component
Benefit to Overall Fuel Management
Livestock Management
Biophysical

2.2.1 Benefit to Overall Fuel Management

a. Overlap with woody fuel treatments

Combining targeted grazing with woody fuel mitigation treatments (Fig. 7) such as removal of overstory trees, removal of understory trees, pruning of residual trees, and abatement of surface woody fuels is highly recommended. For example, woody fuel mitigation such as conducted by the Crown Land Wildfire Risk Reduction Program (CLWRR)[2] is an important component for the overall wildfire risk reduction on a site. Areas treated by prescribed burns, or commercial forest harvesting, or that have experienced recent wildfires are also suitable overlays for targeted grazing due to lower woody fuel loads and higher levels of available forage.

[2] Crown Land Wildfire Risk Reduction Program: https://www2.gov.bc.ca/gov/content/safety/wildfire-status/prevention/funding-for-wildfire-prevention/crip/wrr

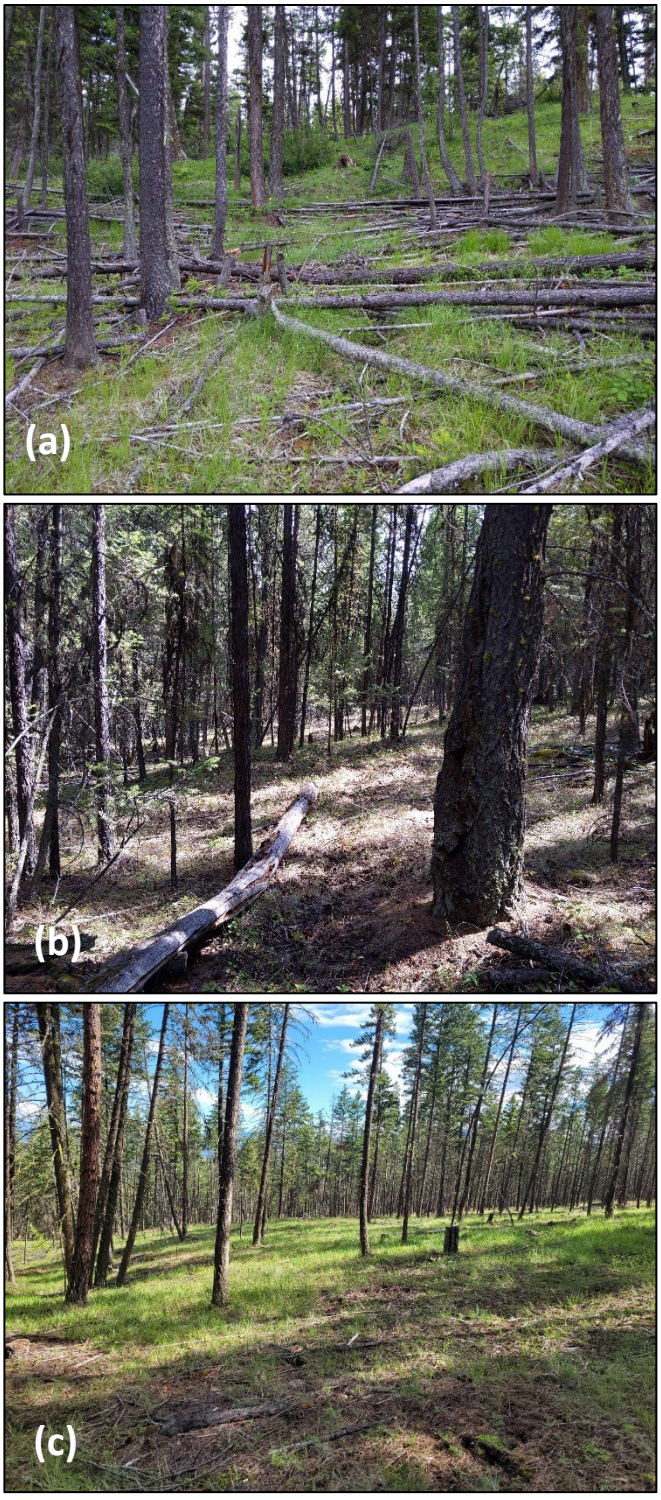

Figure 7. Woody fuel loads in a Douglas-fir/pinegrass forest. (a) Untreated showing heavy surface woody fuel; (b) untreated showing dense stems and ladder fuels; (c) treated.

b. Contribution to the landscape level fuel break

Targeted grazing projects that extend the landscape level fuel break are recommended. Adjacency of targeted grazing sites with other fuel breaks enhances the level of protection of communities, ranches and significant infrastructure by lengthening the landscape level fuel break. Fuel breaks can include other targeted grazing sites, areas treated to reduce woody fuel, open grasslands, previously burnt areas, agricultural areas, roads, and rights-of-way (Fig. 8).

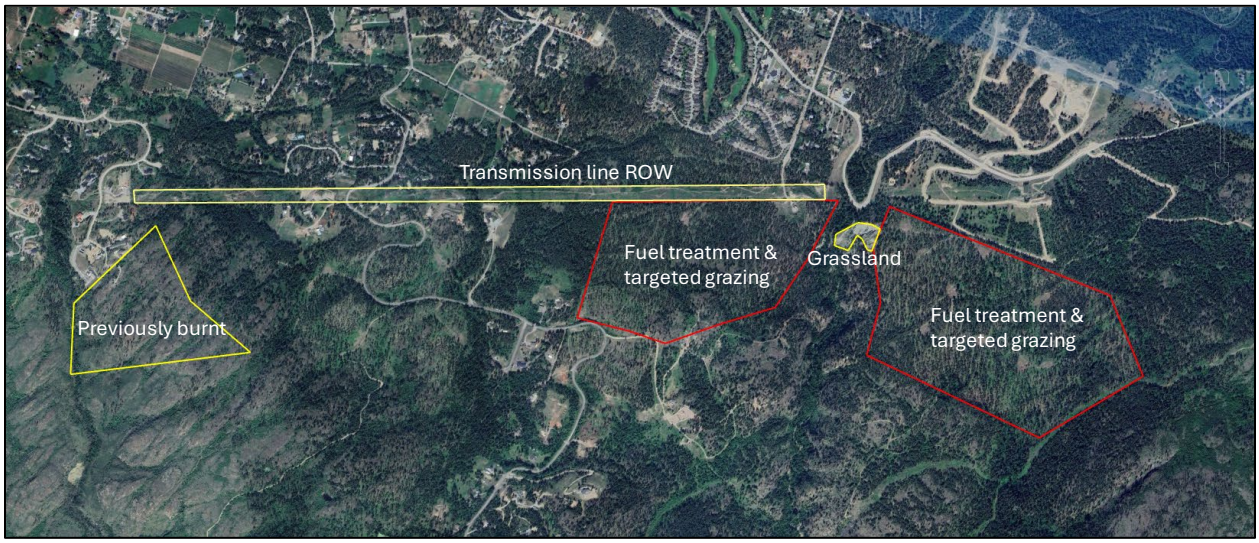

Figure 8. Adjacency of treatment areas and natural fuel break features creates a landscape level fuel break.

c. Maximizing treatment in the 400-m zone

Pasture layouts that maximize the percentage of total pasture area in the 400-m zone from the community, ranch, or significant infrastructure interfaces are recommended. Figure 9 shows stylized 128-ha pastures with different shapes and the effect on percentage area within the 400-m zone.

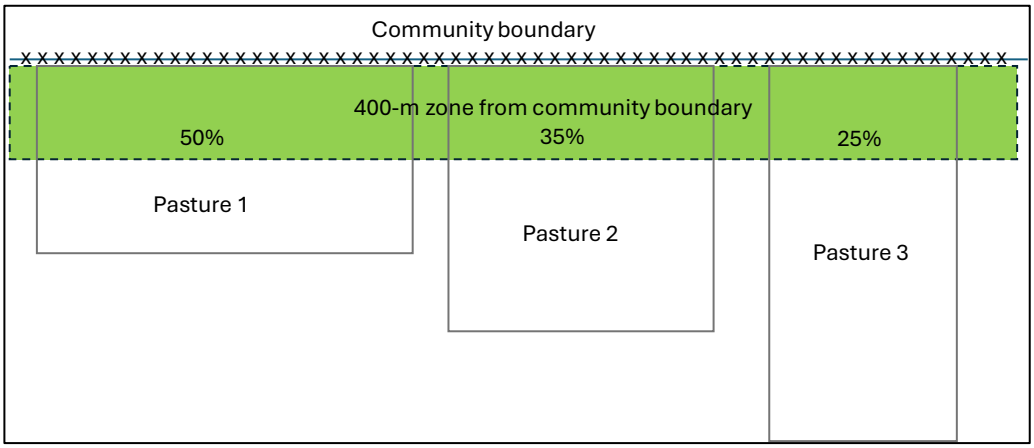

Figure 9. Stylized pastures of equal area showing percentage of total pasture area within the 400-m zone from the community boundary being protected. Pasture 1: 50%; Pasture 2: 35%; Pasture 3: 25%.

2.2.2 Livestock Management

Livestock management considerations are key when determining suitability of a site for targeted grazing treatments. Targeted grazing treatments require an enhanced level of livestock management and site monitoring to ensure that the treatment is meeting but not exceeding objectives and that livestock health and welfare are closely monitored. This includes increased infrastructure requirements to ensure that livestock are constrained to the target area and have adequate water and forage resources to maintain health. Accessibility to the site is also important for livestock handling.

a. Fencing/Infrastructure

Maintaining optimal livestock utilization rates requires the use of intensive distribution tools, such as herding, fencing, or natural range barriers to restrict movements. A suitable perimeter fence adjacent to the community boundary is necessary. Electric fences can provide temporary containment in some situations.

b. Stock water

Livestock must be supplied with an adequate supply of water of suitable quality. Livestock distribution is limited by distance to water sources, where cattle preferentially use range that is 1.6 km or less from water resources. There may be a need to develop additional water sources to improve distribution.

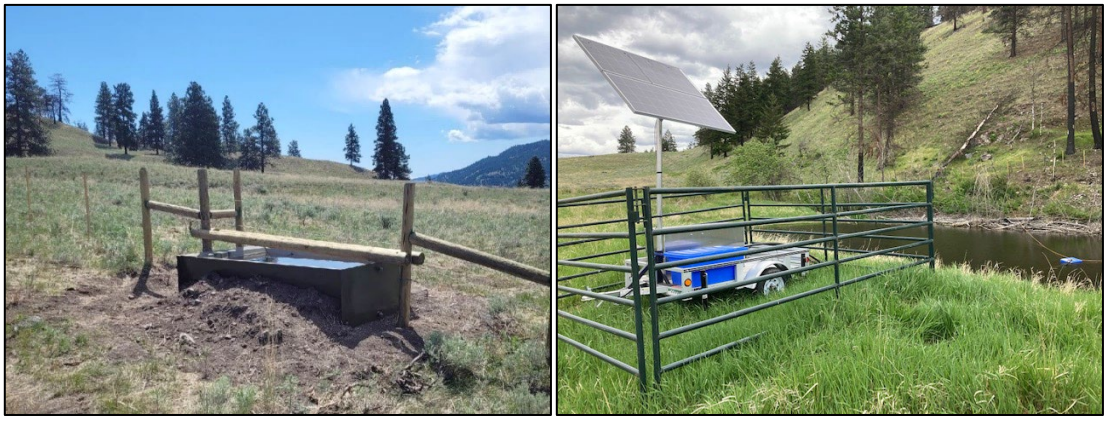

Figure 10. Permanent or temporary water developments can improve the distribution of cattle.

c. Transportation of cattle

The travel distance from the livestock operator's base of operations or continuity from other licensed range use area are important considerations. Sites close to existing ranch operations or grazing tenures are preferable to more distant or isolated areas. Sites with good road access are preferable to areas with difficult access.

Figure 11. Transportation of cattle.

2.2.3 Biophysical

The plant community and physical site factors of a targeted grazing treatment site are important considerations for assessing suitability. These factors can affect the difficulty of management and/or the cost, and the impact on site health of a targeted grazing project.

a. Ecosystem type

Some ecosystems are less resilient to high density grazing (e.g., low-elevation bunchgrass ecosystems) and some may be more suitable for grazing due to good understory forage availability. The Province's Biogeoclimatic Ecosystem Classification system (Fig. 12) provides a good coarse filter for determining suitable ecosystems for targeted grazing.

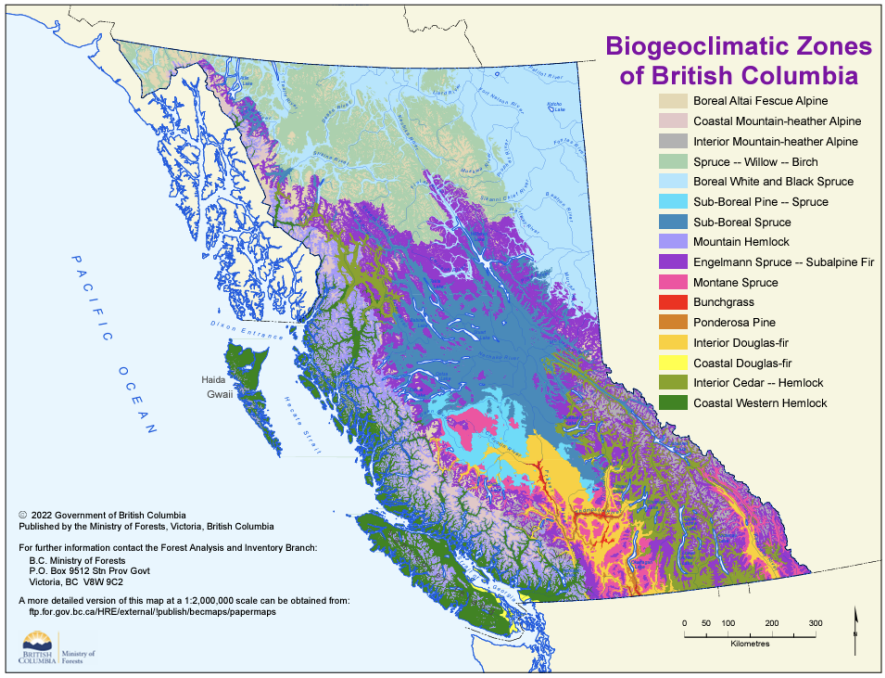

Figure 12. Biogeoclimatic zones and subzones provide a framework for determining suitable ecosystems for targeted grazing treatment.

b. Slope and landform

Uniform livestock distribution is necessary to achieve consistent fuel reduction outcomes, which requires increased operational costs in rugged terrain due to additional management inputs necessary to manage grazing distribution (Fig. 13). Cattle will typically avoid slopes of over 30%.

Figure 13. Rugged terrain results in uneven cattle distribution.

c. Cattle access to forage

Limitations to accessing forage such as blowdown or slash (Fig. 14a) or dense tree regeneration (Fig. 14b) may restrict cattle distribution.

Figure 14. (a) Heavy slash and (b) dense tree regeneration restricts cattle access to forage and limits cattle distribution.

d. Range condition/health

Range condition or health is a key consideration when considering targeted grazing treatments. If condition or health is poor, then high density grazing may continue to degrade the system and may not be an appropriate land use. If the treatment area is in a healthy enough state that it is resilient to the grazing treatment, then it is less likely to degrade.

Guidance for healthy vs. unhealthy range can be found in the province of BC's range type summaries[3] and the Grassland Conservation Council's Grassland Monitoring Manual for British Columbia (2009). Examples of healthy and unhealthy range are illustrated in Figure 15.

Figure 15. (a) Healthy rough fescue grassland in background and (b) unhealthy rough fescue grassland in foreground.

[3] BC Range Type Summaries: https://www2.gov.bc.ca/gov/content/industry/rangelands/ecology

e. Toxic plants

The presence of toxic plants may represent a constraint to targeted grazing implementation (Fig. 16). If there are high levels of toxic plants on the site, then it may not be suitable for high density grazing due to increased likelihood of toxic effects or livestock fatalities.

Figure 16. Upland larkspur (blue) and meadow death camas (white) are toxic to cattle and sheep.

f. Invasive plants

The presence of invasive plants, like cheatgrass or *Forest & Range Practices Act* (FRPA)-listed invasives (Appendix 5) will require specialized management to reduce the chances of further spread (Fig. 17).

Figure 17. A high frequency of invasive plants like diffuse knapweed (light green in foreground) and cheatgrass (purple in foreground) requires careful cattle management to avoid further spread.

3 Targeted Grazing Site Selection Process

This section provides a step-by-step method for assessing potential targeted grazing sites. For **Urgency** and **Suitability** ratings, a scoring system is provided where a higher score indicates that the site should have a higher priority.

3.1 Urgency Rating

3.1.1 Site Location

The site should be within the Wildland Urban Interface (WUI) area defined by BC Wildfire Service as a two-kilometer buffer from the edge of developed areas with six or more structures per square kilometer[4]. The WUI includes areas adjacent to communities, ranches, and significant infrastructure. To determine WUI locations, use the high-resolution version of the map illustrated in Appendix 1 or available on the Province's Provincial Strategic Threat Analysis (PSTA) website[5].

Table 2. Scoring for proximity to the developed area.

Proximity	Score[a]
Primarily within the first 400 m of a WUI	100
Primarily within the first 2 km of a WUI	75
Beyond 2 km	0

[a]Scores highlighted with red indicate a higher likelihood of scoring as a priority targeted grazing site.

3.1.2 Wildfire Threat

Using the Provincial Strategic Threat Analysis map (Appendix 1), prioritize candidate sites with high or extreme wildfire threat ratings, using the suggested scoring provided in Table 3. For natural areas that are not mapped, such as on private or unoccupied municipal land, use the wildfire threat rating of immediately adjacent areas.

Table 3. Scoring for Wildfire Threat rating.

Rating	Score
Extreme (10)	100
Extreme (9)	75
High (8)	60
High (7)	45
Moderate (6)	30
Moderate (5)	15
Moderate (4)	0

[4] Eligibility of locations adjacent to transportation corridors are being considered pending further research and monitoring.

[5] Provincial Strategic Threat Analysis: https://www2.gov.bc.ca/gov/content/safety/wildfire-status/prevention/vegetation-and-fuel-management/fire-fuel-management/psta

3.1.3 *Amount of Fine Fuel*

Determine the biomass of herbaceous fine fuel on the site based on dry weight of grasses, forbs, and current-year's growth of shrubs. Use the clipping and drying methods provided in Elliot and Tucker (2013) or visually estimate biomass in broad categories (Table 4). Appendix 2 provides example sites with biomass estimated in broad categories. In cases where the forest overstory canopy has recently been reduced (within 0 – 3 years), the understory biomass will not have reached its full potential. Estimate the potential future understory vegetation growth based on the response of older treated areas at nearby sites. Score your site using Table 4.

Table 4. Scoring for the amount of fine fuel.

Weight (oven dried kg/ha)	Score
>1500	100
1000 - 1500	80
500 - 1000	60
250 - 500	40
<250	0

3.1.4 *Continuity of Fine Fuel*

Estimate the continuity of grasses more than 10 cm high using the methodology provided in Appendix 3. Appendix 2 provides photos of example sites with known fuel continuity ratings.

Table 5. Scoring for continuity of fine fuel.

Fuel continuity	Definition	Score
Continuous	Grasses[b] form > 75% of the stand	100
Moderately continuous	Grasses form 50 – 75% of the stand	75
Moderately discontinuous	Grasses form 25 – 50% of the stand	50
Discontinuous	Grasses form < 25% of the stand	0

[b]Only consider grasses that are greater than 10 cm in height

3.1.5 Plant Community Growth Form

Rate the site based on the dominant plant growth form (Table 6). Shrub dominated sites are scored on the low end of suitability for control by cattle as cattle tend not to browse shrubs. Although big sagebrush is highly flammable and presents a high wildfire risk, it is unpalatable to cattle, and there is a low likelihood that targeted grazing by cattle will effectively reduce sagebrush cover and height unless stocking is at such a high rate that significant negative impacts on rangeland health and animal health will occur. Other shrubs may be more palatable to cattle, however, limits to shrub use are set in the Range Use Plan (RUP) and these must not be exceeded. Other treatments, such as brushing or burning, will be required to control shrubs.

Table 6. Scoring for dominant plant growth form.

Growth form	Score
Grass predominant	100
Grass/forb mix	75
Grass/shrub mix	50
Grass/forb/shrub mix	40
Forb predominant	25
Shrub predominant	0

3.1.6 Overall Urgency Rating

Total the individual scores determined for sections 3.1.1 to 3.1.5. Sites with an urgency rating score of 300 or greater should be prioritized for further consideration.

Table 7. Overall urgency rank scoring.

Components of Urgency Ranking	Score
Proximity to the developed area	
Wildfire threat rating	
Amount of fine fuel	
Continuity of fine fuel	
Dominant plant growth form	
TOTAL	

3.2 Suitability Screening Rating

3.2.1 Benefit to Overall Fuel Management

a. Overlap with woody fuel treatments

Determine the age of woody fuel treatments that have occurred on the site. Provincial CLWRR program spatial records and community wildfire protection plans are recommended resources. Include woody fuel treatments that are planned for the site.

Table 8. Scoring for woody fuel treatments conducted on the site.

Timeframe[c]	Score
Less than 5 years ago or planned in near future	100
5 to 10 years ago	75
Greater than 10 years ago	50
No work done	25

[c]Fuel treatments include removal of overstory trees, removal of understory trees, pruning of residual trees, abatement of surface woody fuels, prescribed burns, commercial forest harvesting or recent wildfires.

b. Contribution to the landscape level fuel break

Determine if other fuel breaks exist within 10 km of the site. Recent Google Earth imagery can be useful for an initial scan for fuel breaks.

Table 9. Scoring for adjacency to other fuel breaks.

Distance[d]	Score
Adjacent	100
Within 2 km	75
Within 10 km	50
None	25

[d]Fuel breaks include other targeted grazing sites, areas treated for woody fuel mitigation, areas recently burned, agricultural areas, roads, rights-of-way.

c. Maximizing treatment in the 400-m zone

Determine the percentage of the pasture area within the 400-m zone from the community boundary and rate using the suggested scoring in Table 10.

Table 10. Scoring for portion of pasture area within the 400-m zone.

Percentage	Score
> 40% of total pasture area	100
> 30% of total pasture area	85
< 30% of total pasture area	20

3.2.2 Livestock Management

a. Fencing

Assess the status of pasture fencing and rate using the suggested scoring in Table 11 or use the actual percentage of the perimeter fenced.

Table 11. Scoring for status of pasture fencing.

Portion fenced	Score
Pasture is completely fenced	100
Pasture is 75% fenced	75
Pasture is 50% fenced	50
Pasture is 25% fenced	25
No fences in place	10

b. Stock water

Assess the status of water developments in the pasture and rate using the suggested scoring in Table 12.

Table 12. Scoring for status of stock water development.

Status	Score
Water developments exist every 1.6 km	100
Water developments exist but more needed	75
Potential sources of water but none developed	50
No developable water sources exist	10

c. Transportation of cattle

Assess the methods that cattle will be moved onto and off the targeted grazing site and use Table 13 to determine the score.

Table 13. Scoring for livestock transportation requirements.

Method	Score
Cattle can be turned out from an adjacent pasture	100
Cattle can be herded through tenured or private land	85
Cattle must be trucked by liner. Corral on site.	60
Cattle must be trucked by liner. No corral on site.	45
Cattle must be trucked by stock trailer. Corral on site.	45
Cattle must be trucked by stock trailer. No corral on site.	30

3.2.3 Biophysical

a. Ecosystem type

Use the Biogeoclimatic ecosystem classification website (BEC)[6] mapping to determine the zone and subzone of the pasture.

Table 14. Scoring for suitability of ecosystem type.

Type	Score
Low to mid-elevation Douglas-fir dry forest (e.g., IDFxh, IDFdk)	100
Mid-elevation spruce forest (MS)	100
Primarily domestic seeded grass (e.g., crested wheatgrass, Kentucky bluegrass, smooth brome, orchardgrass)	100
Lodgepole pine or trembling aspen seral stages	100
Low elevation ponderosa pine forest (PPxh)	75
Low elevation bunchgrass grassland (BGxh, BGxw)	50
Other spruce forests (SBS, BWBS, SBPS, SWB, ESSF)	25
Interior cedar forests (ICH)	25
All others	5

b. Slope and landform

Assess the pasture's terrain and rate using the suggested scoring in Table 15.

Table 15. Scoring for slope and landform type.

Type	Score
Flat	100
Mix of flat and slopes under 30%	100
Slopes under 30%	80
Mix of slopes under 30% and slopes greater than 30%	40
Slope > 30%	10

c. Cattle access to forage

Assess any obstacles or tree regeneration affecting cattle accessing the forage (Table 16).

Table 16. Scoring for obstacles or tree regeneration impeding cattle access.

Amount and height[e]	Score
Few obstacles to cattle access. No regen	100
Some obstacles to 0.25 m height	90
Continuous obstacles to 0.25 m height, or some regen < 1 m spacing	60
Some obstacles to 0.5 m height	50
Continuous obstacles to 0.5 m height or higher, or continuous regen < 1 m spacing	10

[e]includes blowdown and/or slash, tree regeneration

[6] Biogeoclimatic ecosystem classification website: https://www.for.gov.bc.ca/hre/becweb/

d. Range condition/health

Determine the range condition or health of the pasture, and rank using Table 17.

Table 17. Scoring for rangeland health.

Rating[f]	Score
Properly functioning condition (PFC) or Reference Condition	100
Slightly at risk or slightly altered	90
Moderately at risk or moderately altered	0
Highly at risk or greatly altered	-50
Non-functional	-100

[f]Based on Fraser (2009) and Delesalle et al. (2009).

e. Toxic plants

Determine the frequency of toxic plants in the pasture. A recommended resource is *Stock-poisoning Plants of Western Canada* (Majak et al., 2008).

Table 18. Scoring for toxic plant occurrence.

Occurrence[g]	Score
None or infrequent	100
Scattered and uncommon	75
Moderately frequent	-50
Frequent	-100

[g]Includes plants that are known to be grazed by cattle with small to moderate amounts of ingestion causing health problems (Majak et al., 2008).

f. Invasive plants

Determine the frequency of invasive plants like cheatgrass and *Forest & Range Practices Act* (FRPA)-listed invasives (Appendix 5). A recommended resource is *A Field Guide to Noxious and Other Selected Invasive Plants of British Columbia* (Invasive Species Council of BC, 2023).

Table 19. Scoring for invasive plant occurrence.

Occurrence	Score
None or infrequent	100
Scattered and uncommon	75
Moderately frequent	0
Frequent	-50

3.2.4 Overall Suitability Rating

Total the individual scores from sections 3.2.1 to 3.2.3. Sites with the highest suitability rating should be prioritized for further consideration.

Table 20. Overall suitability rating score.

Components of Suitability Rating	Score
Woody fuel treatments conducted on the site	
Adjacency to other fuel breaks	
Portion of pasture area within the 400-m zone	
Status of pasture fencing	
Status of stock water development	
Livestock transportation requirements	
Suitability of ecosystem type	
Slope and landform type	
Obstacles or tree regeneration impeding cattle access	
Rangeland health	
Toxic plant occurrence	
Invasive plant occurrence	
TOTAL	

4 Overall Rating

Determining the **Urgency Rating** and **Suitability Screening Rating** is intended to provide ample information to support candidate site selection, or to verify the suitability of a pre-selected site.

Although this site selection guide provides key indicators of site suitability for targeted grazing, there are likely considerations specific to other regions or to specialized projects that have not been captured. The scoring of individual components is a first approximation and will likely change as more data becomes available and further analysis is conducted. The guide is not intended to be prescriptive in approach to site selection but rather should be used as a tool for consideration of the key components necessary for a successful targeted grazing project.

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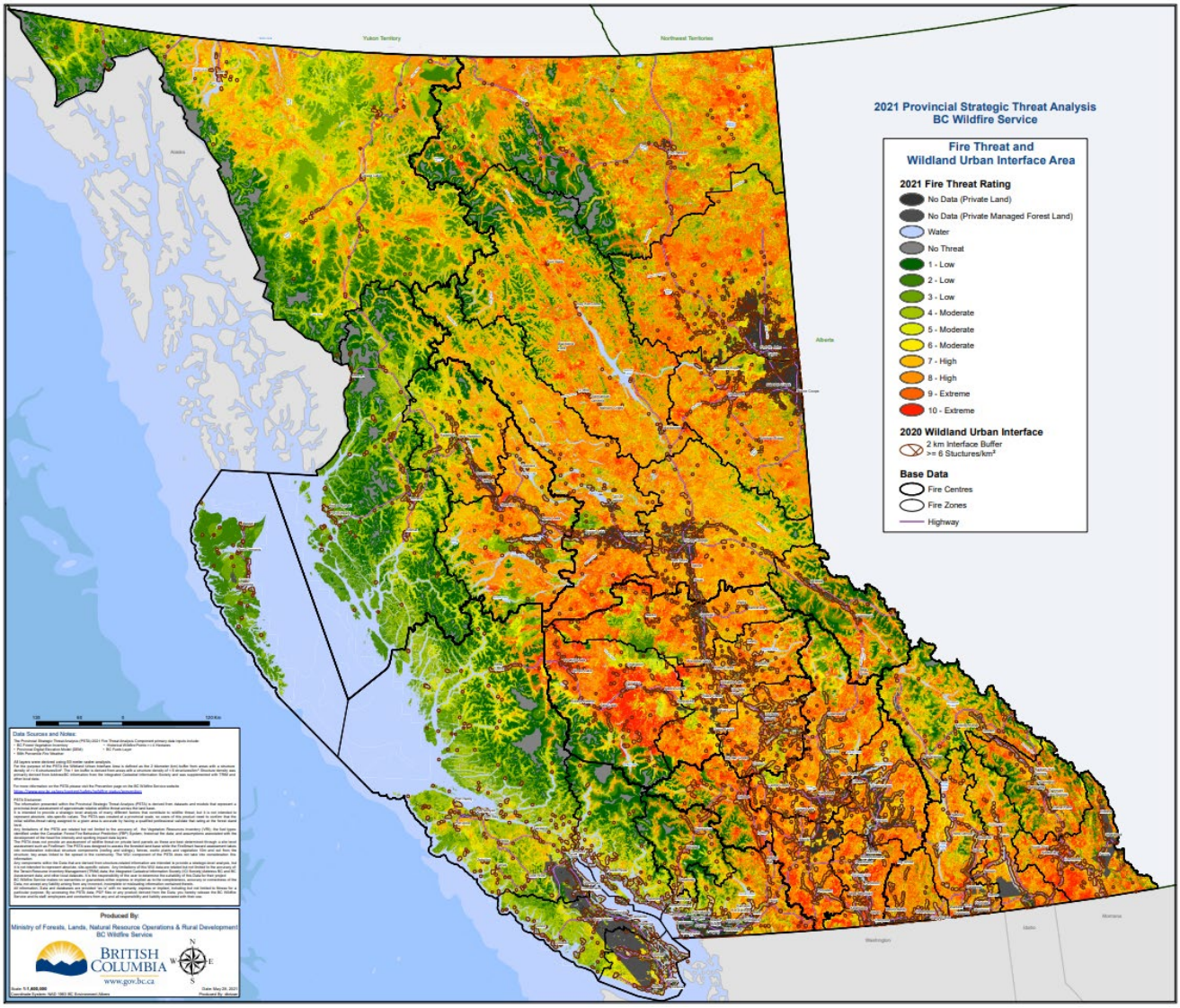
Appendix 1: Provincial fire threat and wildland urban interface areas of B.C.



*Available at https://www2.gov.bc.ca/gov/content/safety/wildfire-status/prevention/fire-fuel-management/psta/download-psta

Appendix 2: Example sites (a to v) showing fine fuel biomass, continuity, and plant growth form.

a) Pinegrass site. Biomass: ~700 kg/ha, continuous fuel, grass predominant.

b) Pinegrass site. Biomass: ~400 kg/ha, moderately continuous fuel, grass predominant.

e) Pinegrass site. Biomass: ~750 kg/ha, discontinuous fuel, shrub predominant.

f) Pinegrass site: Biomass: ~250 kg/ha, discontinuous fuel, grass predominant.

c) Pinegrass site. Biomass: ~300 kg/ha, discontinuous fuel, grass predominant.

d) Pinegrass site. Biomass: ~350 kg/ha, moderately discontinuous fuel, grass/forb mix.

g) Bluebunch wheatgrass site: Biomass: ~900 kg/ha, continuous fuel, grass predominant.

h) Bluebunch wheatgrass site: Biomass: ~1200 kg/ha, moderately continuous fuel, grass/shrub mix.

i) Bluebunch wheatgrass site. Biomass: ~700 kg/ha, moderately continuous fuel, grass predominant.

j) Bluebunch wheatgrass site: Biomass: ~500 kg/ha moderately discontinuous fuel, grass predominant.

k) Bluebunch wheatgrass site. Biomass: ~150 kg/ha, discontinuous fuel, grass predominant.

l) Bluebunch wheatgrass site. Biomass: ~400 kg/ha, discontinuous fuel, grass predominant.

m) Rough fescue site. Biomass: ~1500 kg/ha, continuous fuel, grass predominant.

n) Rough fescue site. Biomass: ~200 kg/ha, discontinuous fuel, grass predominant.

o) Rough fescue site. Biomass: ~700 kg/ha, moderately continuous fuel, grass/forb mix.

p) Rough fescue site. Biomass: ~500 kg/ha, moderately continuous fuel, grass/forb mix.

q) Rough fescue/pinegrass site. Biomass: ~500 kg/ha, continuous fuel, grass predominant.

r) Rough fescue/pinegrass site. Biomass: ~400 kg/ha, continuous fuel, grass predominant.

s) Crested wheatgrass site. Biomass: ~800 kg/ha, continuous fuel, grass predominant.

t) Crested wheatgrass site. Biomass: ~400 kg/ha, moderately discontinuous fuel, grass predominant.

u) Smooth brome. Biomass: ~1,500 kg/ha, continuous fuel, grass predominant.

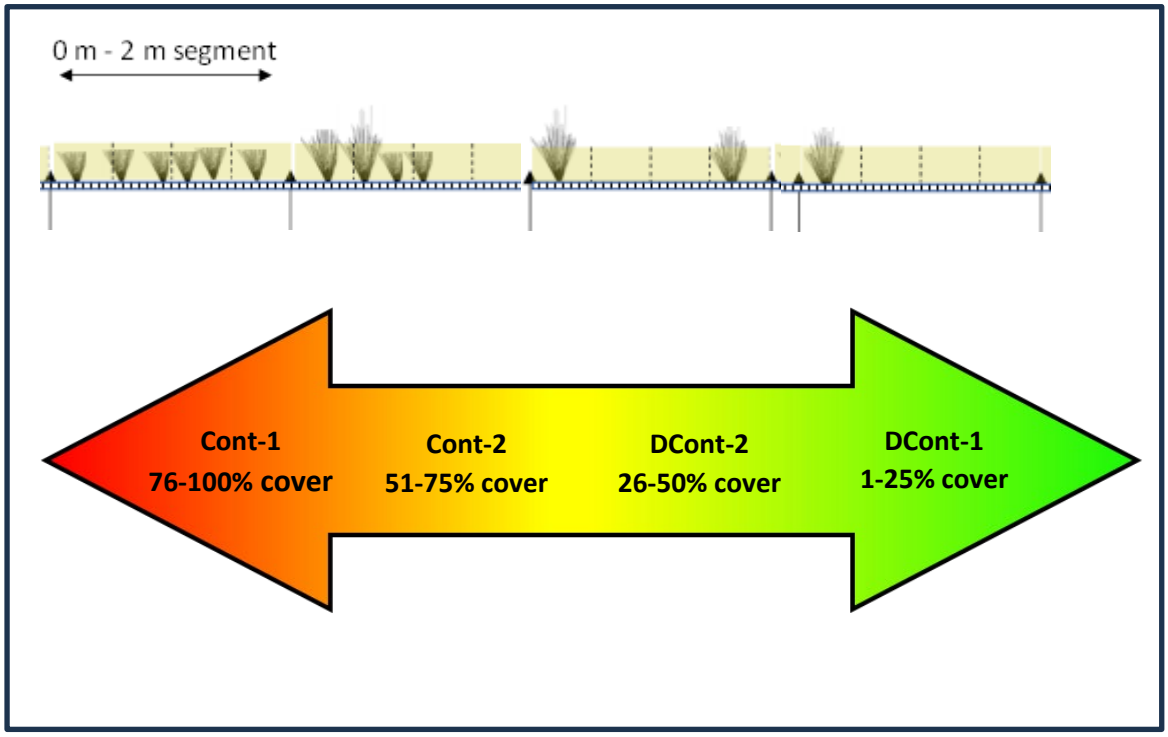
v) Smooth brome/Kentucky bluegrass. Biomass: ~800 kg/ha, continuous fuel, grass predominant.

Appendix 3: Measuring Fuel Continuity

In multiple 2 m by 0.50 m areas (approximately), estimate the percentage cover of grasses higher than 10-cm using the guidance provided in the figure below. Record the estimates using the continuity category definitions in the following Table.

Fuel continuity category definitions.

Continuity Category	Code	Range of Cover (%)
Highly discontinuous	DCont-1	1 - 25
Moderately discontinuous	DCont-2	26 - 50
Moderately continuous	Cont-2	51 - 75
Highly continuous	Cont-1	76 - 100



Methodology for estimating fine fuel continuity.

Appendix 4: Site Selection Checklists

Component	Urgency Rating Checklist	Suggested score	Site score
Wildfire Threat	**Proximity to the developed area**		
	Primarily within the first 400 m of a WUI	100	
	Primarily within the first 2 km of a WUI	75	
	Beyond 2 km	0	
	Wildfire threat rating		
	Extreme (10)	100	
	Extreme (9)	75	
	High (8)	60	
	High (7)	45	
	Moderate (6)	30	
	Moderate (5)	15	
	Moderate (4)	0	
Amount and Characteristics of Fine Fuel	**Amount of fine fuel**		
	>1500	100	
	1000 - 1500	80	
	500 - 1000	60	
	250 - 500	40	
	<250	0	
	Continuity of fine fuel		
	Grasses form > 75% of the stand	100	
	Grasses form 50 – 75% of the stand	75	
	Grasses form 25 – 50% of the stand	50	
	Grasses form < 25% of the stand	0	
	Dominant plant growth form		
	Grass predominant	100	
	Grass/forb mix	75	
	Grass/shrub mix	50	
	Grass/forb/shrub mix	40	
	Forb predominant	25	
	Shrub predominant	0	
	TOTAL		

Component	Suitability Screening Checklist	Suggested score	Site score
Benefit to Overall Fuel Management	**Woody fuel treatments conducted on the site**		
	Less than 5 years ago or planned in near future	100	
	5 to 10 years ago	75	
	Greater than 10 years ago	50	
	No work done	25	
	Adjacency to other fuel breaks		
	Adjacent	100	
	Within 2 km	75	
	Within 10 km	50	
	None	25	
	Portion of pasture area within the 400-m zone		
	> 40% of total pasture area	100	
	> 30% of total pasture area	85	
	< 30% of total pasture area	20	
Livestock Management	**Status of pasture fencing**		
	Pasture is completely fenced	100	
	Pasture is 75% fenced	75	
	Pasture is 50% fenced	50	
	Pasture is 25% fenced	25	
	No fences in place	10	
	Status of stock water development		
	Water developments exist every 1.6 km	100	
	Water developments exist but more needed	75	
	Potential sources of water but none developed	50	
	No developable water sources exist	10	
	Livestock transportation requirements		
	Cattle can be turned out from an adjacent pasture	100	
	Cattle can be herded through tenured or private land	85	
	Cattle must be trucked by liner. Corral on site.	60	
	Cattle must be trucked by liner. No corral on site.	45	
	Cattle must be trucked by stock trailer. Corral on site.	45	
	Cattle must be trucked by stock trailer. No corral on site.	30	
Biophysical	**Suitability of ecosystem type**		
	Low to mid-elevation Douglas-fir dry forest (e.g., IDFxh, IDFdk)	100	
	Mid-elevation spruce forest (MS)	100	

	Primarily domestic seeded grass (e.g., crested wheatgrass, Kentucky bluegrass, smooth brome, orchardgrass)	100	
	Lodgepole pine or trembling aspen seral stages	100	
	Low elevation ponderosa pine forest (PPxh)	75	
	Low elevation bunchgrass grassland (BGxh, BGxw)	50	
	Other spruce forests (SBS, BWBS, SBPS, SWB, ESSF)	25	
	Interior cedar forests (ICH)	25	
	All others	5	
	Slope and landform type		
	Flat	100	
	Mix of flat and slopes under 30%	100	
	Slopes under 30%	80	
	Mix of slopes under 30% and slopes greater than 30%	40	
	Slope > 30%	10	
	Obstacles or tree regeneration impeding cattle access		
	Few obstacles to cattle access. No regen	100	
	Some obstacles to 0.25 m height	90	
	Continuous obstacles to 0.25 m height, or some regen < 1 m spacing	60	
	Some obstacles to 0.5 m height	50	
	Continuous obstacles to 0.5 m height or higher, or continuous regen < 1 m spacing	10	
	Rangeland health		
	Properly functioning condition (PFC) or Reference Condition	100	
	Slightly at risk or slightly altered	90	
	Moderately at risk or moderately altered	0	
	Highly at risk or greatly altered	-50	
	Non-functional	-100	
	Toxic plant occurrence		
	None or infrequent	100	
	Scattered and uncommon	75	
	Moderately frequent	-50	
	Frequent	-100	
	Invasive plant occurrence		
	None or infrequent	100	
	Scattered and uncommon	75	
	Moderately frequent	0	
	Frequent	-50	

Appendix 5. FRPA-listed Invasive Plant Species of BC

Available online under the Invasive Plants Regulation.

Common Name	Scientific Name
Anchusa	*Anchusa officinalis*
Baby's breath	*Gypsophila paniculata*
Black knapweed	*Centaurea nigra*
Blueweed	*Echium vulgare*
Brown knapweed	*Centaurea jacea*
Bull thistle	*Cirsium vulgare*
Canada thistle	*Cirsium arvense*
Common burdock	*Arctium minus*
Common tansy	*Tanacetum vulgare*
Dalmatian toadflax	*Linaria dalmatica*
Diffuse knapweed	*Centaurea diffusa*
Field scabious	*Knautia arvensis*
Giant knotweed	*Polygonum sachalinense*
Gorse	*Ulex europaeus*
Hoary alyssum	*Berteroa incana*
Hoary cress	*Cardaria draba*
Hound's-tongue	*Cynoglossum officinale*
Japanese knotweed	*Polygonum cuspidatum*
Leafy spurge	*Euphorbia esula*
Marsh thistle	*Cirsium palustre*
Meadow hawkweed	*Hieracium pilosella*
Meadow knapweed	*Centaurea pratensis*
Nodding thistle	*Carduus nutans*
Orange hawkweed	*Hieracium aurantiacum*
Perennial pepperweed	*Lepidium latifolium*
Plumeless thistle	*Carduus acanthoides*
Puncture vine	*Tribulus terrestris*
Purple loosestrife	*Lythrum salicaria*
Rush skeletonweed	*Chondrilla juncea*
Russian knapweed	*Acroptilon repens*
Scentless chamomile	*Matricaria maritima*
Scotch broom	*Cytisus scoparius*
Scotch thistle	*Onopordum acanthium*
Spotted knapweed	*Centaurea maculosa*
St. John's-wort	*Hypericum perforatum*
Sulphur cinquefoil	*Potentilla recta*
Tansy ragwort	*Senecio jacobaea*
Teasel	*Dipsacus fullonum*
Yellow iris	*Iris pseudacorus*
Yellow starthistle	*Centaurea solstitialis*
Yellow toadflax	*Linaria vulgaris*