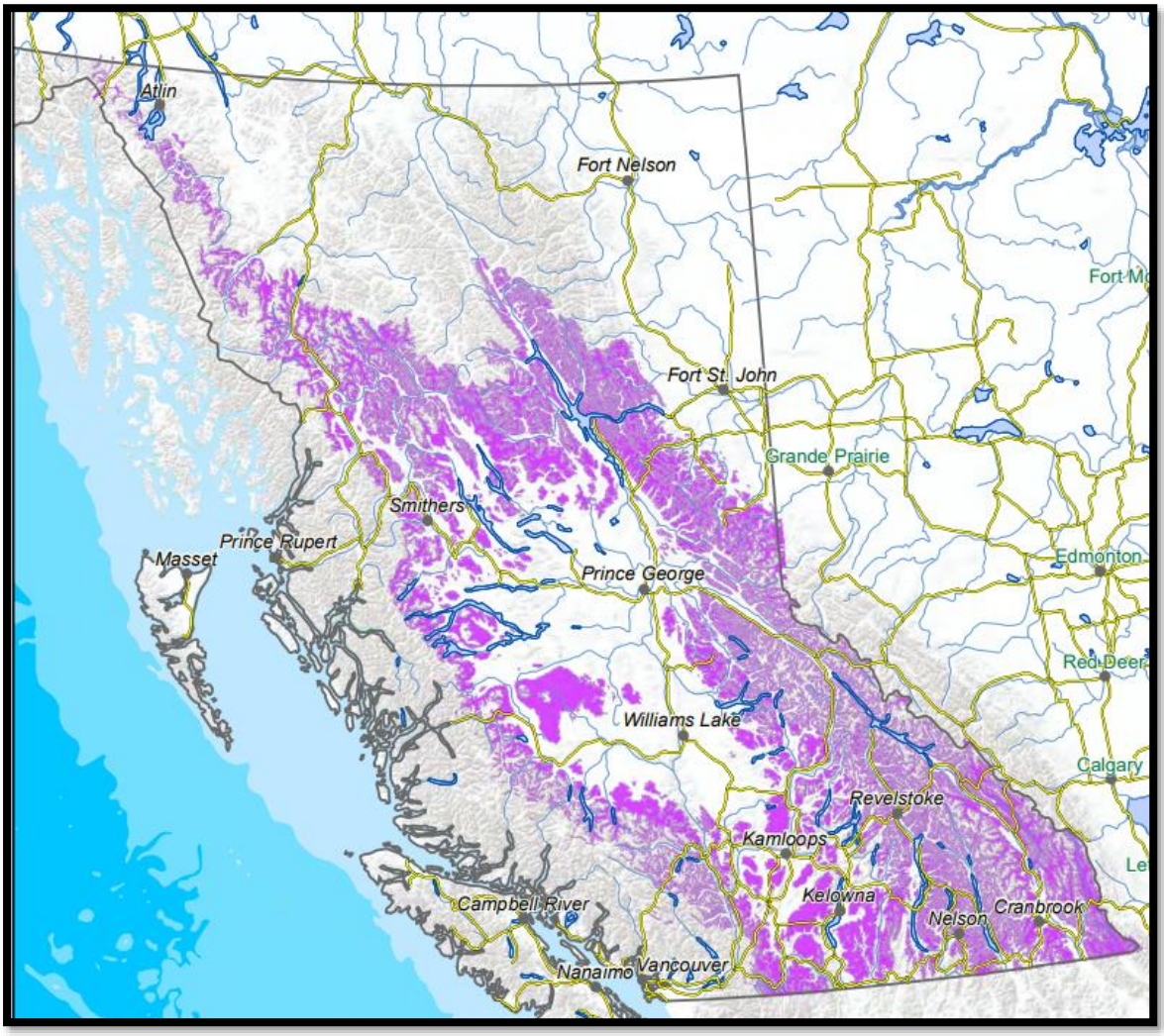


INTERIOR-SUBALPINE FIRE WEATHER ZONE

Best Management Practice Guide for Fuel Treatment

BRITISH COLUMBIA | BC Wildfire Service

FUEL MANAGEMENT
PROVINCIAL OPERATIONS

ECOLOGY OF THE INTERIOR-SUBALPINE FIRE WEATHER ZONE

The interior-Subalpine Fire Weather Zone occupies the uppermost forested elevations in all but the most northern quarter of British Columbia's interior. The Engleman Spruce-Subalpine Fir (ESSF) [i] **Biogeoclimatic (BEC) Zone can be found here, along with high elevation reaches of the and Montane Spruce (MS)** [iii] **BEC Zone.**

- Occurring mainly in steep and rugged terrain, coniferous forests and subalpine parklands predominate the harsh climactic conditions of the Interior Subalpine Fire Weather Zone.
- Subalpine fir, Engelmann spruce, and hybrid white spruce are the most common canopy species, while stands of lodgepole pine are abundant in middle and lower reaches, particularly following stand-clearing wildfire events.
- Whitebark pine, limber pine, and alpine larch are also common in drier forested parts of the zone. Other species of conifer occur only occasionally in special circumstances. The zone contains few deciduous trees of any kind.
- White-flowered rhododendron is a characteristic shrub that occurs throughout, as well as black huckleberry, grouseberry, and false azalea in the south.
- At the upper elevations, the landscape is covered with open parkland. Trees are sparce, often found clumped and interspersed with meadow, heath, and grassland.
- Rich in showy, flowering herbs, open meadows also occur in valley bottoms and on lower, gentling sloping ground where melting snow produces continuous seepage and the ground stays moist throughout the growing season. Hellebore, arrow-leaved groundsel, subalpine daisy, paintbrush and foam-flower can be found here, as well as Sitka valerian which gives the Interior-Subalpine Zone its characteristic scent.

Wildlife is abundant in this zone, with moose, black bear, and grizzly bears found in abundance. Rocky Mountain elk, Rocky Mountain bighorn sheep, white-tailed deer, and stone sheep are also found in restricted areas. [i]

INTERACTIONS WITH FIRE

In the generally cool, high elevation forests of the Interior Subalpine Fire Weather Zone, fires tend to burn less frequently and at higher severities. Here, stand-replacing fires have historically occurred every 200-400 years. [iv] In the driest areas of the ESSF in the southeast of the province as well as in included MS sub-zones, these fires can be more common. [iv] Forests here have a mixed severity regime, in some areas experiencing low to high intensity fires at a median frequency from 15.5 to 77.5 years, and others from 150-200 years. [iv, vi]

Lodgepole pine is the primary pioneer species post fire disturbance. This species is particularly adapted to survive in fire affected regions. When fires sweep through the forest, the heat causes the pinecones to open, making it possible for seeds to drop to the forest floor. Under the right nutrient and moisture conditions, the pine seeds sprout, and this begins the process of succession that leads ultimately to a mature forest. This has had a particular impact on the MS zone, where lodgepole pine is now the dominant species in several areas due to the higher interval and intensity of fires experienced. [ii]

CANADIAN FOREST FIRE BEHAVIOUR PREDICTION SYSTEM- FUEL TYPE

In the Interior Subalpine Fire Weather Zone, the ESSF and MS and BEC zones are typically classified as a C-3 (closed canopy) or C-7 (open canopy) fuel type in the Canadian Forest Fire Behaviour Prediction (FBP) system. [v] This fuel type is a conifer dominated stand with a moderately high crown base height (CBH), sparse conifer understory, and little down woody fuels. [vi, vii] The organic layer can range from shallow to moderately deep and compacted. Although stand characteristics may differ than the descriptors for each classification, the burning characteristics tend to be the best match with these FBP fuel types. [vi, vii]

Interior Subalpine parklands, that support small stands of subalpine fir and Engelmann spruce and are largely separated by wet meadows or shrublands, are difficult to classify in the FBP system. The open herb- and shrublands tend to be dominated by forbs and graminoids (rushes, sedges, heather, etc.) and are less flammable than classic O-1 grasslands; although the conifers often have crowns extending to the ground and will burn readily under certain conditions. These areas therefor do not yet have a classification in the FBP system. [vii]

FUEL MANAGEMENT

Surface Fuels

- All slash from the thinning treatment/ beetle attack must be managed as part of the fuel and wildfire threat reduction.
- Coarse woody debris (CWD) management should follow the Chief Forester's guidance. CWD should be kept to a minimum and only large piece size (>20 cm in diameter and >10 m in length) be left on site. The number of CWD pieces per ha should be maximum 18 pieces in the ESSF zone and maximum 4 in included MS subzones. Preference should be given to existing CWD (<50% decayed) that is already functioning in the treatment area.
- Explore the opportunity to treat and maintain surface fuels with prescribed fire.

Ladder Fuels

- ladder fuel must be managed as part of any treatment.
- Consider growth progression of the stand and explore opportunities to leave patches of understory trees where both vertical and horizontal separation from the overstory fine fuels exists.
- Increase gap between surface and canopy base.

Crown Fuels

- Consideration of stand conversion to deciduous species such as aspen is recommended to reduce wildfire risk and decrease fire intensity.
- A closed canopy may help maintain the moisture regime and ideally surface fuel at lower levels, thus keeping any surface fire at a lower intensity level.
- If overstory thinning is deemed necessary, focus on removing unhealthy stems and retaining those that will be resilient to windthrow, mechanical damage, fire, and pest disturbances and minimize soil disturbance to not promote invasive species.
- Stands should be managed to maintain wind firmness/ resistance to snow press.
- When using a "patch cut" treatment method, care must be taken to ensure crown separation, both vertically (manage ladder fuels in the clump) and horizontally (crown separation between clumps) is managed for fire threat reduction.
- Clumps of "regeneration" left in the residual stand must be separated from overstory/ crown fuels horizontally and vertically (recommend 2 times the height of the regeneration to crown fuel of overstory)

Maintenance

- The maintenance of these fuel treatments is an important component of continued wildfire threat reduction.
- Stands should be monitored over successive years for breakage and fuel accumulation from windthrow, snow, or ice.

RECOMMENDATIONS FOR MITIGATING IMPACT ON FOREST HEALTH

The following activities include those used to limit pest or disease outbreaks that could result from treatment. In areas susceptible to bark beetle outbreaks, additional consultation from experts regarding management may be required.

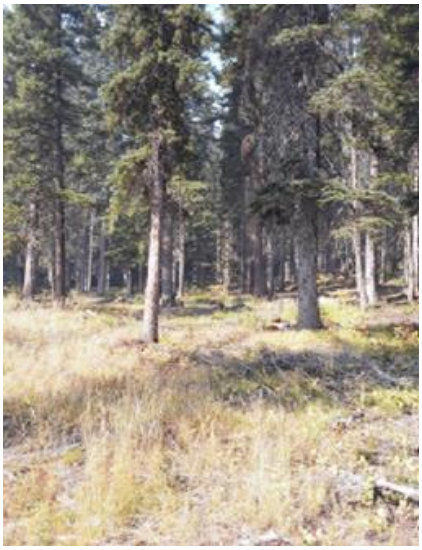
- A two-stage approach when conducting thinning treatments could minimize tree loss from wind damage, by initially removing 1/2 – 1/3 of stems, with the remainder of treatment to be conducted 5-10 years later.
- Trees that are unhealthy at the time of treatment should be identified and removed.
- Non-merchantable green logs or pieces (e.g., sections of Douglas-fir and spruce containing decay and discarded during harvesting or bucking) should be removed from the stand and destroyed so they are not attracting insects or disease.
- Trees with significant logging damage, particularly falling damage (e.g., stripping of a significant part of the crown), should be removed because they attract insects or disease. Stump heights should be kept to a minimum for this same reason.
- Stands should be monitored over successive years for breakage from windthrow, snow, or ice. Sanitation logging should be carried out as necessary to prevent the spread of insects or disease.

This document is not intended to cover all aspects of fuel management and fire behaviour. It is directed towards experienced professionals working well within their scope of practice as outlined in the 2013 ABCFP released Interim Guidelines – Fire and Fuel Management.

Examples of Best Management Practices in Fuel Management	The following examples had the prescriptions completed by a qualified Forest Professional and were reviewed and approved by the local Wildfire Prevention Officer. The treatment units were assessed as part of the Crown Land Wildfire Risk Reduction assessment project.

Manning Park, TU: ALL, Natural Resource District DCS
BEC Zone & Subzone: ESSF dh1

Attribute	Post Treatment Characteristics
Overstory	200 SPH
Understory	Target: L3: 100% removal L4: 50% removal
Average CBH (m)	3.8m
Crown Closure (%)	27%
Fine Woody Debris (< 7 cm)	0.8 kg/m^2
Large Woody Debris (7 - 20 cm)	1.35kg/m^2
Coarse Woody Debris (Target > 20 cm)	Coarse Woody Debris should follow the Chief Forester's guidance - maximum 18 pieces in the ESSF zone and maximum 4 in included MS subzones.



ADDITIONAL INFORMATION

- Benson et al., "Stand Conversion for Wildfire Risk Mitigation". https://library.fpinnovations.ca/en/viewer?file=%2fmedia%2fFOP%2fTR2021N7.PDF#phrase=false
- BC Wildfire Service, "Tools for Fuel Management." https://www2.gov.bc.ca/gov/content/safety/wildfire-status/prevention/fire-fuel-management/fuel-management
- BC Wildfire Service, "Wildfire Hazard Assessment and Abatement." https://www2.gov.bc.ca/gov/content/safety/wildfire-status/prevention/for-industry-commercial-operators/hazard-assessment-abatement
- Parisien *et al.* "Abrupt, climate-induced increase in wildfires in British Columbia since the mid-2000s." 2023. *Commun Earth Environ* **4**, 309. https://doi.org/10.1038/s43247-023-00977-1
- Wang W et al., "Burn Severity in Canada's Mountain National Parks: Patterns, Drivers, and Predictions." 2022. Geophysical Research Letters [Internet];49(12). https://doi.org/10.1029/2022gl097945
- Higuera et al., "Rocky Mountain Subalpine Forests Now Burning More Than Any Time in Recent Millennia." 2010. Proceedings of the National Academy of Sciences of the United States of America, vol. 118, no. 25. https://doi.org/10.1073/pnas.2103135118
- Whitehead et al., "Effect of commercial thinning on within-stand microclimate and fine fuel moisture conditions in a mature lodgepole pine stand in southeastern British Columbia". 2008. Natural Resources Canada, Information Report. https://epe.lac-bac.gc.ca/100/200/301/nrcan-rncan/information_report_fi_x/fi_x_004/Fo148-1-4E.pdf
- Coops et al., "Investigating the effectiveness of Mountain Pine Beetle mitigation strategies." 2008. https://www.tandfonline.com/doi/full/10.1080/09670870701805737

---

[i] Ministry of Forests, "The Ecology of the Engelmann Spruce – Subalpine Fir Zone" https://www.for.gov.bc.ca/hfd/pubs/docs/bro/bro55.pdf

[ii] Ministry of Forests, "The Ecology of the Sub-Boreal Spruce Zone" https://www.for.gov.bc.ca/hfd/pubs/docs/bro/bro53.pdf

[iii] Ministry of Forests, "The Ecology of the Montane Spruce Zone" https://www.for.gov.bc.ca/hfd/pubs/docs/bro/bro62.pdf

[iv] Ministry of Forests, *Biodiversity Guidebook*. https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/natural-resource-use/land-water-use/crown-land/land-use-plans-and-objectives/cariboo-region/cariboochilcotin-rlup/biodiversity_guidebook.pdf

[v] Daniels L. et al., "Historic climate-fire-vegetation interactions of the West versus East Kootenays: Implications of climate change and fire suppression." 2011. Tree-Ring Lab at UBC, Department of Geography. https://www.researchgate.net/publication/237842523_Historic_climate-fire-vegetation_interactions_of_the_West_versus_East_Kootenays_Implications_of_climate_change_and_fire_suppression

[vi] Daniels L., Cochrane J., "Mixed-Severity Fire Regimes: Regional Analysis of the Impacts of Climate on Fire Frequency in the Rocky Mountain Forest District." 2007. Tembec Inc., BC Division., Canadian Forest Products. https://www.for.gov.bc.ca/hfd/library/FIA/2007/LBIP_4592002.pdf

[vii] Natural Resources Canada, "British Columbia Wildfire fuel typing and fuel type layer description." Canadian Forest Service Publications. https://cfs.nrcan.gc.ca/publications?id=39432

[viii] Natural Resources Canada, "FBP Fuel Type Descriptions". https://cwfis.cfs.nrcan.gc.ca/background/fueltypes/c3

[ix] Natural Resources Canada, "FBP Fuel Type Descriptions". https://cwfis.cfs.nrcan.gc.ca/background/fueltypes/c7