COASTAL FIRE WEATHER ZONE

Best Management Practice Guide for Fuel Treatment

BRITISH COLUMBIA | BC Wildfire Service

FUEL MANAGEMENT PROVINCIAL OPERATIONS

ECOLOGY OF THE COASTAL FIRE WEATHER ZONE

The Coastal Fire Weather Zone encompasses all of British Columbia's coastal region, and east into the Coast Mountains. Two Biogeoclimatic (BEC) zones are predominant in this area: the Coastal Western Hemlock (CWH) Zone [i], and the Coastal Douglas Fir (CDF) Zone. [ii]

- Coniferous forests predominate across the Coastal Fire Weather Zone. Commonly called "temperate rainforests" because of the mild, wet climate in which they grow, these forests are complex and often highly productive ecosystems, home to trees of great age and massive proportions.
- Wind is a common form of natural disturbance in this zone, especially on the exposed outer coast, where storms are often accompanied by strong winds. By blowing down one tree or small patches of trees, wind disturbance creates openings or gaps in the forest canopy. These gaps allow light to penetrate to the forest floor, stimulating the growth of shrubs and tree seedlings and contributing to the overall high levels of biodiversity that this region is known for.
- Western hemlock and western redcedar trees are very common canopy species here. Other species include amabilis fir and yellow-cedar in wetter and cooler areas and at higher elevations; grand fir, Douglas-fir, western white pine, and bigleaf maple in warmer and drier areas; red alder on disturbed sites; black cottonwood along rivers; and lodgepole pine on very dry sites, or in very wet boggy areas. In the south, Sitka spruce occurs along coastlines and floodplains, while further north it occupies a wider variety of habitats.
- Wetlands, particularly bogs, are common in coastal lowland areas. They range from "closed" bog forests with scrubby and irregular tree cover to "open" bogs with few trees.
- Two trees, Garry Oak and arbutus, that are abundant in the small area on south coast covered by the CDF zone, are found nowhere else in Canada. Here, in dry sites with deep soils, Garry oaks form an open tree cover above a carpet of grasses and colorful spring flowers, including blue camas, shooting star, easter lily, chocolate lily, and satin flower.

Although it is one of the smallest of British Columbia's 14 ecological zones, the Coastal Douglas-fir Zone is home to some of the province's rarest vegetation, which is seriously threatened by growing human settlement. [iii]

INTERACTIONS WITH FIRE

The Coastal Fire Weather Zone supports a temperate rainforest with long growing seasons and high levels of precipitation. Due to low fuel flammability in the understory, high water retention of downed fuels, and a typically closed canopy reducing surface temperatures, fires uncommonly spread over large areas in mature stands. [iv] However, in transition zones on slopes with higher levels of exposure, such as those found in the Coast Mountains, larger wildfires are becoming more common.

Suppression concerns typically arise in open fuel types, such as in stands that have recently experienced disturbance. Stands adjacent to these disturbances are also at a higher risk of increased fire activity due to drying effects from exposure to heat and wind, as well as from the potential increase in fine fuel loads. [v]

In grassy areas more common of the drier CDF zone, but also found in sections of the CWH, a high presence of invasives species supports the potential for particularly flashy fire behaviour. Scotch Broom and Gorse are pervasive in many areas and require consideration during fuel treatments.

CANADIAN FOREST FIRE BEHAVIOUR PREDICTION SYSTEM- FUEL TYPE

When host to mature stands in typical conditions, these ecosystems are best represented by the C-5 fuel type in the Canadian Forest Fire Behavior Prediction (FBP) System. [vi] Through the dry portions of the CDF in the south, C-7 stands can also be found. [vi] Both fuel types are characterized by conifer dominated stands with a high (usually >12m) crown base height, sparse conifer understory, and sparse down woody fuels. [vii, viii]

In the dry subzones within the Coast Mountains and at some higher elevation sites, stands are typed as M-2 40% conifer, representing predicted Rate of Spread (ROS) and Head Fire Intensity (HFI) values somewhere between C-5 and C-3 outputs. [vi] In most fire weather conditions, M-2 40% conifer produces ROS near the C-3 prediction, although at high and extreme fire danger conditions (ISI >25 or so) the predicted spread rate is lower, representing more canopy openings and discontinuities which are believed to occur in these stands. [vi]

It is important to note that surface fuel loading in the coastal region can be much greater than in typical C-5 forests. While these forests are known to burn rarely and with low intensity, drought conditions can lead to higher fuel consumption and fire intensity in untreated stands. [vi] Climate change has begun to alter these dynamics, with more dramatic changes anticipated in coming years. [v]

FUEL MANAGEMENT

Surface Fuel

- Address surface fuels as an essential part of every fuel treatment. Consider continuity and distribution of surface fuels left on site.
- Explore the opportunity to treat and maintain with prescribed fire.
- 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 23 pieces across the zone, or 11 pieces in CWHxm subzones. Preference should be given to existing CWD (<50% decayed) that is already functioning in the treatment area.

Ladder Fuel

- 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.
- Ladder fuel must be managed as part of any treatment.
- Increase Fuel Stratum Gap (FSG) / gap between surface fuels and canopy base.

Crown Fuel

- Fuel treatment completed adequately on the surface and ladder fuels is likely enough to achieve the objective of keeping fire out of the canopy.
- If the canopy is opened too much during the thinning process, the surface fuels will be more susceptible to drying out from an increase amount of direct sunlight, as well as increased winds to dry out the fine fuels.
- 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.
- Consider fire management stocking standards if any reforestation is required or desired species conversion.

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.

- 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 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.
- If thinning is required, a two-stage approach could minimize tree loss from wind damage. Initially removing 1/2 – 1/3 of stems, with the remainder of treatment to be conducted 5-10 years later.

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	These 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.

Mesachie Lake WUI, Natural Resource District DSI
BEC Zone & Subzone: CWH xm1

Attribute	Post Treatment Characteristics
Overstory	717 SPH
Understory	Minor number of L3 and L4 conifers retained but no concerns with their density or positioning.
Average CBH (m)	8.5m – 10m minimum average Pruned to 3m where required.
Crown Closure (%)	60-75%
Fine Woody Debris (< 7 cm)	0.37 kg/m2
Large Woody Debris (7 - 20 cm)	0.27 kg/m2
Coarse Woody Debris	Adhered to Chief Foresters Guidance for wildfire mitigation, maximum 11 pieces for this zone.

Five Mile Creek, Natural Resource District DSE
BEC Zone & Subzone: ICH mw4 (Characteristics representative of some CWH subzones)

Attribute	Post Treatment Characteristics
Overstory	600 SPH
Understory	No L3-L4 conifers captured in plots. One isolated clump observed, no concerns for laddering.
Average CBH (m)	5.4m minimum average CBH Pruning height: 3-4m
Crown Closure (%)	70%– High crown closure on average, very shaded understory, heavily suppressed regeneration (herbs / shrubs / conifers)
Fine Woody Debris (< 7 cm)	0.22 kg/m2
Large Woody Debris (7 - 20 cm)	1.5 kg/m2 retained between 7 – 20 cm. Scattered on average, flat on the ground, and decomposing.
Coarse Woody Debris	Adhered to Chief Foresters Guidance for wildfire mitigation, maximum 23 pieces for this zone.

Rocky Point, Natural Resource District: DSI
BEC Zone: CDF

Prescription	Method
Surface Fuels	Brushing / Prescribed fire
Ladder Fuels	Crowns may lifted to increase light to the understory or to increase height of ladder fuels to reduce risk of canopy fire
Thinning	Modify stand structure to reduce encroaching conifer numbers and associated woody debris and fine fuels in the event of a wildfire.

Notes:

"In 2021 the burn occurred on September 24. The O1 plots had complete consumption of fuels. Both point and line ignitions techniques resulted in good burning outcomes. [Within] closed canopy the fire self-extinguished. Under these circumstances the timber edge could be used as a control line and efforts to burn this fuel type should be minimized. For a burn to be successful in this fuel the type of the grass needs to be at least 70% cured and a high FWI."

Conditions on day of ignitions:

DATE	STATION	TEMP	DEW PNT	RH	W.SPEED	FFMC	DMC	DC	ISI	BUI	FWI
2021-09-24	VICTORIA AP (EC)	19.6	10.7	56	12	84.4	12	568	3.6	23	6

ADDITIONAL INFORMATION

In addition to the resources below, several case studies regarding fuel treatment effectiveness in coastal regions are nearing completion and will soon be available for reference.

- 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
- Taylor and Alexander, "Field Guide to the Canadian Forest Fire Behavior Prediction (FBP) System". 3rd Edition (BINDER). http://cfs.nrcan.gc.ca/publications?id=39516
- K.J. Brown, N.J.R. Hebda, R.J. Hebda, R. Fitton, J.A. Trofymow, and N. Conder. 2022. Development and wildfire dynamics of dry coastal temperate forests, BC, Canada. Canadian Journal of Forest Research. 52(10): 1320-1333. https://doi.org/10.1139/cjfr-2022-0020 access at: https://tspace.library.utoronto.ca/bitstream/1807/124492/5/cjfr-2022-0020.pdf
- Tutsch, M. S. 2009. "People are the problem and the solution: characterizing wildfire risk and risk mitigation in a wildland-urban intermix area in the Southern Gulf Islands." Access at: https://summit.sfu.ca/item/9888

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[i] Ministry of Forests, "The Ecology of the Coastal Western Hemlock Zone." https://www.for.gov.bc.ca/hfd/pubs/docs/Bro/bro31.pdf

[ii] Ministry of Forests, "The Ecology of the Coastal Douglas-fir Zone." https://a100.gov.bc.ca/pub/eirs/finishDownloadDocument.do?subdocumentId=14724

[iii] Ministry of Forests, "Ecologically suitable species and landscape descriptions". https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/silviculture/tree-species-selection/tool-introduction/ecologically-suitable-species

[iv] Daniels L., Gray W., "Disturbance Regimes in Coastal British Columbia." 2006. https://jem-online.org/forrex/index.php/jem/article/view/542/449

[v] Lindenmayer D. et al., "Effects of logging on fire regimes in moist forests". 2009. https://doi.org/10.1111/j.1755-263X.2009.00080.x

[vi] 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

[vii] Natural Resources Canada, "FBP Fuel Type Descriptions". https://cwfis.cfs.nrcan.gc.ca/background/fueltypes/c5

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