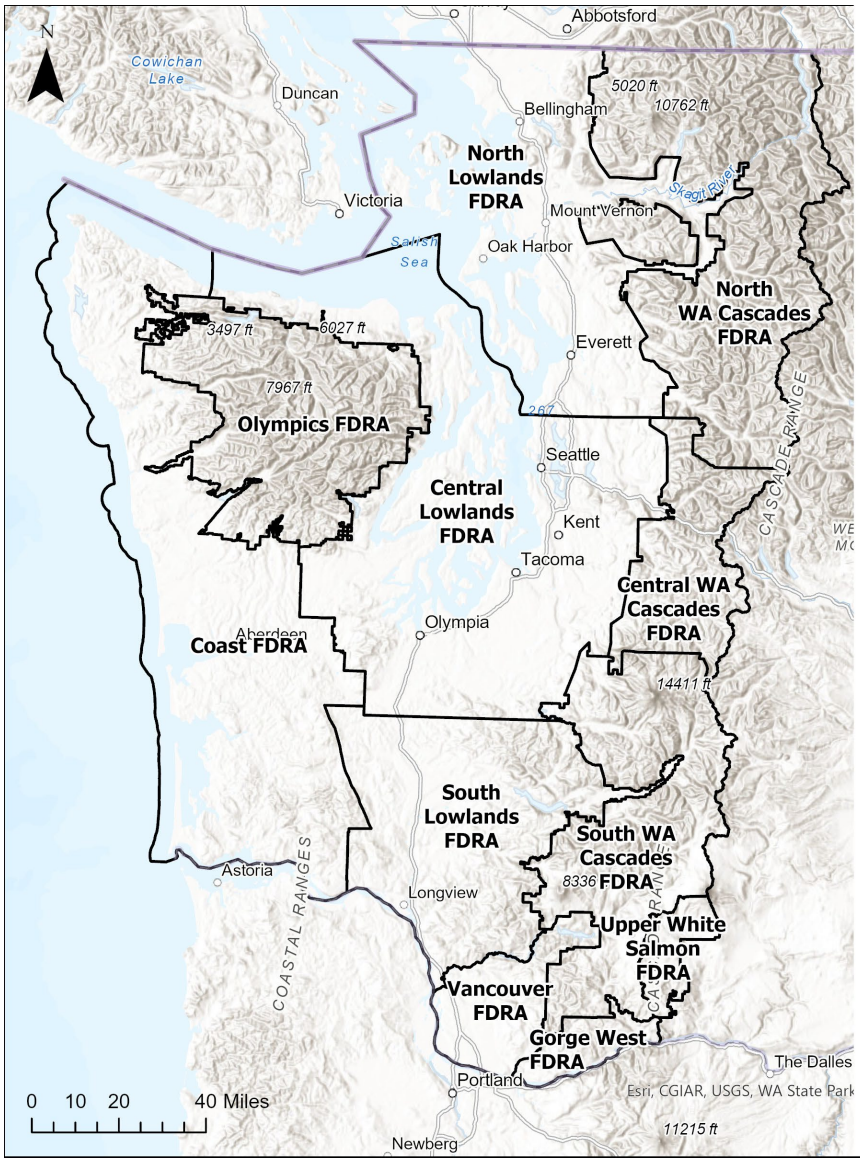
Western Washington
Fire Danger Operating Plan



Fire danger rating areas (FDRA's) of the Western Washington Fire Danger Operating Plan.

Legend

Fire Danger Rating Areas

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1.0 Introduction

1.1 Purpose

The public, industry, and our own agency personnel expect the interagency wildland fire management agencies to implement appropriate and timely decisions which ultimately result in safe, efficient, and effective wildland fire management actions.

This fire danger operating plan (FDOP) is intended to establish and document interagency planning and response levels based upon an assessment of vegetation, climate, topography and an analysis of historical weather and fire data. The plan provides a science-based tool for incorporating a measure of risk associated with decisions which have the potential to affect the safe and effective control of wildland fire.

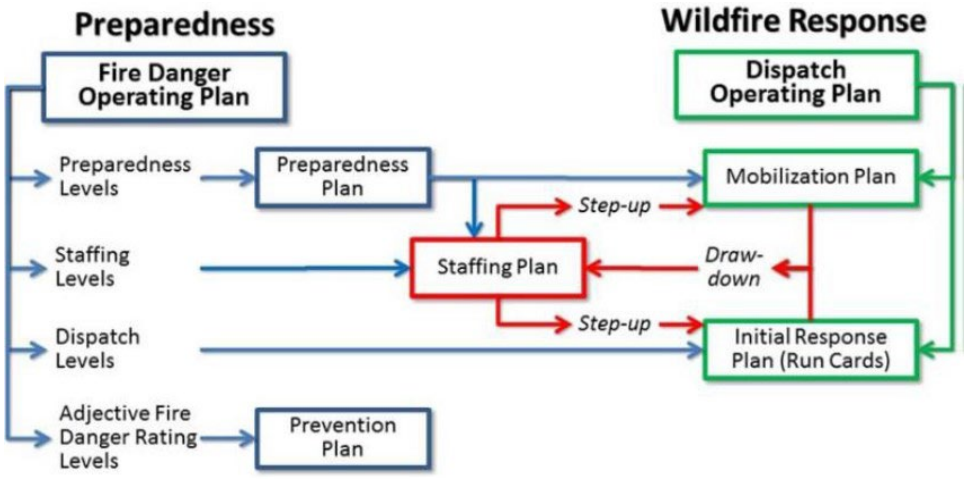
Interagency policy and guidance regarding the development of Fire Danger Operating Plans can be found in the Interagency Standards for Fire & Aviation Operations (Red Book).

1.2 Operating Plan Objectives

- Provide a tool for agency administrators, fire managers, dispatchers, agency cooperators, and firefighters to correlate fire danger ratings with appropriate fire business decisions. (1.3)
- Document an interagency fire weather monitoring network consisting of remote automatic weather stations. (2.2)
- Develop fire danger rating areas based upon similar climate, vegetation, and topography. (2.3)
- Define the fire problem and determine the most appropriate fire danger-based decision tool to mitigate the problem. (3.0)
- Determine relevant decision points for fire management actions based upon an analysis of historical fire weather and fire occurrence data. (4.0)
- Document the most effective methods for fire managers to communicate potential fire danger to cooperating agencies, industry, and the public. (5.0)
- Identify seasonal risk analysis criteria, establish general fire severity thresholds, and develop fire danger pocket cards for distribution. (Appendices 6.0)
- Identify program needs and suggest improvements for implementation of the fire danger operating plan. (7.0)

1.3 Application

The FDOP guides the application of the national fire danger rating system (NFDRS) through the use of decision points and management actions associated with system output. Interagency decision points are developed and documented herein. The mitigating fire management actions taken at each decision point are described in the following supplemental action plans. Supplemental action plans are not interagency and are developed by and housed with each agency.



1.3.1 Staffing Plan

The staffing plan describes action to ensure sufficient unit resource capability to respond to unplanned ignitions during short periods, one to several burn periods. It combines decision points with short-term events. Examples include forecast lighting, watch, warning, or other pre-planned events such as Fourth of July. Interagency staffing level decision points and calculation are identified and documented in this FDOP. Decisions and planned actions are located within the individual unit preparedness plans.

1.3.1.1 Staffing Levels

Staffing levels form the basis for decisions regarding the degree of readiness of initial attack (IA) and support resources. They are expressed as numeric values where 1 represents the low end of the fire danger continuum and 5 the high end. Staffing level is intended to provide fire managers with day-to-day decision support regarding staffing of suppression resources such as employee overtime associated with working people beyond their normal schedules and extended staffing resources, types of resources and minimum number of resources.

The process for determining local staffing levels is not always the same as staffing level calculated directly from WIMS (Weather Information Management System). WIMS calculates staffing level on climatological breakpoints. Currently, individual dispatch centers will calculate their respective staffing levels, with an expectation of coordination with adjacent or overlapping centers.

1.3.2 Preparedness Plan

The preparedness plan describes actions to ensure sufficient unit resource capability to respond to unplanned ignitions for longer periods, several days to weeks. It combines decision points with mid- to long-term events. Examples include drought, the peak of burn season, or local fire activity and resource availability. Interagency preparedness level decision points and preparedness level calculation are identified and documented in this FDOP. Decisions and planned actions are located within the individual unit preparedness plans.

1.3.3 Prevention/Restriction Plan

Prevention/restriction plans document the wildland fire problems and outline efforts regarding fire restrictions and closures. An interagency analysis of the fire problem and associated target group are identified and documented in this FDOP. Decisions and planned actions associated with the decision points identified in this FDOP are located within individual unit prevention/restriction plans.

1.3.4 Initial Response Plan/Mobilization Plan

Initial response plans, also referred to as run cards or pre-planned response plans, specify the fire management response to an unplanned ignition within a defined geographic area based on fire danger, fire management objectives, and resource availability. Interagency response levels and calculation are identified and documented in this FDOP. The initial response plans which contain the specifics of any preplanned actions, are maintained and located at individual units.

1.3.4.1 Response Levels

Response levels are established to assist fire managers with decisions regarding the most appropriate *response* to an initial fire report until a qualified Incident Commander arrives at the incident.

Response Levels are a direct function of staffing levels. The number and type of suppression resources dispatched to a reported fire is developed by local units and located within the individual dispatch centers.

2.0 Fire Danger Planning Area Inventory and Analysis

2.1 Fire Danger Rating Areas

A fire danger rating area (FDRA) is defined as a large geographic area that is relatively homogenous with respect to climate, vegetation, and topography. Because of these similarities it can be assumed that fire danger within an FDRA is relatively uniform.

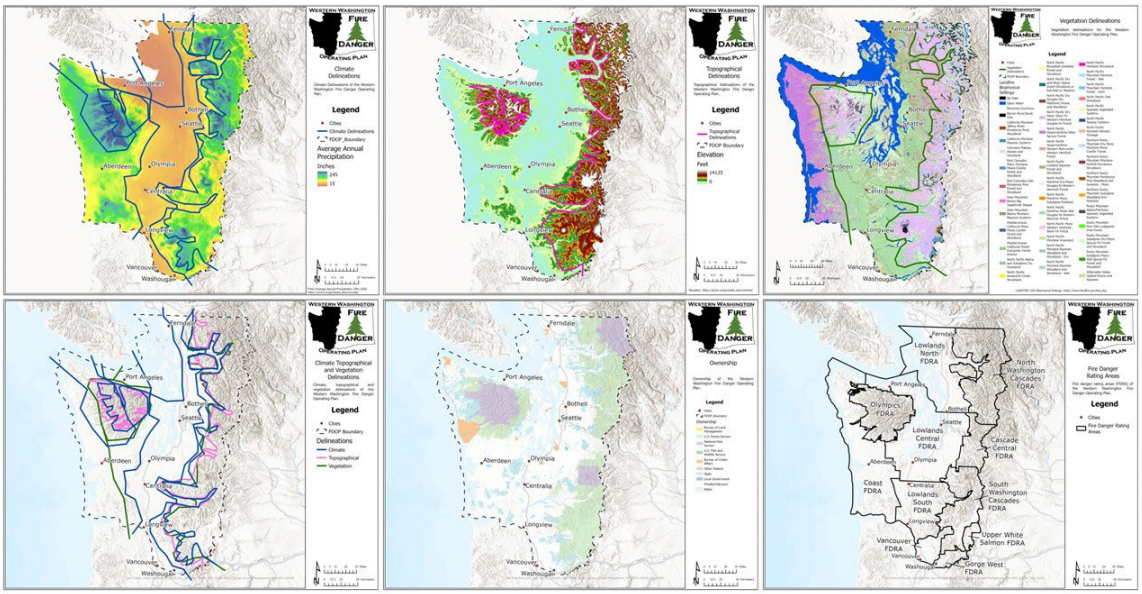


Figure 1. Top row from left to right: individual delineations for climate, topography, and vegetation. Bottom row from left to right: climate, topography and vegetation delineations grouped together, land ownership, and final Western Washington Fire Danger Rating Areas. See appendix for larger versions of each map.

FDRAs are developed through spatial delineation of climate, vegetation, and topography (Figure 1). After these environmental factors are considered independently, they are interpolated to form draft FDRA. Where possible, final FDRA were formed by edge matching the draft FDRA to existing administrative boundaries and fire weather zones (Figure 2).

Table 1. LANDFIRE elevation (median, feet), LANDFIRE slope (median, percent), PRISM annual precipitation (median, inches), and LANDFIRE FBFM 40 (majority) for FDRA.

FDRA	Elevation	Slope	Precipitation	FBFM 40
Cascade Central	3,179	44	100	185
Coast	269	9	94	161
Gorge West	1,131	24	84	185
Lowlands Central	301	4	47	98
Lowlands North	108	2	39	98
Lowlands South	915	18	64	185
Cascade North	3,533	51	110	185
Olympics	2,565	53	127	185
Cascade South	3,438	34	88	185
Upper White Salmon	3,490	15	83	165
Vancouver	597	9	69	91

2.2 Administrative Units

This document supports consistent application of fire danger decisions applied across multiple agency jurisdictional boundaries. Wildland fire management and suppression responsibilities are shared among federal, state, and local cooperators. Participants in this plan will communicate and coordinate fire danger with one another.

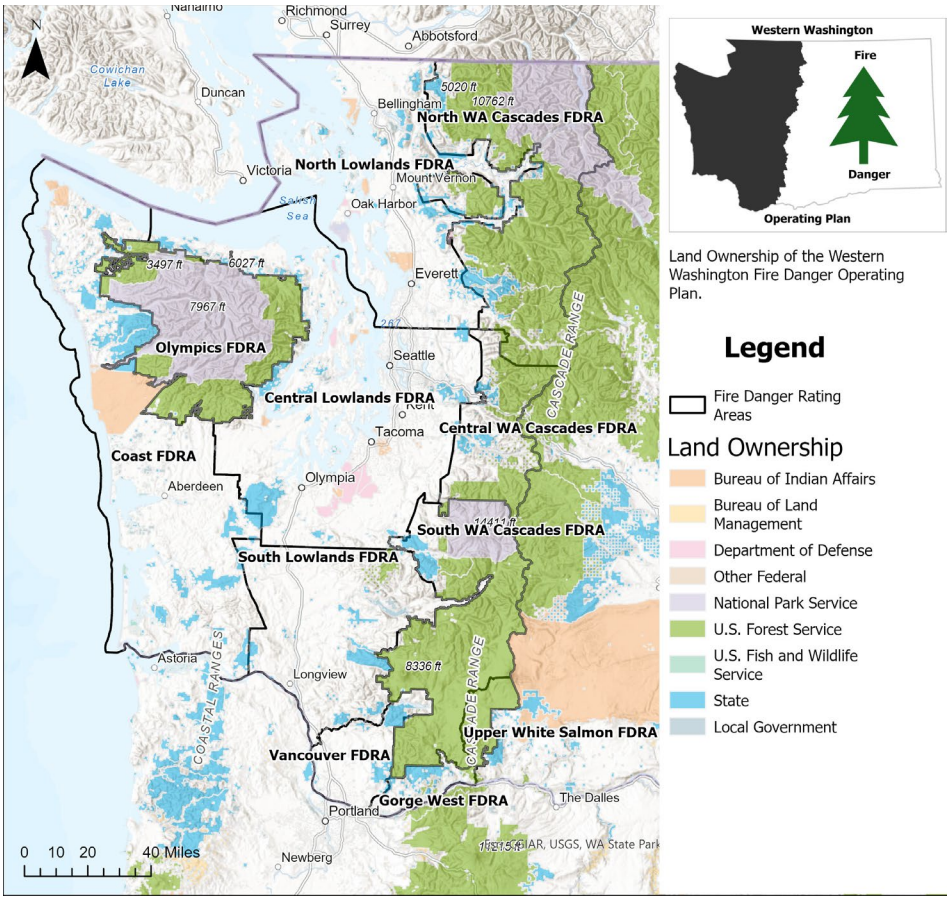


Figure 2. Land management and ownership within the Western Washington Fire Danger Operating Plan.

Table 2. Percent ownership within the FDOP totaling at least one-percent (BLM Oregon/Washington LLI).

Ownership	Percent Area
PV	52%
USFS	24%
NPS	11%
ST	10%
BIA	2%

Table 3. Percent ownership by Fire Danger Rating Area, top three totaling at least one-percent (BLM Oregon/Washington LLI).

FDRA	Ownership	Percent Area

Cascade Central	USFS	49%
Cascade Central	PV	44%
Cascade Central	ST	7%
Coast	PV	70%
Coast	ST	18%
Coast	BIA	9%
Gorge West	PV	40%
Gorge West	USFS	28%
Gorge West	ST	26%
Lowlands Central	PV	84%
Lowlands Central	ST	10%
Lowlands Central	WATER	3%
Lowlands North	PV	82%
Lowlands North	ST	13%
Lowlands North	BIA	3%
Lowlands South	PV	88%
Lowlands South	ST	9%
Lowlands South	USFS	2%
Cascade North	USFS	58%
Cascade North	NPS	23%
Cascade North	PV	10%
Olympics	NPS	57%
Olympics	USFS	41%
Cascade South	USFS	73%
Cascade South	NPS	15%
Cascade South	PV	8%
Upper White Salmon	USFS	100%
Vancouver	PV	79%
Vancouver	ST	16%
Vancouver	WATER	2%

2.3 Weather

2.3.1 Weather Stations

It is critical that all remote automatic weather stations (RAWS) used in this plan to produce NFDRS outputs comply with the National Wildfire Coordinating Group (NWCG) weather

station standards and guidelines (PMS 426-3).

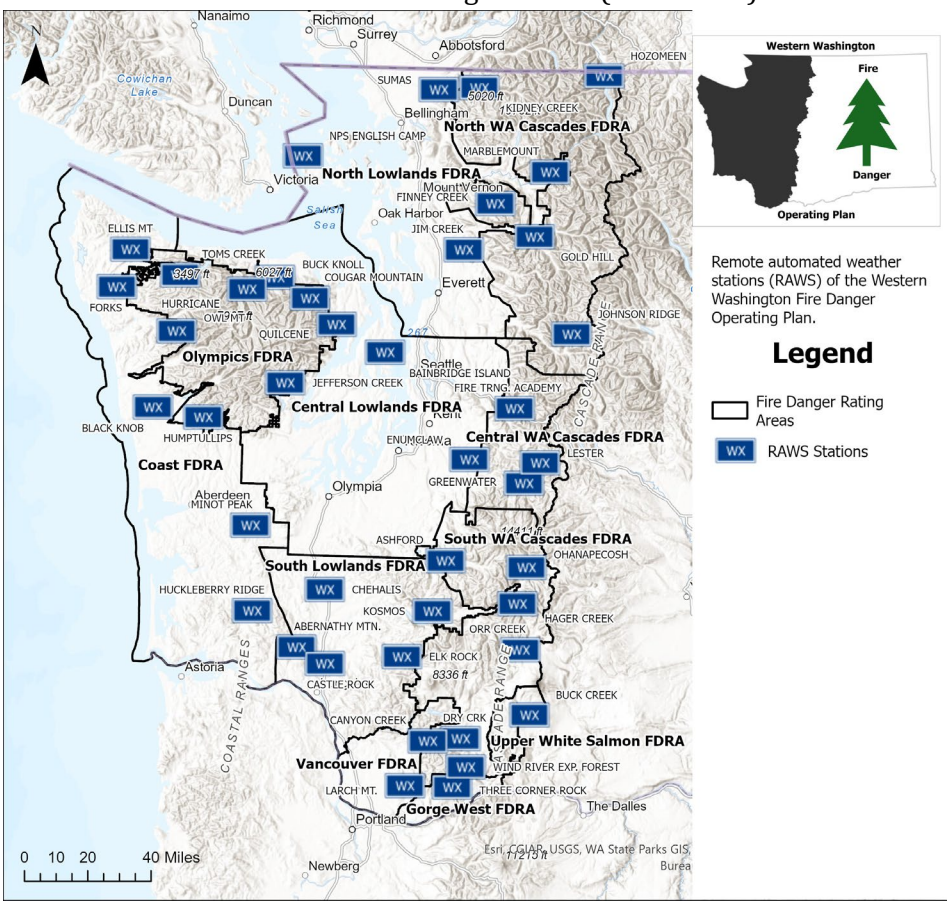


Figure 3. Active, permanent Remote Automated Weather Stations (RAWS) in the Western Washington Fire Danger Operating Plan area.

Table 4. All weather stations within the Western Washington Fire Danger Operating Plan area.

FDRA	NWS ID	RAWS	Agency	Unit	Installed Date
Cascade Central	451718	GREENWATER	S&PF	DNR	2002-06-20
Cascade Central	451705	LESTER	USFS	MT. BAKER/SNOQUALMIE	1989-01-01
Cascade Central	451721	FIRE TRNG. ACADEMY	USFS	MT. BAKER/SNOQUALMIE	1991-08-05
Coast	450407	HUCKLEBERRY RIDGE	S&PF	DNR	1995-04-13
Coast	450306	MINOT PEAK	S&PF	DNR	1995-04-17
Coast	450321	BLACK KNOB	BIA	Taholah Agency	2003-03-27
Coast	450211	OWL MT	S&PF	DNR	1996-06-17
Coast	450105	FORKS	S&PF	DNR	2011-05-05
Coast	450130	ELLIS MT	S&PF	DNR	2013-04-22
Gorge West	451929	THREE CORNER ROCK	S&PF	DNR	1989-01-01
Lowlands Central	450207	QUILCENE	USFS	OLYMPIC NF	1993-04-17
Lowlands Central	450131	BUCK KNOLL	S&PF	DNR	2005-05-08
Lowlands Central	451702	ENUMCLAW	S&PF	DNR	2004-06-28
Lowlands North	451615	JIM CREEK	S&PF	DNR	2013-04-24
Lowlands North	451504	MARBLEMOUNT	NPS	NORTH CASCADES NP	2003-05-23

Lowlands North	451415	SUMAS	S&PF	DNR	1989-01-01
Lowlands South	451207	CASTLE ROCK	S&PF	DNR	2003-05-28
Lowlands South	451209	ABERNATHY MTN.	S&PF	DNR	1993-05-28
Lowlands South	451103	CHEHALIS	S&PF	DNR	2004-05-17
Lowlands South	451208	ELK ROCK	S&PF	DNR	1989-01-01
Lowlands South	451105	KOSMOS	S&PF	DNR	1995-04-17
Cascade North	451611	JOHNSON RIDGE	USFS	MT. BAKER/SNOQUALMIE	1982-11-24
Cascade North	451613	GOLD HILL	USFS	MT. BAKER/SNOQUALMIE	2001-06-06
Cascade North	451509	FINNEY CREEK	USFS	MT. BAKER/SNOQUALMIE	1989-06-17
Cascade North	451409	KIDNEY CREEK	USFS	MT. BAKER/SNOQUALMIE	1989-01-01
Cascade North	451412	HOZOMEEN	NPS	NORTH CASCADES NP	2005-06-20
Olympics	450312	HUMPTULLIPS	USFS	OLYMPIC NF	1992-06-18
Olympics	450911	JEFFERSON CREEK	USFS	OLYMPIC NF	1992-06-18
Olympics	450117	COUGAR MOUNTAIN	USFS	OLYMPIC NF	1997-05-16
Olympics	450121	TOMS CREEK	USFS	OLYMPIC NF	2012-06-29
Cascade South	451921	CANYON CREEK	USFS	GIFFORD PINCHOT NF	1988-10-18
Cascade South	451924	DRY CRK	USFS	GIFFORD PINCHOT NF	2003-07-01
Cascade South	451919	ORR CREEK	USFS	GIFFORD PINCHOT NF	2004-05-05
Cascade South	451115	HAGER CREEK	USFS	GIFFORD PINCHOT NF	1990-12-05
Cascade South	451119	OHANAPECOSH	NPS	MT. RAINIER NP	2003-10-04
Cascade South	451809	ASHFORD	S&PF	DNR	2011-04-04
Upper White Salmon	451917	BUCK CREEK	USFS	GIFFORD PINCHOT NF	1991-06-11
Vancouver	451301	LARCH MT.	S&PF	DNR	2003-05-28

2.3.2 Weather Data

Weather data was obtained from Fire Environment Mapping System (FEMS). This data includes gap filled weather data to replace errant or missing data that has passed QAQC requirements based on gridded weather inputs.

Table 5. PRISM annual precipitation (inches), LANDFIRE elevation (feet) and LANDFIRE slope (percent) for Active, Permanent, Fire RAWS (WXx).

FDRA	NWS ID	RAWS	Elevation	Slope	Precipitation
Cascade Central	451705	LESTER	1,637	0.0	66.1
Cascade Central	451718	GREENWATER	2,468	7.5	47.7
Cascade Central	451721	FIRE TRNG. ACADEMY	1,576	10.6	96.8
Coast	450105	FORKS	311	1.0	114.4
Coast	450130	ELLIS MT	2,296	26.8	118.5
Coast	450211	OWL MT	3,297	41.8	157.8
Coast	450306	MINOT PEAK	1,765	8.1	85.1
Coast	450321	BLACK KNOB	679	9.3	118.5
Coast	450407	HUCKLEBERRY RIDGE	2,566	7.7	115.2
Gorge West	451929	THREE CORNER ROCK	2,959	25.5	114.1
Lowlands Central	450131	BUCK KNOLL	1,620	16.1	40.7
Lowlands Central	450207	QUILCENE	75	2.0	37.3
Lowlands	451702	ENUMCLAW	747	2.0	52.1

Central					
Lowlands North	451415	SUMAS	3,399	8.8	107.1
Lowlands North	451504	MARBLEMOUNT	362	2.0	80.1
Lowlands North	451615	JIM CREEK	838	13.5	51.6
Lowlands South	451103	CHEHALIS	245	2.0	48.3
Lowlands South	451105	KOSMOS	2,054	21.9	83.0
Lowlands South	451207	CASTLE ROCK	143	4.8	50.7
Lowlands South	451208	ELK ROCK	3,170	15.5	96.4
Lowlands South	451209	ABERNATHY MTN.	1,537	27.4	84.4
Cascade North	451409	KIDNEY CREEK	3,483	12.8	91.9
Cascade North	451412	HOZOMEEN	1,713	22.2	42.1
Cascade North	451509	FINNEY CREEK	2,156	20.0	133.4
Cascade North	451611	JOHNSON RIDGE	1,989	62.2	89.3
Cascade North	451613	GOLD HILL	3,332	10.6	119.9
Olympics	450117	COUGAR MOUNTAIN	2,433	19.8	48.2
Olympics	450121	TOMS CREEK	2,441	11.6	99.6
Olympics	450312	HUMPTULLIPS	2,199	42.2	172.8
Olympics	450911	JEFFERSON CREEK	2,390	26.9	122.0
Cascade South	451115	HAGER CREEK	3,613	6.8	74.1
Cascade South	451119	OHANAPECOSH	1,944	5.7	73.8
Cascade South	451809	ASHFORD	1,429	1.9	71.7
Cascade South	451919	ORR CREEK	2,974	6.4	69.5
Cascade South	451921	CANYON CREEK	2,592	23.1	113.8
Cascade South	451924	DRY CRK	2,697	18.2	104.1
Upper White Salmon	451917	BUCK CREEK	2,708	4.6	50.1
Vancouver	451301	LARCH MT.	1,454	26.5	111.0

Table 6. Weather stations selected to produce NFDRS output based on the analysis in section 4.0(WXx data).

FDRA	RAWS	NWS ID	Agency	Unit	Installed Date
Cascade Central	LESTER	451705	USFS	MT. BAKER/SNOQUALMIE	1989-01-01
Cascade Central	GREENWATER	451718	S&PF	DNR	2002-06-20
Cascade Central	FIRE TRNG. ACADEMY	451721	USFS	MT. BAKER/SNOQUALMIE	1991-08-05
Coast	ELLIS MT	450130	S&PF	DNR	2013-04-22
Coast	BLACK KNOB	450321	BIA	Taholah Agency	2003-03-27
Gorge West	THREE CORNER ROCK	451929	S&PF	DNR	1989-01-01
Lowlands Central	QUILCENE	450207	USFS	OLYMPIC NF	1993-04-17
Lowlands Central	ENUMCLAW	451702	S&PF	DNR	2004-06-28
Lowlands North	SUMAS	451415	S&PF	DNR	1989-01-01
Lowlands South	CASTLE ROCK	451207	S&PF	DNR	2003-05-28
Lowlands South	ELK ROCK	451208	S&PF	DNR	1989-01-01
Cascade North	KIDNEY CREEK	451409	USFS	MT. BAKER/SNOQUALMIE	1989-01-01
Cascade North	FINNEY CREEK	451509	USFS	MT. BAKER/SNOQUALMIE	1989-06-17
Cascade North	GOLD HILL	451613	USFS	MT. BAKER/SNOQUALMIE	2001-06-06
Olympics	HUMPTULLIPS	450312	USFS	OLYMPIC NF	1992-06-18
Olympics	JEFFERSON CREEK	450911	USFS	OLYMPIC NF	1992-06-18
Cascade South	HAGER CREEK	451115	USFS	GIFFORD PINCHOT NF	1990-12-05
Cascade South	ORR CREEK	451919	USFS	GIFFORD PINCHOT	2004-05-05

				NF	
Cascade South	DRY CRK	451924	USFS	GIFFORD PINCHOT NF	2003-07-01
Upper White Salmon	BUCK CREEK	451917	USFS	GIFFORD PINCHOT NF	1991-06-11
Vancouver	LARCH MT.	451301	S&PF	DNR	2003-05-28

3.0 Fire Danger Problem Analysis

To apply a fire danger system which will assist managers with fire management decisions, ignition problems need to be identified, quantified, framed, and associated with a specific target group to determine the most appropriate fire danger-based decision tool to mitigate the given issue.

3.1 Fires

3.1.1 Fire Occurrence Data

Fire occurrence data was sourced from the following publication: *Short, Karen C. 2022. Spatial wildfire occurrence data for the United States, 1992-2020 [FPA_FOD_20221014]. 6th Edition. Fort Collins, CO: Forest Service Research Data Archive.* [*https://doi.org/10.2737/RDS-2013-0009.6*](https://doi.org/10.2737/RDS-2013-0009.6). This data was merged with data from Interagency Fire Occurrence Reporting Modules (InFORM) for the years 2022-2024.

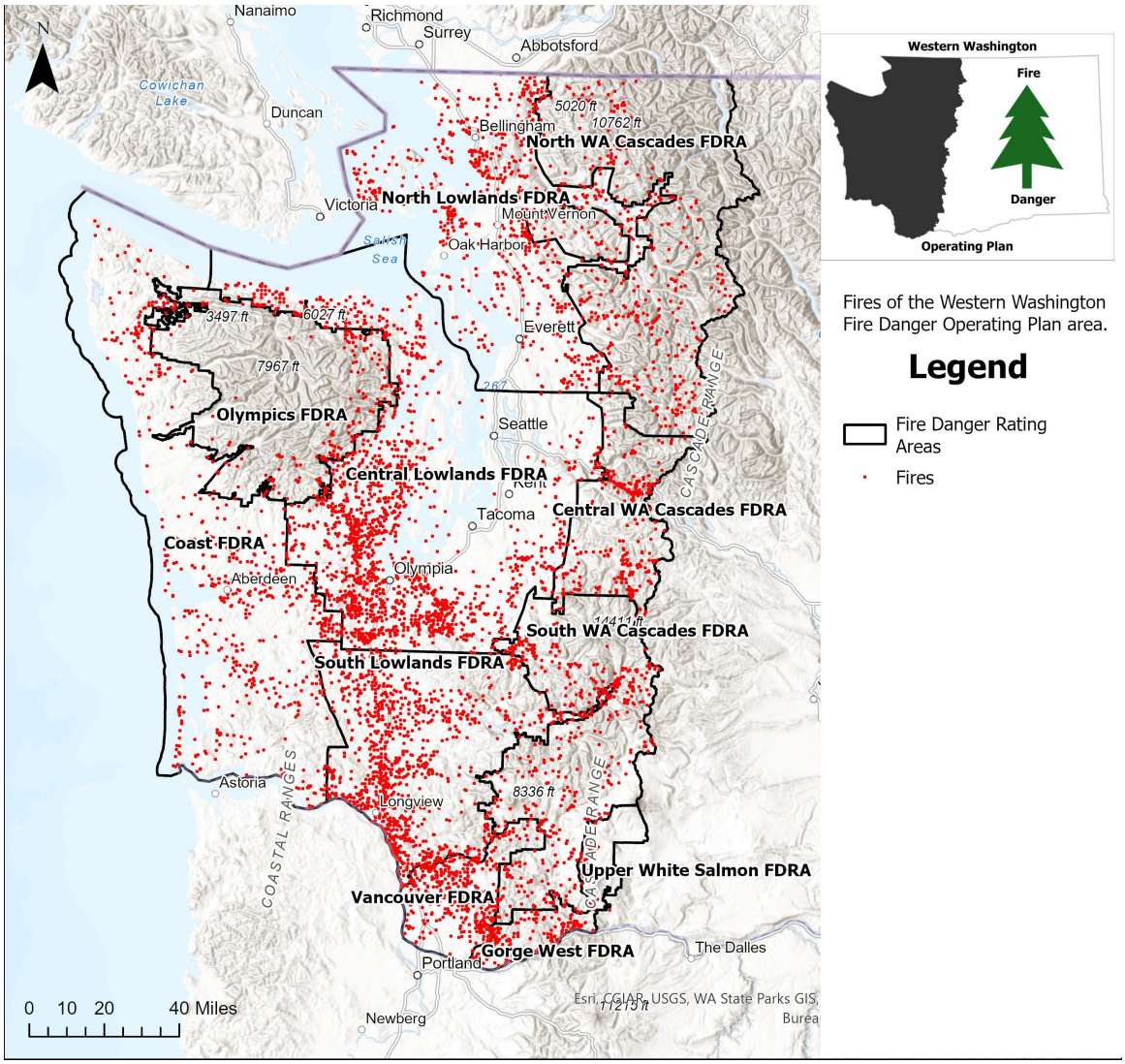


Figure 4. Fire locations within the Western Washington Fire Danger Operating Plan area (2005-2025).

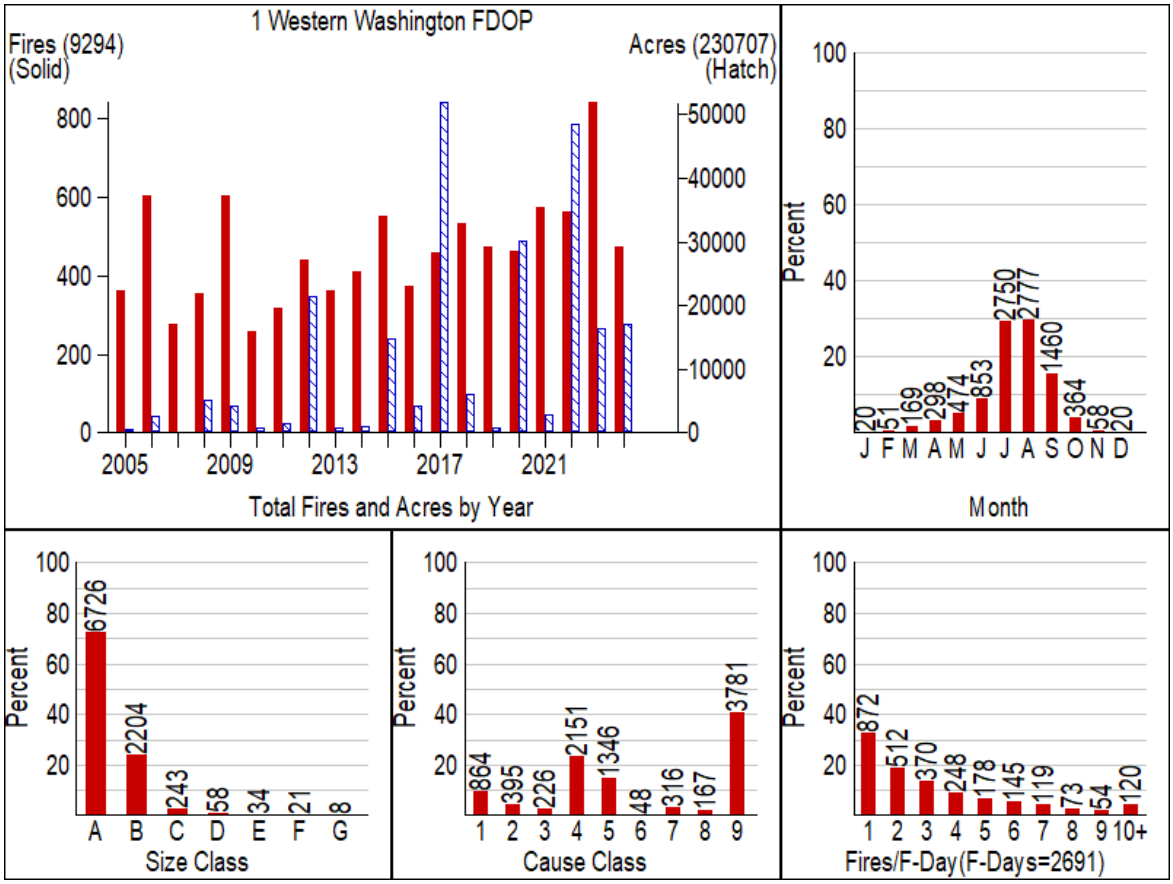


Figure 5. Fire occurrence summary graph data for the Western Washington Fire Danger Operating Plan area.

Size Classes: A - <= 0.25 acres, B - 0.26 to 9.9 acres C - 10 to 99.9 acres D - 100 to 299 acres E - 300 to 999 acres F - 1000 to 4999 acres G - >= 5000 acres.

Cause Classes: 1 – Lightning 2 - Equipment Use 3 – Smoking 4 – Campfire 5 - Debris Burning 6 – Railroad 7 – Arson 8 – Children 9 - Miscellaneous

3.1.2 MODIS and VIIRS Heat Detection Data

MODIS and VIIRS heat detection data from 2001 forward was sourced from the Fire for Information Resource Management System (FIRMS).

3.2 Identification/Definition of the Fire Problem(s)

Table 7. NWCG fire cause class for the FDOP.

NWCG General Cause	Count	Percent
Missing data/not specified/undetermined	3697	41.4%
Recreation and ceremony	2035	22.8%
Debris and open burning	1273	14.3%
Natural	845	9.5%
Arson/incendiarism	300	3.4%
Equipment and vehicle use	367	4.1%
Smoking	215	2.4%
Misuse of fire by a minor	157	1.75%
Railroad operations and maintenance	42	0.4%

3.3 Target Group/Tool Association

Table 8. Leading NWCG fire cause classes excluding "Missing data/not specified/undetermined" and "Other Causes" within the FDOP area.

NWCG General Cause	Target Group	Degree of Control	Index/Component	Management Tool
Recreation and ceremony	Public	Low	ERC	PL (Restriction Plan) & Adj (Prevention Plan)
Debris and open burning	Public	Low	ERC	Other (Restriction Plan)
Natural	Agency	High	BI	SL/RL (Staffing Plan/Mob Guide)
Fireworks	Public	Low	ERC	PL (Restriction Plan) & Adj (Prevention Plan)
Arson/incendiarism	Agency	High	BI	SL/RL (Staffing Plan/Mob Guide)

3.4 Fire Problem by FDRA

Table 9. Leading NWCG fire cause classes excluding "Missing data/not specified/undetermined" and "Other Causes" within each FDRA.

FDRA	NWCG General Cause	Count
Cascade Central	Recreation and ceremony	313
Cascade Central	Natural	49
Cascade Central	Debris and open burning	18
Cascade Central	Arson/incendiarism	12
Cascade Central	Equipment and vehicle use	9
Coast	Debris and open burning	205
Coast	Recreational and ceremony	188
Coast	Equipment and vehicle use	70
Coast	Arson/incendiarism	45
Coast	Natural	27
Gorge West	Recreation and ceremony	90
Gorge West	Equipment and vehicle use	63
Gorge West	Debris and open burning	42
Gorge West	Arson/incendiarism	21
Gorge West	Natural	18
Lowlands Central	Debris and open burning	319
Lowlands Central	Recreation and ceremony	288
Lowlands Central	Equipment and vehicle use	99
Lowlands Central	Arson/incendiarism	96
Lowlands Central	Misuse of fire by a minor	67
Lowlands North	Debris and open burning	236
Lowlands North	Recreation and ceremony	215
Lowlands North	Smoking	51
Lowlands North	Misuse of fire by a minor	31
Lowlands North	Equipment and vehicle use	29
Lowlands South	Debris and open burning	362
Lowlands South	Recreation and ceremony	135
Lowlands South	Equipment and vehicle use	66
Lowlands South	Natural	46
Lowlands South	Arson/incendiarism	45
Cascade North	Recreation and ceremony	362
Cascade North	Natural	294
Cascade North	Debris and open burning	24
Cascade North	Equipment and vehicle use	15
Cascade North	Arson/incendiarism	12
Olympics	Recreation and ceremony	158
Olympics	Natural	116
Olympics	Equipment and vehicle use	18

Olympics	Arson/incendiarism	17
Olympics	Debris and open burning	16
Cascade South	Recreation and ceremony	268
Cascade South	Natural	206
Cascade South	Smoking	31
Cascade South	Arson/incendiarism	22
Cascade South	Equipment and vehicle use	19
Upper White Salmon	Recreation and ceremony	83
Upper White Salmon	Smoking	51
Upper White Salmon	Natural	25
Upper White Salmon	Equipment and vehicle use	6
Upper White Salmon	Debris and open burning	6
Vancouver	Debris and open burning	147
Vancouver	Recreation and ceremony	95
Vancouver	Arson/incendiarism	26
Vancouver	Equipment and vehicle use	25
Vancouver	Natural	22

4.0 Fire Danger Decision Point Analysis

The FDOP will be used to support fire management decisions made at specific decision points. When conditions, or a combination of events and conditions, signal that it is time to do something different a decision point has been reached. Decision points are typically based upon either climatological breakpoints or fire business thresholds. Western Washington presents an atypical fire problem, wherein large fires often do not have significant growth on the date of discovery, but in some cases several weeks to months after discovery. All FDRA's were analyzed against MODIS derived fire activity. For some FDRA's the MODIS derived data provided the best fit for determining thresholds.

4.1 Climatological Breakpoints

Climatological breakpoints are points on the cumulative distribution curve of a fire danger index. For example, the value at the 90th percentile ERC is the climatological breakpoint at which 10 percent of the ERC values are greater in value.

When using climatology, it is important to identify the period of record used to determine the percentile values. The percentile values for the calendar year will be different from the percentile values for the fire season. In lieu of national direction, to provide consistency across the Pacific Northwest, this FDOP, related plans, products, and communications will use **annual (full calendar year) percentile values.**

Table 10. Agency ERC -Y breakpoints (historical USDA and USDI).

FDRA	80	85	90	97
Cascade Central	22.1	24.8	27.5	33.9
Coast	33.8	39.4	46.8	66.0
Gorge West	20.9	24.0	27.8	37.7
Lowlands Central	41.3	46.3	52.2	64.2
Lowlands North	17.4	21.5	25.9	35.8
Lowlands South	47.1	53.0	59.6	75.6
Cascade North	18.0	21.8	26.0	34.6
Olympics	40.4	46.7	55.3	74.7
Cascade South	55.3	63.6	71.8	94.3
Upper White Salmon	73.7	82.1	91.9	109.7

Vancouver	23.0	26.0	29.5	38.1

Table 11. Agency BI -Y breakpoints (historical USDA and USDI).

FDRA	80	85	90	97
Cascade Central	16.0	17.5	19.3	23.1
Coast	31.0	35.5	40.3	52.4
Gorge West	18.9	21.1	23.7	30.7
Lowlands Central	31.6	34.5	37.8	46.2
Lowlands North	12.4	14.8	17.0	21.2
Lowlands South	31.2	34.7	38.4	46.4
Cascade North	12.6	14.7	16.6	20.5
Olympics	36.7	41.0	46.6	57.6
Cascade South	35.7	39.9	43.9	53.8
Upper White Salmon	53.0	57.5	62.9	73.6
Vancouver	17.9	19.4	21.2	26.0

4.2 Fire Business Thresholds

Fire business thresholds, unlike decision points based on climatological percentiles, make a direct relationship between NFDRS output and historic fire business. Thresholds based on fire business are determined through analysis of historic weather and fire occurrence data and set such that each decision point represents a meaningful increase in fire activity.

4.3 Methods

In addition to Fire Family Plus, receiver operator curves were used in the analysis. For this purpose, daily listing files were generated from Fire Family Plus. Daily listing settings for elevation, precipitation, and slope were set based on the analysis results in the appendices section 2.2. Herb (annual vs. perennial) was set based on local expertise. Fuel model selections were based on FDRA majority fuel model listed in section 2.3. Latitude and all other settings such as maximum spread component were left at Fire Family Plus defaults.

Table 12. Fire Family Plus settings used to produce daily listing files for analysis.

NWS ID	FDRA	Slope Class	Avg Ann Precip	Herb	Lat
451705	Cascade Central	1	66.1	P	47.21
451718	Cascade Central	1	47.7	P	47.12
451721	Cascade Central	1	96.8	P	47.46
450130	Coast	1	118.0	P	48.13
450321	Coast	1	118.0	P	47.41
451929	Gorge West	1	114.0	P	45.73
451301	Gorge West	1	60.0	P	45.73
450131	Lowlands Central	1	30.0	P	48.03
451702	Lowlands Central	1	52.1	P	47.22
451504	Lowlands North	1	90.0	P	48.54
451415	Lowlands North	1	107.0	P	48.91
451105	Lowlands South	1	62.0	P	46.53
451207	Lowlands South	1	83.0	P	46.31
451209	Lowlands South	1	90.0	P	46.34
451409	Cascade North	1	91.9	P	49.0
451509	Cascade North	1	133.0	P	48.4
451611	Cascade North	1	119.0	P	47.8
450312	Olympics	1	172.0	P	47.37
450911	Olympics	1	122.0	P	47.55

451917	Cascade South	1	69.5	P	46.14
451921	Cascade South	1	50.0	P	45.92
451809	Upper White Salmon	1	85.0	P	46.76
451917	Upper White Salmon	1	60.0	P	46.06
451921	Upper White Salmon	1	50.0	P	45.92
451207	Vancouver	1	45.0	P	46.31
451301	Vancouver	1	111.0	P	45.73

A receiver operating characteristic curve, or ROC curve, is a graphical plot that illustrates the performance of a binary classifier model [fire or no fire] at varying threshold values [ex. ERC values]. The ROC curve is the plot of the true positive rate [predicted fire and fire] against the false positive rate [predicted fire and no fire] at each threshold setting [ex. ERC 40, 41, 42]. The best possible prediction method would yield a point in the upper left corner or coordinate (0,1) of the ROC space, representing 100% sensitivity (no false negatives [predict no fire and fire]) and 100% specificity (no false positives). The (0,1) point is also called a perfect classification. - (Wikipedia)

ROC generated decision points are the value on the ROC curve that is closest to being a perfect classification, referred to in this document as the optimum value.

ROC curves and optimum value thresholds using fire occurrence were generated for each FDRA and possible station combination using the index chosen in section 3.3. Weather stations and fire occurrence were limited to the FDRA, and station combinations limited to three or fewer. FDRA fire size percentiles were used for thresholding; thus, each decision point represents conditions at which fires of a certain size can be expected based on historic data. Final station and threshold selection were determined based on the spread between thresholds (decision space) and ROC metric Area Under the Curve (ROC AUC).

If no ROC Optimum Values were acceptable the above process was repeated using MODIS or VIIRS satellite data, replacing final fire size percentiles with percentiles of the number of heat detections per day. In this case decision points represent conditions at which n-MODIS/VIIRS within the FDRA can be expected based on historic data.

4.4 Decision Points

Table 13. Selected fuel model, decision point source (fire occurrence, MODIS, or climatology), and decision point values. See section 2.3.2 for selected weather stations.

FDRA	Stations	Fuel Model	Method	ERC Values	ERC Percentiles	BI Values	BI Percentiles
Cascade Central	[451705 451718 451721]	Y	ROC Fires	18, 22, 27, 32	73, 83, 92, 98	NA	NA
Coast	['450321', '450130', '450306']	Z	ROC Fires	NA	NA	19, 23, 29, 37	63, 70, 80, 93
Gorge West	[451929 451301]	Z	ROC Fires	23, 30, 37, 67	61, 68, 74, 96	NA	NA
Lowlands Central	['450131', '450207']	Z	ROC Fires	28, 35, 42, 57	61, 71, 79, 92	NA	NA
Lowlands North	['451415', '451504']	Z	ROC Fires	29, 36, 44, 56	66, 73, 80, 91	NA	NA
Lowlands	['451207',	Z	ROC	27, 32, 42, 55	61, 66, 79, 92	NA	NA

South	'451209', '451105']		Fires				
Cascade North	['451409', '451509', '451611']	Y	ROC Fires	24, 29, 36, 42	72, 78, 87, 94	NA	NA
Olympics	['450312', '450911']	Z	ROC MODIS	27, 41, 54, 66	65, 79, 90, 95	NA	NA
Cascade South	['451917', '451921']	Y	ROC Fires	20, 26, 32, 37	68, 78, 89, 94	NA	NA
Upper White Salmon	['451917', '451921', '451809']	Y	ROC Fires	17, 22, 28, 32	66, 76, 88, 94	NA	NA
Vancouver	['451207', '451301']	Z	ROC Fires	29, 34, 46, 55	62, 68, 83, 92	NA	NA

4.5 Fire Danger Rating Area Results

4.5.1 Cascade Central FDRA

General Location: The Cascade Central FDRA extends from approximately the King-Snohomish county line to the northern boundary of Mt Rainier NP.

Vegetation: Primarily heavy timber with Douglas Fir, cedar, and hemlock with an understory of rhododendron, vine maple and salal.

Climate: Annual precipitation ranges between 40 inches and 180 inches with a median of 100 inches. The driest months are July through September. Some years may see the dry season carry on into October. Surface thermal troughs are most common in September through October; but may occur in any month.

Topography: Elevation ranges from 700 feet to 7,500 feet. The median elevation is 3,179feet. Terrain is heavily bisected by drainages and steep slopes.

Fire Occurrence

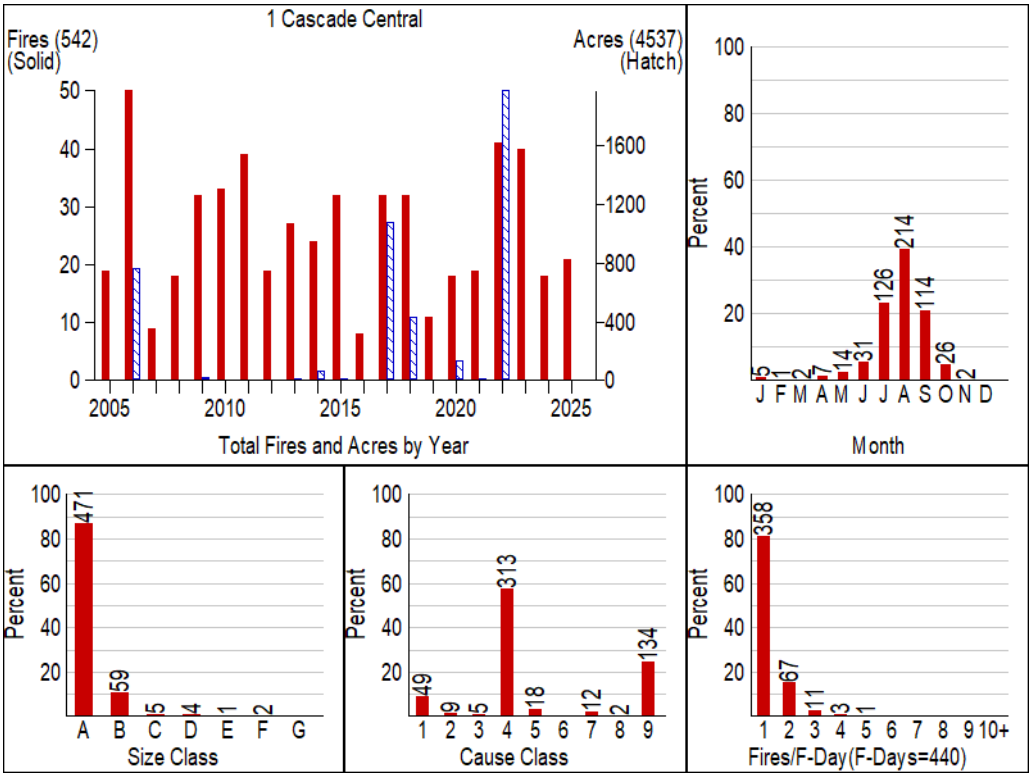


Figure 6. Fire occurrence summary graph data for the Cascade Central FDRA

Fire size class and cause definitions:
Size Classes: A - <= 0.25 acres, B - 0.26 to 9.9 acres, C - 10 to 99.9 acres, D - 100 to 299 acres, E - 300 to 999 acres, F - 1000 to 4999 acres, G - >= 5000 acres.

Cause Classes: 1 – Lightning, 2 - Equipment Use, 3 – Smoking, 4 – Campfire, 5 - Debris Burning, 6 – Railroad, 7 – Arson, 8 – Children, 9 – Miscellaneous

Table 14. Fire summary graph data for Cascade Central FDRA

Fire Cause Classes		Fires By Month Lightning vs Human			Fire Size Percentiles	
		Month	Lightning	Human	Percentile	Acres
1	Lightning	Jan	0	5	83	0.1
2	Equipment	Feb	0	1	85	0.2
3	Smoking	March	0	2	90	0.5
4	Campfire	April	0	7	92	0.5
5	Debris	May	1	13	93	1.0
6	Railroad	June	3	28	94	1.0
7	Arson	July	10	116	95	1.5
8	Children	August	23	191	96	2.4
9	Misc	Sept	11	103	97	3.0
		Oct	1	25	98	11.0
		Nov	0	2	99	132.0
		Dec	0	0	100	1918

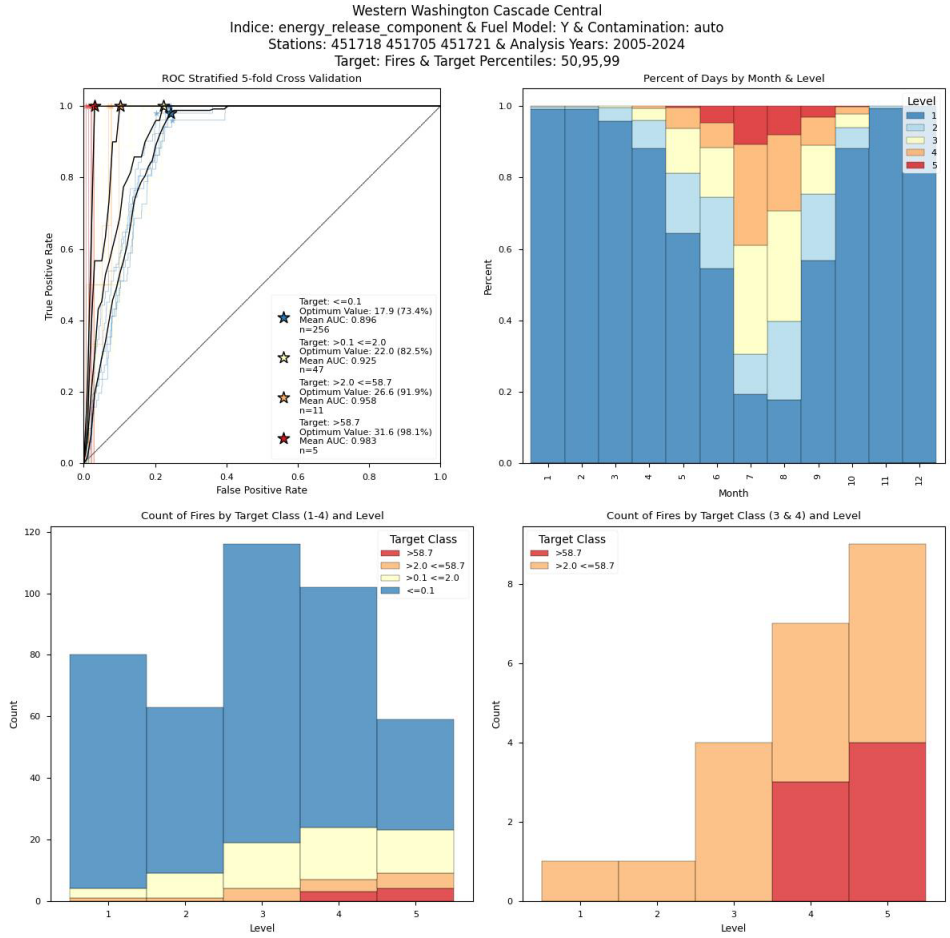


Figure 7. ROC chart with optimum values for fire danger thresholds on the upper left and graphical representation of the number of days each month that have historically fallen in each input staffing level on the upper right. Fire size occurrence at each level is on the bottom charts.

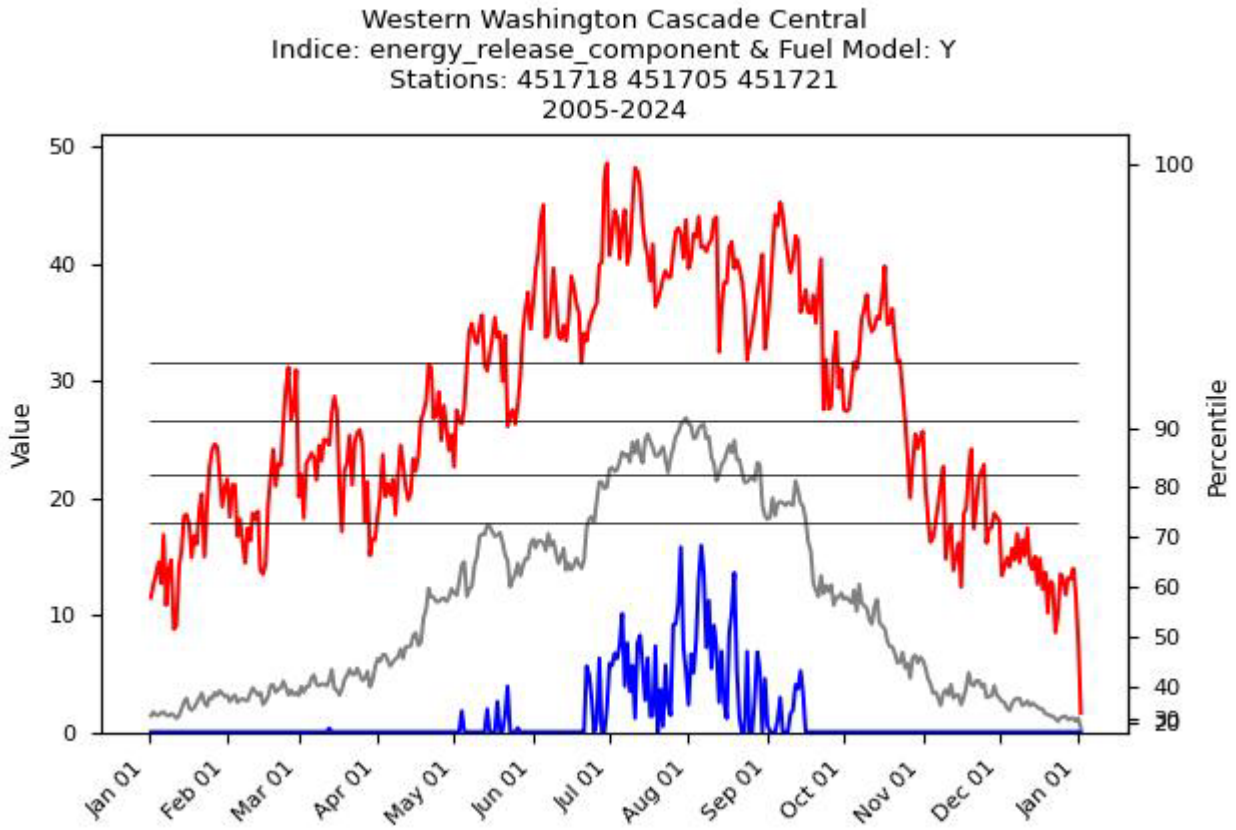


Figure 8. Cascade Central FDRA season trend graph with staffing level thresholds identified by horizontal lines.

Table 15. Number All Days (AD) expressed as the number of days in the analysis period and proportion of the analysis period. Number of fire days (FD) is the proportion of days with a fire. Large fire day (LFD) is the proportion of days that had a fire over 58 acres. Multiple fire days (MFD) is the proportion of days with more than 3 fires in a single day.

Class	ERC Range	All Days (AD)		Fire Days (FD)			Large Fire Days (LFD)				Multiple Fire Days (MFD)			
		# AD	%AD	#FD	%FD	%AD	#LFD	%LFD	%FD	%AD	#MFD	%MFD	%FD	%AD
1	0-17.9	4932	71	61	15	1	0	0	0	0	0	0	0	0
2	17.9-22	466	7	30	7	6	0	0	0	0	1	7	3	0
3	22-26.6	569	8	66	16	12	0	0	0	0	4	27	6	1
4	26.6-31.6	501	7	102	25	20	0	0	0	0	1	7	1	0
5	31.6+	467	7	145	36	31	7	100	5	1	9	60	6	2

Table 16. Staffing level and adjective rating by ERC-Y range for Cascade Central in both absolute value (ABS) and percentile.

Staffing Level and Adjective Rating for Cascade Central FDRA					
ERC-Y (ABS)	0-17.9	17.9-22	22-26.6	26.6-31.6	31.6+
ERC-Y %	0-73.4	73.4-82.5	82.5-91.9	91.9-98.1	98.1+
Staffing Level	1	2	3	4	5
Adjective Rating	Low	Moderate	High	Very High	Extreme

4.5.2 Coast FDRA

General Location: This area includes the coastal plains and the western slope of the Coastal Range from the Columbia River to the Strait of Juan de Fuca. It extends from the coastline to approximately 40 miles inland at its furthest extent.

Vegetation: Timber with some grass fuel types found in coastal prairies and areas of dune grasses, generally following the natural range of Sitka Spruce.

Climate: The area receives the full force of storms moving inland from over the Pacific Ocean. The "rainforest" area along the southwestern and western slopes of the Olympic Mountains receives the heaviest precipitation in the continental United States. Annual precipitation ranges from 70 to 100 inches over the Coastal Plains to 150 inches or more along the windward slopes of the mountains. A morning marine layer with mist or drizzle is common during the spring and summer.

Topography: Elevation ranges from sea level to 2000' at the highest points.

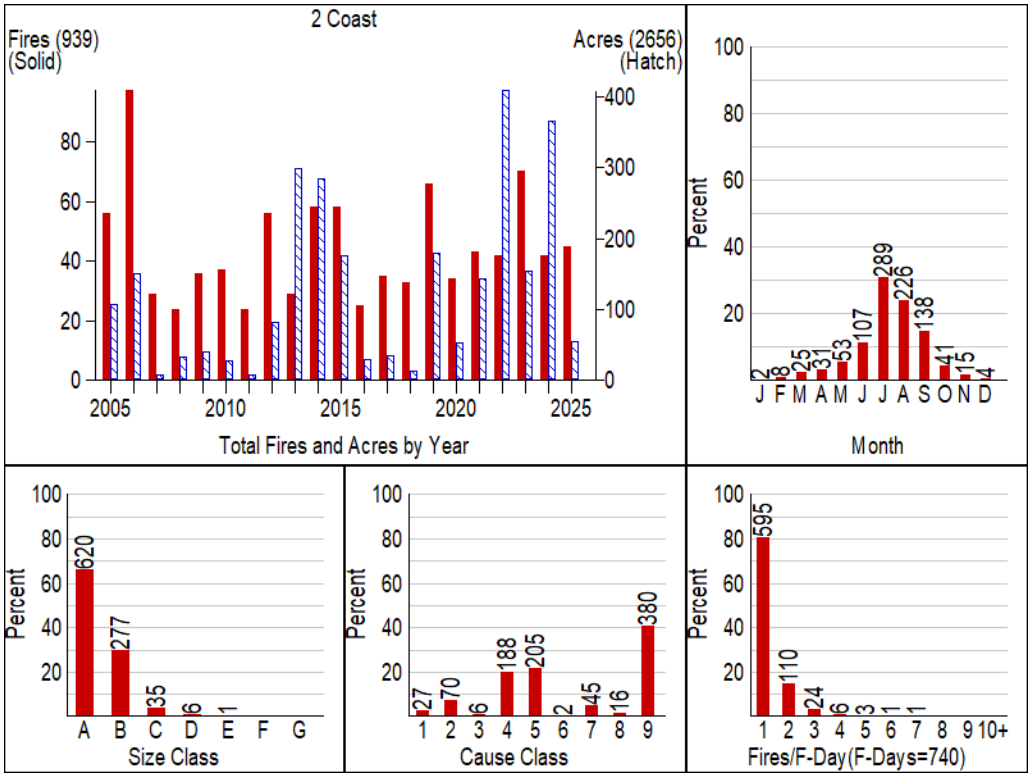


Figure 9. Fire Summary Graph for analysis years for Coast FDRA

Fire size class and cause definitions:
Size Classes: A - <= 0.25 acres, B - 0.26 to 9.9 acres, C - 10 to 99.9 acres, D - 100 to 299 acres, E - 300 to 999 acres, F - 1000 to 4999 acres, G - >= 5000 acres.

Cause Classes: 1 – Lightning, 2 - Equipment Use, 3 – Smoking, 4 – Campfire, 5 - Debris Burning, 6 – Railroad, 7 – Arson, 8 – Children, 9 - Miscellaneous

Table 17. Fire summary graph data for Coast FDRA

Fire Cause Classes		Fires By Month Lightning vs Human			Fire Size Percentiles	
		Month	Lightning	Human	Percentile	Acres
1	Lightning	Jan	0	2	100	127
2	Equipment	Feb	0	5	99	80
3	Smoking	March	0	20	98	25
4	Campfire	April	1	12	97	12.2
5	Debris	May	0	21	95	6.0
6	Railroad	June	1	67	90	2.5
7	Arson	July	0	159	85	1.0
8	Children	August	7	174	80	0.5
9	Misc	Sept	5	82	75	0.2
		Oct	0	45	70	0.2
		Nov	0	9		
		Dec	0	6		

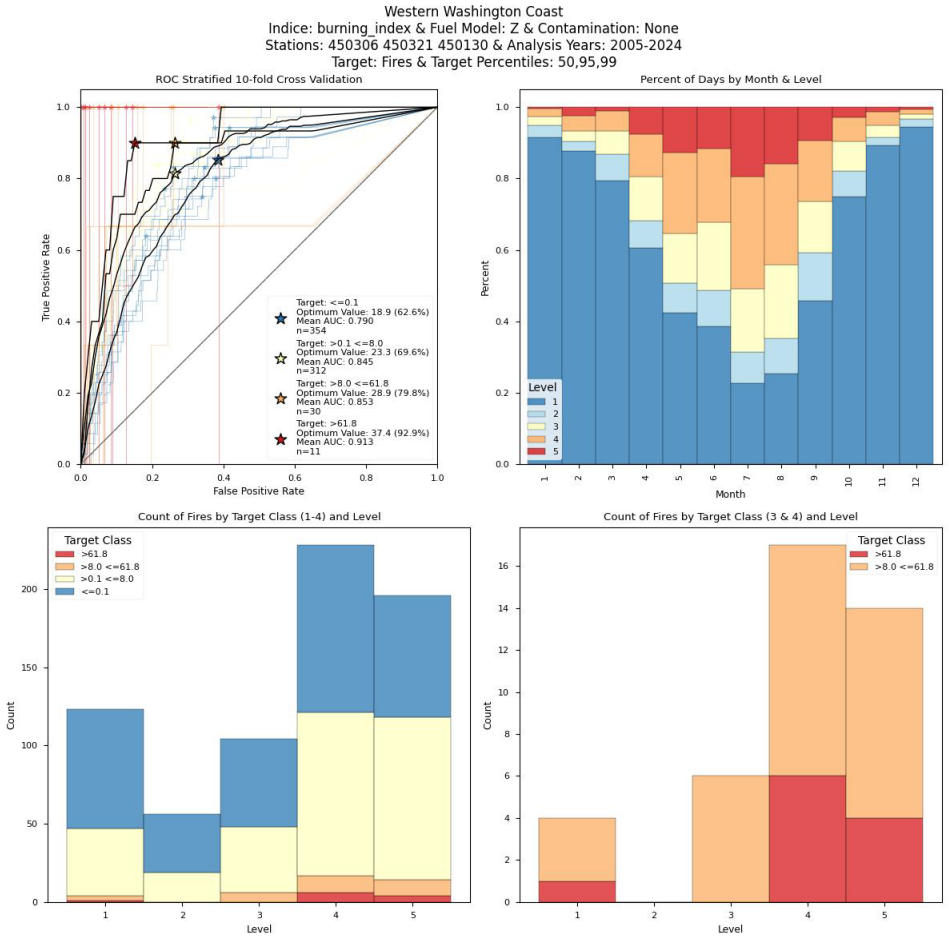


Figure 10. ROC chart with optimum values for fire danger thresholds on the upper left and graphical representation of the number of days each month that have historically fallen in each input staffing level on the upper right. Fire size occurrence at each level is on the bottom charts.

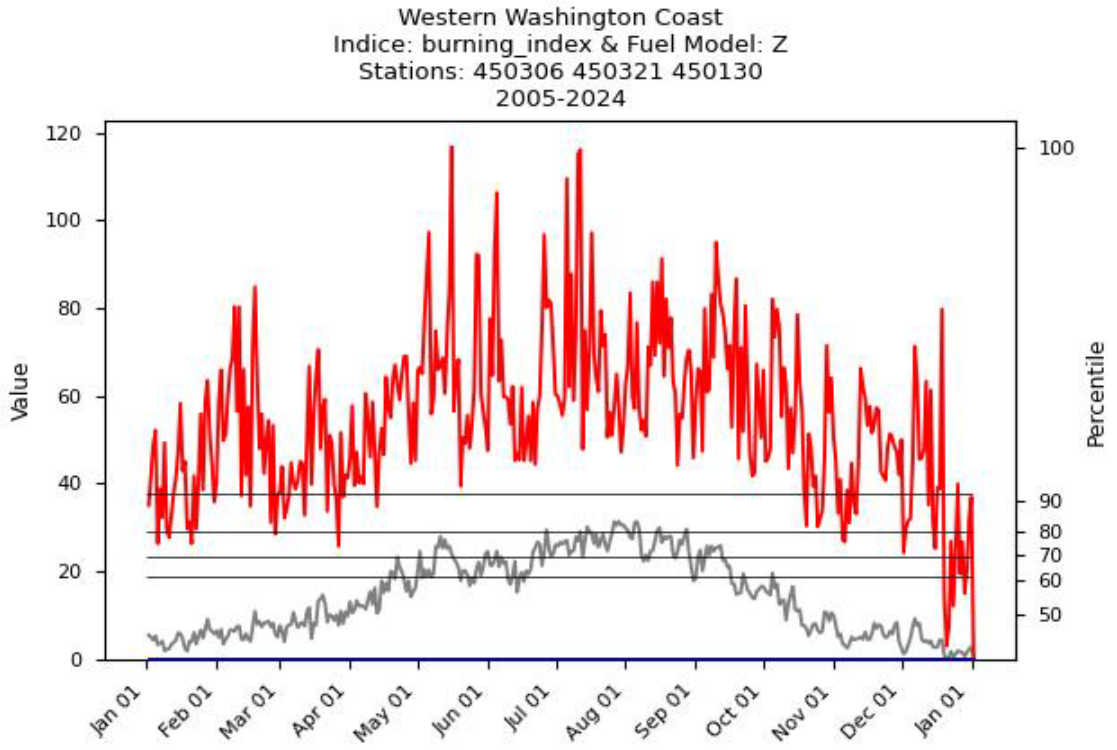


Figure 11. Coast FDRA season trend graph with staffing level thresholds identified by horizontal lines.

Table 18. Number All Days (AD) expressed as the number of days in the analysis period and proportion of the analysis period. Number of fire days (FD) is the proportion of days with a fire. Large fire day (LFD) is the proportion of days that had a fire over 15 acres. Multiple fire days (MFD) is the proportion of days with more than 3 fires in a single day.

Class	BI Range	All Days (AD)		Fire Days (FD)			Large Fire Days (LFD)				Multiple Fire Days (MFD)			
		# AD	%AD	#FD	%FD	%AD	#LFD	%LFD	%FD	%AD	#MFD	%MFD	%FD	%AD
1	0-18.9	4554	60	109	15	2	3	7	3	0	2	6	2	0
2	18.9-23.3	403	5	24	3	6	1	2	4	0	1	3	4	0
3	23.3-28.9	642	8	75	10	12	4	9	5	1	0	0	0	0
4	28.9-37.4	896	12	158	21	18	13	29	8	1	9	26	6	1
5	37.4+	1112	15	374	51	34	24	53	6	2	23	66	6	2

Table 19. Staffing level and adjective rating by BI-Z range for Coast in both absolute value (ABS) and percentile (%)

Staffing Level and Adjective Rating for Coast FDRA					
Coast BI-Z ABS	0-18.9	18.9-23.3	23.3-28.9	28.9-37.4	37.4+
Coast BI-Z %	0-62.6	62.7-69.6	69.7-79.8	79.9-92.9	92.9+
Staffing Level	1	2	3	4	5
Adjective Rating	Low	Moderate	High	Very High	Extreme

4.5.3 Gorge West FDRA

General Location: This area includes western portions of the Columbia River Gorge in Oregon and Washington. It runs west from Camas or the Sandy River to Dog Mountain or Viento Ridge. South of the Gifford Pinchot National Forest in Washington and north of the Mark O Hatfield Wilderness in Oregon.

Vegetation: Primarily heavy to moderate timber with Douglas Fir, and cedar with areas of harvest residues.

Climate: The annual median precipitation is 84 inches but varies significantly across the FDRA with minimum annual precipitation reaching 41 inches on lower slopes. The driest months are July through September. Some years may see the dry season carry on into October. Surface thermal troughs are most common in September through October; but may occur in any month.

Topography: Elevation ranges from just above sea-level to almost 3,500 feet. The median elevation is 1,135 feet. Terrain can be steep and is dominated by the Columbia River and its tributaries.

Fire Occurrence

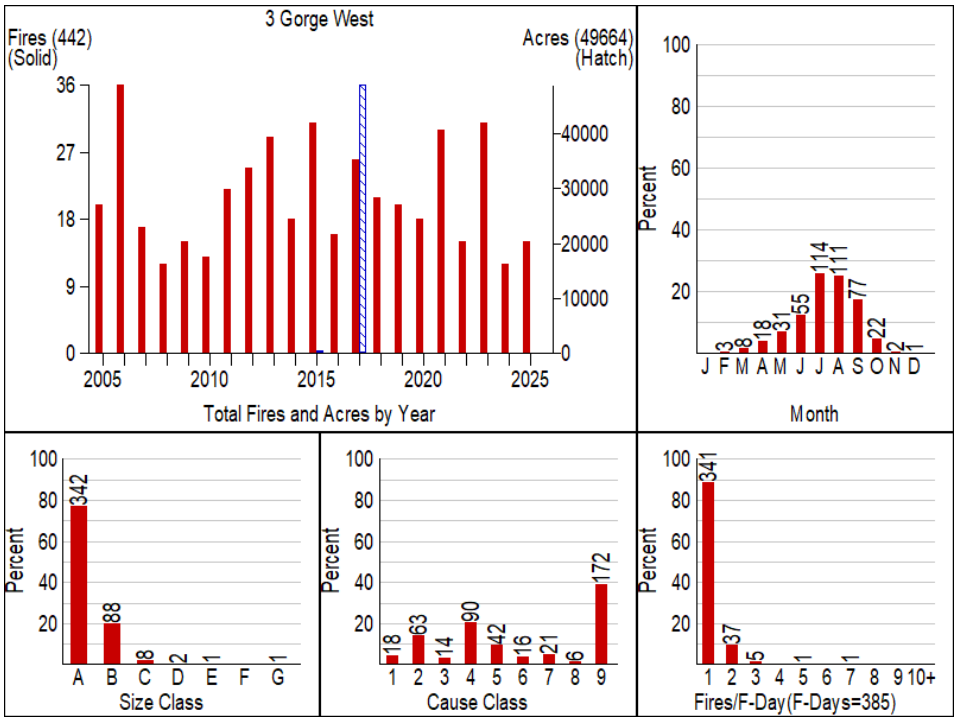


Figure 12. Fire occurrence summary graph data for the Gorge West FDRA

Fire size class and cause definitions:
Size Classes: A - <= 0.25 acres, B - 0.26 to 9.9 acres, C - 10 to 99.9 acres, D - 100 to 299 acres, E - 300 to 999 acres, F - 1000 to 4999 acres, G - >= 5000 acres.

Cause Classes: 1 – Lightning, 2 - Equipment Use, 3 – Smoking, 4 – Campfire, 5 - Debris Burning, 6 – Railroad, 7 – Arson, 8 – Children, 9 - Miscellaneous

Table 20. Fire summary graph data for Gorge West FDRA

Fire Cause Classes		Fires By Month Lightning vs Human			Fire Size Percentiles	
		Month	Lightning	Human	Percentile	Acres
1	Lightning	Jan	0	0	85	0.5
2	Equipment	Feb	0	1	90	1
3	Smoking	March	0	7	91	1.2
4	Campfire	April	1	14	92	1.4
5	Debris	May	0	25	93	1.5
6	Railroad	June	3	45	94	2.0
7	Arson	July	1	96	95	3.0
8	Children	August	11	79	96	3.3
9	Misc	Sept	1	60	97	6.8
		Oct	0	22	98	10.5
		Nov	0	2	99	60
		Dec	0	1	100	48488

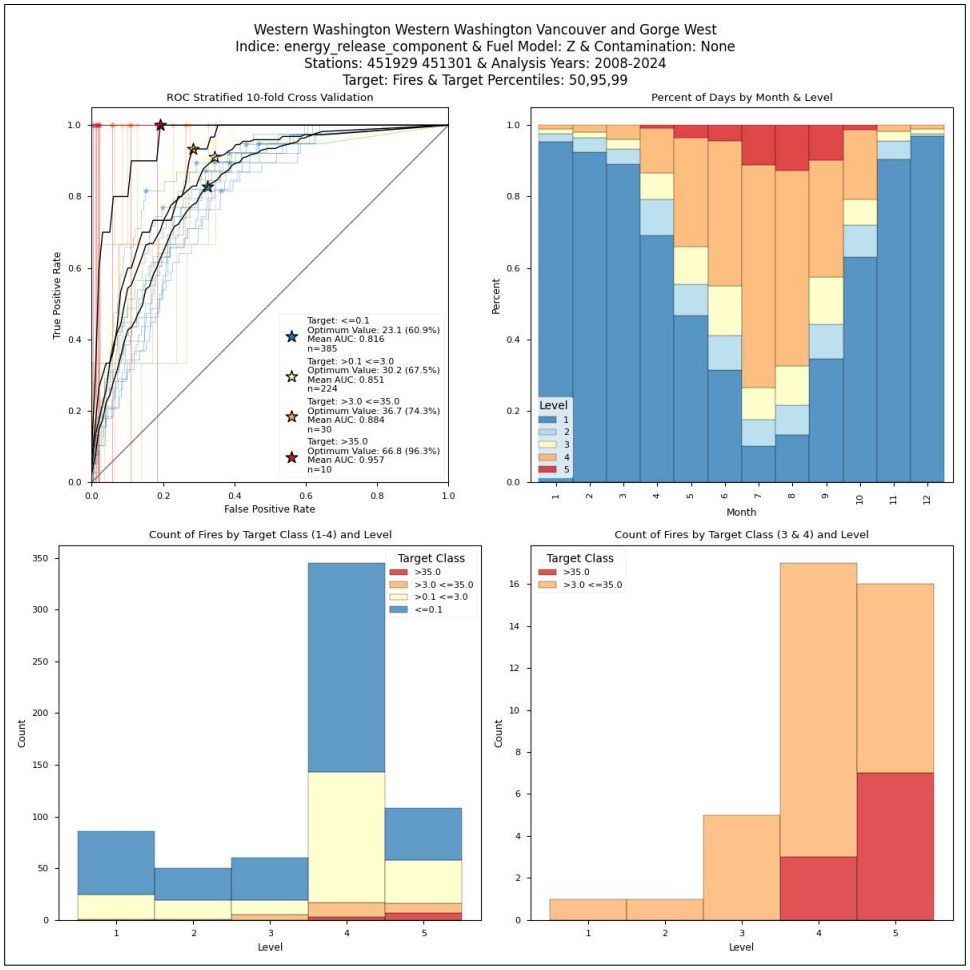


Figure 13. ROC chart with optimum values for fire danger thresholds on the upper left and graphical representation of the number of days each month that have historically fallen in each input staffing level on the upper right. Fire size occurrence at each level is on the bottom charts.

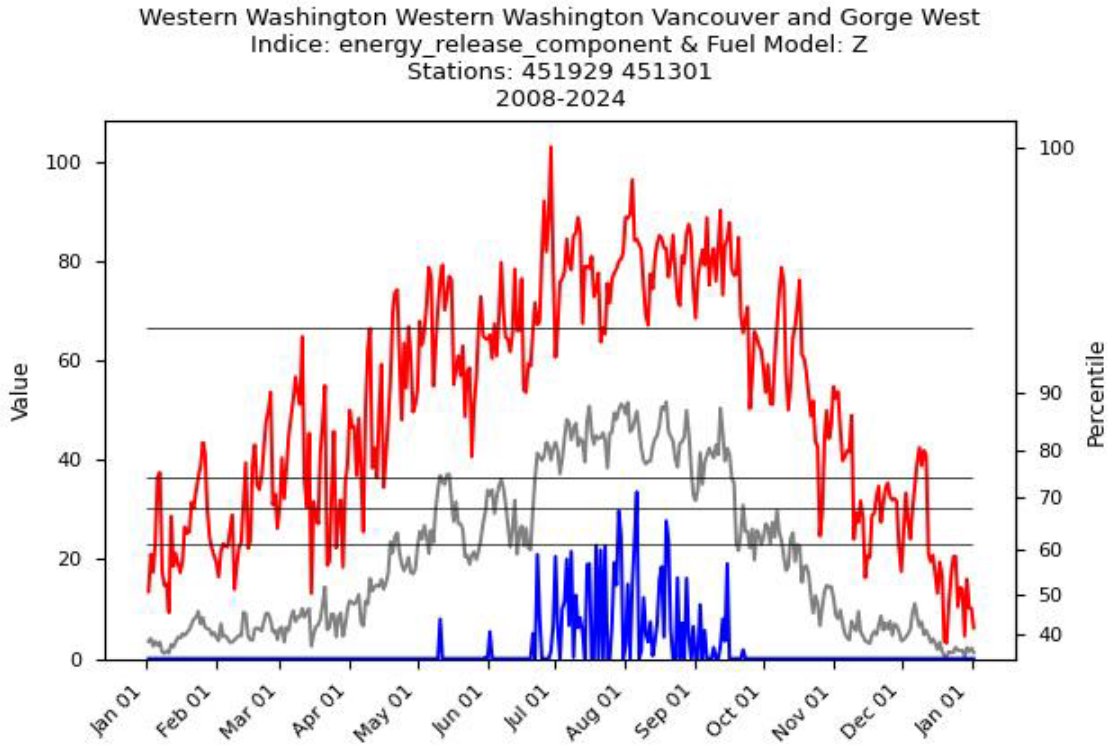


Figure 14. Gorge West FDRA season trend graph with staffing level thresholds identified by horizontal lines.

Table 21. Number All Days (AD) expressed as the number of days in the analysis period and proportion of the analysis period. Number of fire days (FD) is the proportion of days with a fire. Large fire day (LFD) is the proportion of days that had a fire over 35 acres. Multiple fire days (MFD) is the proportion of days with more than 3 fires in a single day.

Class	ERC Range	All Days (AD)		Fire Days (FD)			Large Fire Days (LFD)				Multiple Fire Days (MFD)			
		# AD	%AD	#FD	%FD	%AD	#LFD	%LFD	%FD	%AD	#MFD	%MFD	%FD	%AD
1	0-23.1	3886	59	38	12	1	0	0	0	0	0	0	0	0
2	23.1-30.2	372	6	22	7	6	0	0	0	0	0	0	0	0
3	30.2-36.7	406	6	21	7	5	0	0	0	0	0	0	0	0
4	36.7-66.8	1411	21	142	45	10	1	20	1	0	4	57	3	0
5	66.8+	495	8	95	30	19	4	80	4	1	3	43	3	1

Table 22. Staffing level and adjective rating by ERC-Z range for Gorge West in both value (ABS) and percentile.

Staffing Level and Adjective Rating for Gorge West FDRA					
ERC-Z (ABS)	0-23.1	23.1-30.2	30.2-36.7	36.7-66.8	66.8+
ERC-Z %	0-60.9	60.9-67.5	67.5-74.3	74.3-96.3	96.3+
Staffing Level	1	2	3	4	5
Adjective Rating	Low	Moderate	High	Very High	Extreme

4.5.4 Lowlands Central FDRA

General Location: The Lowlands Central FDRA extends from Southern Thurston county in the south to approximately the King/Snohomish county line in the north, and between the Olympic and the Cascade foothills. It includes the Kitsap Peninsula and the lower elevations of the eastern half of the Olympic Peninsula.

Vegetation: Timber Grass and Brush, Douglas Fir/Hemlock forests with Oak prairie in some locations.

Climate: This is the most densely populated region of western Washington. In the rain shadow of the Olympics the annual precipitation ranges from 18 to 55 inches. Average summertime highs range from 65° F near the water, to 75° F inland.

Topography: The majority of the FDRA is made up of gently rolling terrain below 800ft MSL, with a few mountainous sections along the Cascade foothills that reach up to 3,800ft MSL.

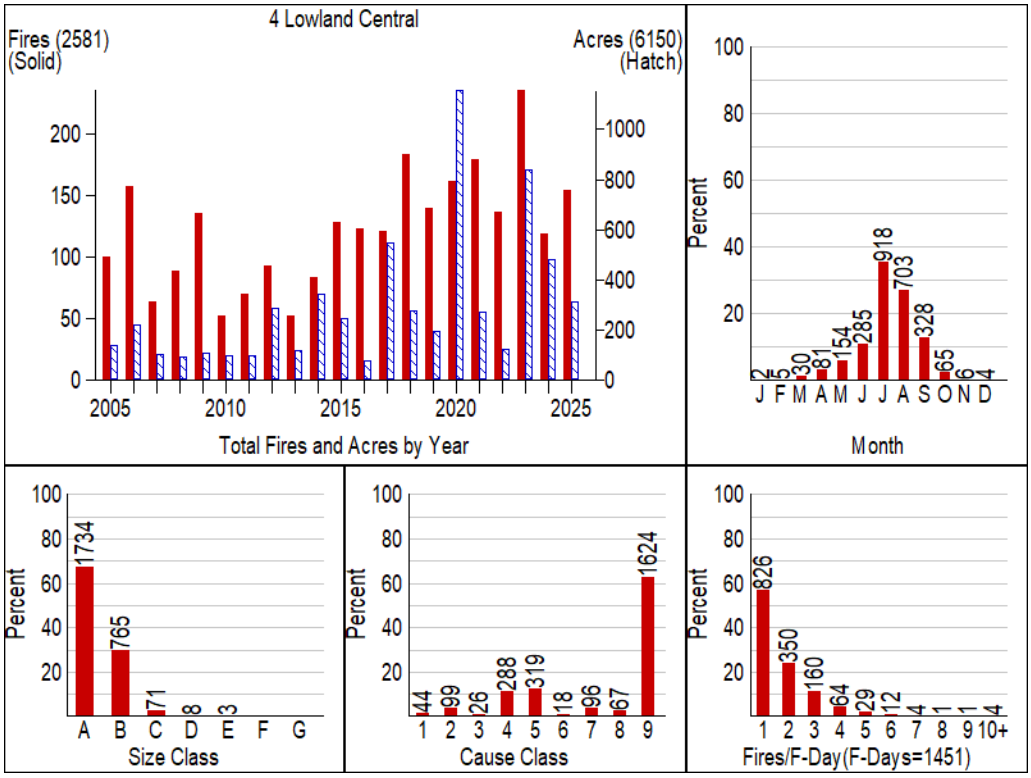


Figure 15. Fire Summary Graph for analysis years for Lowlands Central FDRA

Fire size class and cause definitions:
Size Classes: A - <= 0.25 acres, B - 0.26 to 9.9 acres, C - 10 to 99.9 acres, D - 100 to 299 acres, E - 300 to 999 acres, F - 1000 to 4999 acres, G - >= 5000 acres.

Cause Classes: 1 – Lightning, 2 - Equipment Use, 3 – Smoking, 4 – Campfire, 5 - Debris Burning, 6 – Railroad, 7 – Arson, 8 – Children, 9 – Miscellaneous

Table 23. Fire summary graph data for Lowlands Central FDRA

Fire Cause Classes		Fires By Month Lightning vs Human			Fire Size Percentiles	
		Month	Lightning	Human	Percentile	Acres
1	Lightning	Jan	0	2	85	1.1
2	Equipment	Feb	0	5	90	2.0
3	Smoking	March	0	22	91	2.3
4	Campfire	April	0	81	92	2.9
5	Debris	May	1	153	93	3.5
6	Railroad	June	2	279	94	4.2
7	Arson	July	7	890	95	5.0
8	Children	August	25	634	96	7.3
9	Misc	Sept	7	300	97	10.2
		Oct	1	62	98	15.6
		Nov	0	6	99	35.0
		Dec	0	4	100	494.0

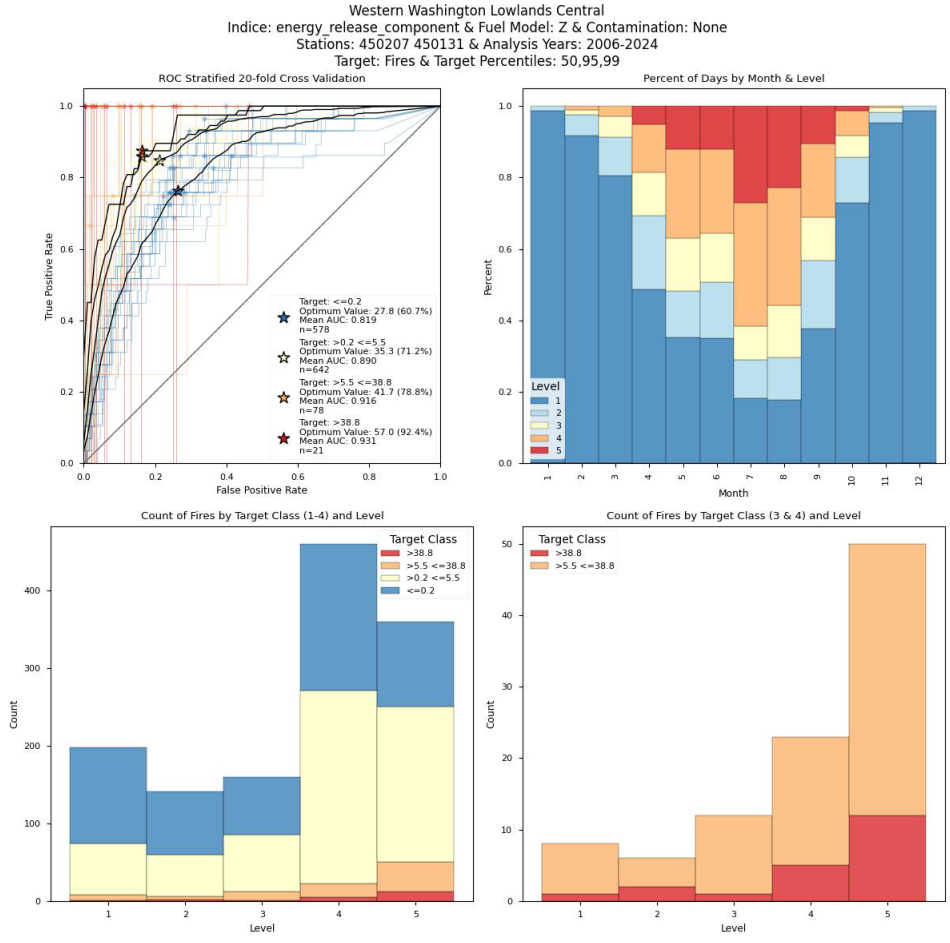


Figure 16. ROC chart with optimum values for fire danger thresholds on the upper left and graphical representation of the number of days each month that have historically fallen in each input staffing level on the upper right. Lower left shows number of fires in each class of day, by sizes. Lower right shows number of fires in each class of day as either large or small.

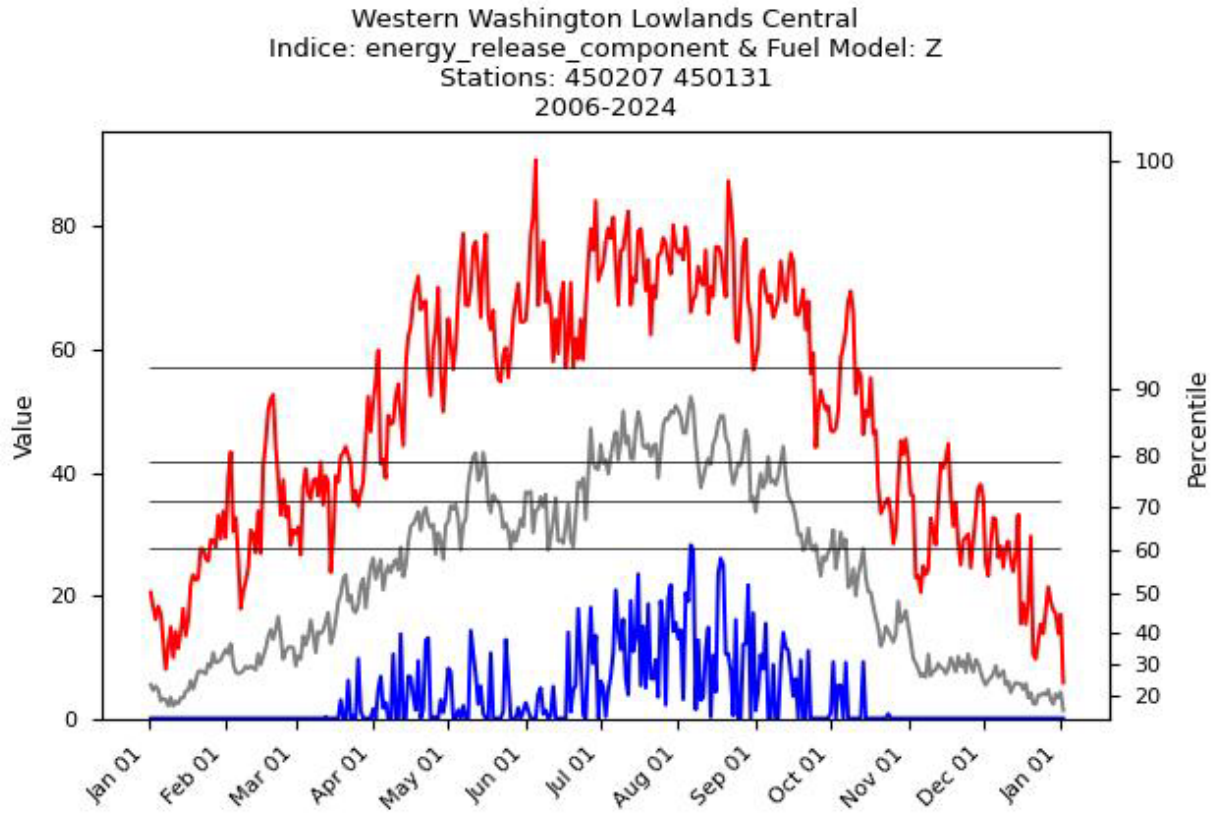


Figure 17. Lowlands Central FDRA season trend graph with staffing level thresholds identified by horizontal lines.

Table 24. Number All Days (AD) expressed as the number of days in the analysis period and proportion of the analysis period. Number of fire days (FD) is the proportion of days with a fire. Large fire day (LFD) is the proportion of days that had a fire over 38 acres. Multiple fire days (MFD) is the proportion of days with more than 3 fires in a single day.

Class	ERC Range	All Days (AD)		Fire Days (FD)			Large Fire Days (LFD)				Multiple Fire Days (MFD)			
		# AD	%AD	#FD	%FD	%AD	#LFD	%LFD	%FD	%AD	#MFD	%MFD	%FD	%AD
1	0-27.8	4432	61	199	14	4	2	9	1	0	14	5	7	0
2	27.8-35.3	658	9	113	8	17	1	4	1	0	12	4	11	2
3	35.3-41.7	545	7	151	11	28	1	4	1	0	17	6	11	3
4	41.7-57.0	965	13	448	32	46	5	22	1	1	84	31	19	9
5	57+	700	10	478	34	68	14	61	3	2	142	53	30	20

Table 25. Staffing level and adjective rating by ERC-Z range for Lowlands Central in both absolute value (ABS) and percentile (%)

Staffing Level and Adjective Rating for Lowlands Central FDRA					
LOCE ERC-Z ABS	0-27.8	27.8-35.3	35.3-41.7	41.7-57.0	57.0+
LOCE ERC-Z %	0-60.7	60.7-71.2	71.2-78.8	78.8-92.4	92.4+
Staffing Level	1	2	3	4	5
Adjective Rating	Low	Moderate	High	Very High	Extreme

4.5.5 Lowlands North FDRA

General Location: The Lowlands North FDRA extend from the Canadian border to approximately the King/Snohomish County line, and to the Cascade foothills. It includes the San Juan Islands, and Whidby Island.

Vegetation: Timber Grass and Brush.

Climate: In the rain shadow of the Olympics, from Port Angeles to Mt Vernon, and including the San Juan Islands the annual precipitation ranges from 18 to 30 inches. Average summertime highs range from 65° F near the water, to 75° F inland.

Topography: The majority of the FDRA is made up of gently rolling terrain below 800ft MSL, with a few mountainous sections along the Cascade foothills that reach up to 3,800ft MSL.

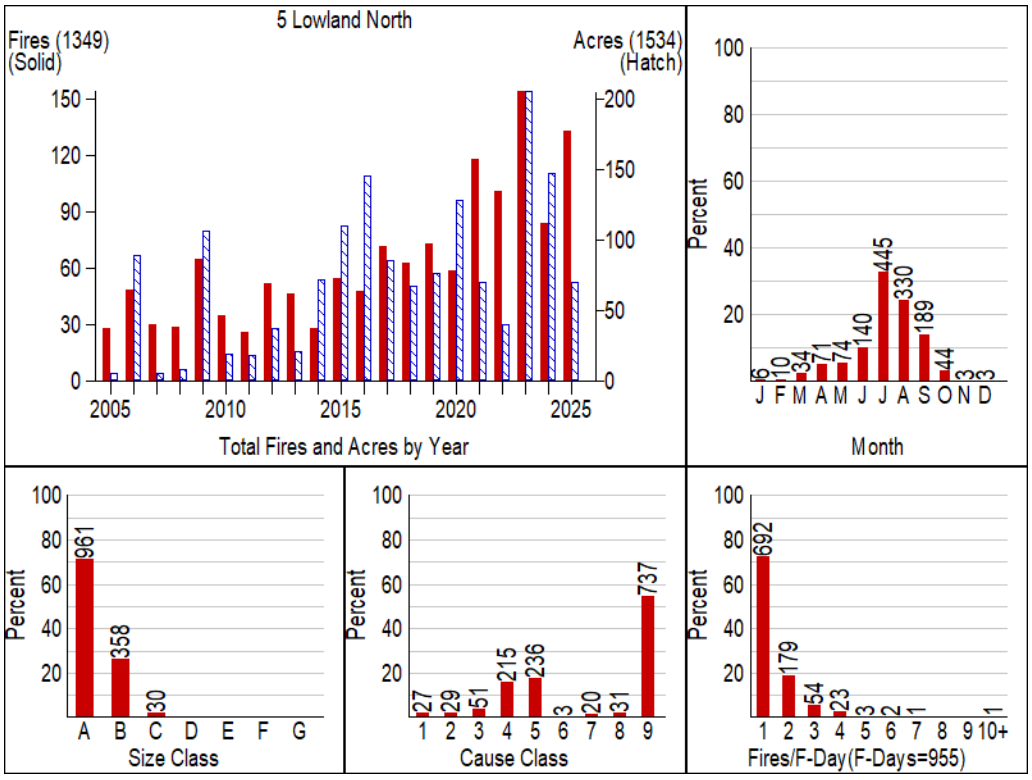


Figure 18. Fire Summary Graph for analysis years for the Lowlands North FDRA.

Fire size class and cause definitions:
Size Classes: A - <= 0.25 acres, B - 0.26 to 9.9 acres, C - 10 to 99.9 acres, D - 100 to 299 acres, E - 300 to 999 acres, F - 1000 to 4999 acres, G - >= 5000 acres.

Cause Classes: 1 – Lightning, 2 - Equipment Use, 3 – Smoking, 4 – Campfire, 5 - Debris Burning, 6 – Railroad, 7 – Arson, 8 – Children, 9 – Miscellaneous

Table 26. Select Fire Summary graph data for Lowlands North FDRA

Fire Cause Classes		Fires By Month Lightning vs Human			Fire Size Percentiles	
		Month	Lightning	Human	Percentile	Acres
1	Lightning	Jan	0	5	85	1.0
2	Equipment	Feb	0	7	90	1.5
3	Smoking	March	0	32	91	2.0
4	Campfire	April	0	66	92	2.0
5	Debris	May	0	66	93	2.2
6	Railroad	June	1	118	94	3.0
7	Arson	July	8	371	95	3.3
8	Children	August	7	296	96	4.5
9	Misc	Sept	11	178	97	6.9
		Oct	0	44	98	10.2
		Nov	0	3	99	21.1
		Dec	0	3	100	89.0

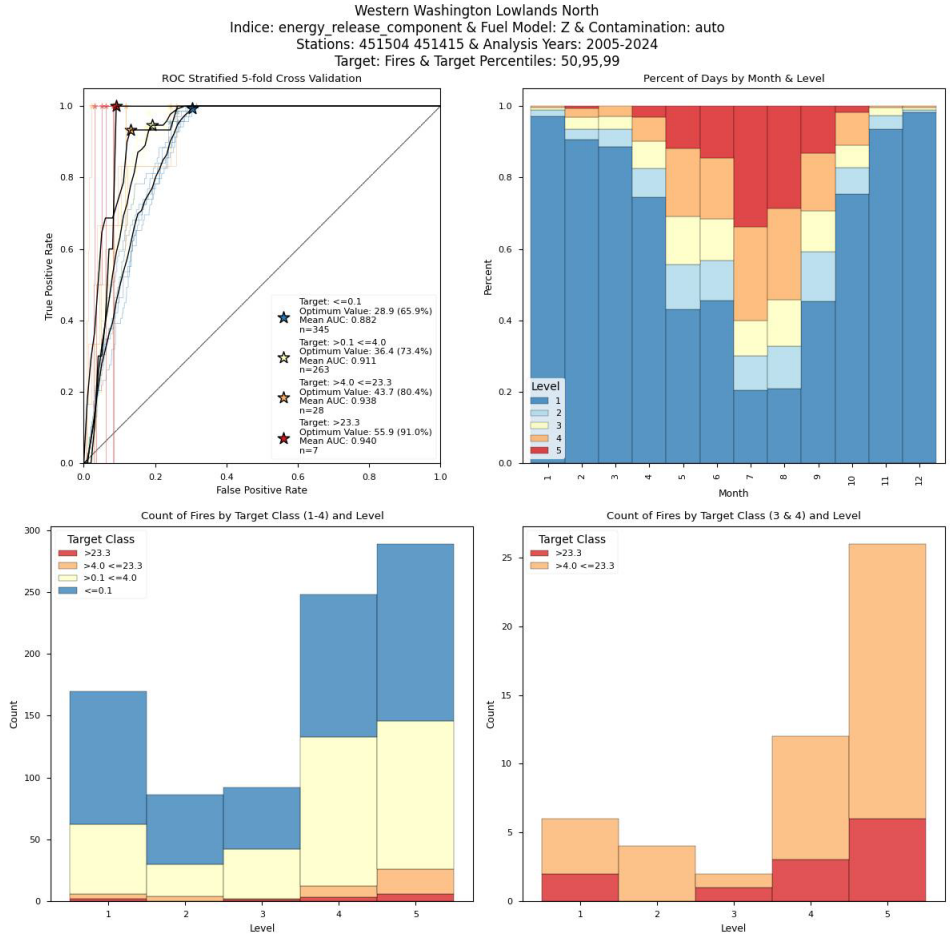


Figure 19. ROC chart with optimum values for fire danger thresholds on the upper left and graphical representation of the number of days each month that have historically fallen in each input staffing level on the upper right. Lower left shows number of fires in each class of day, by sizes. Lower right shows number of fires in each class of day as either large or small.

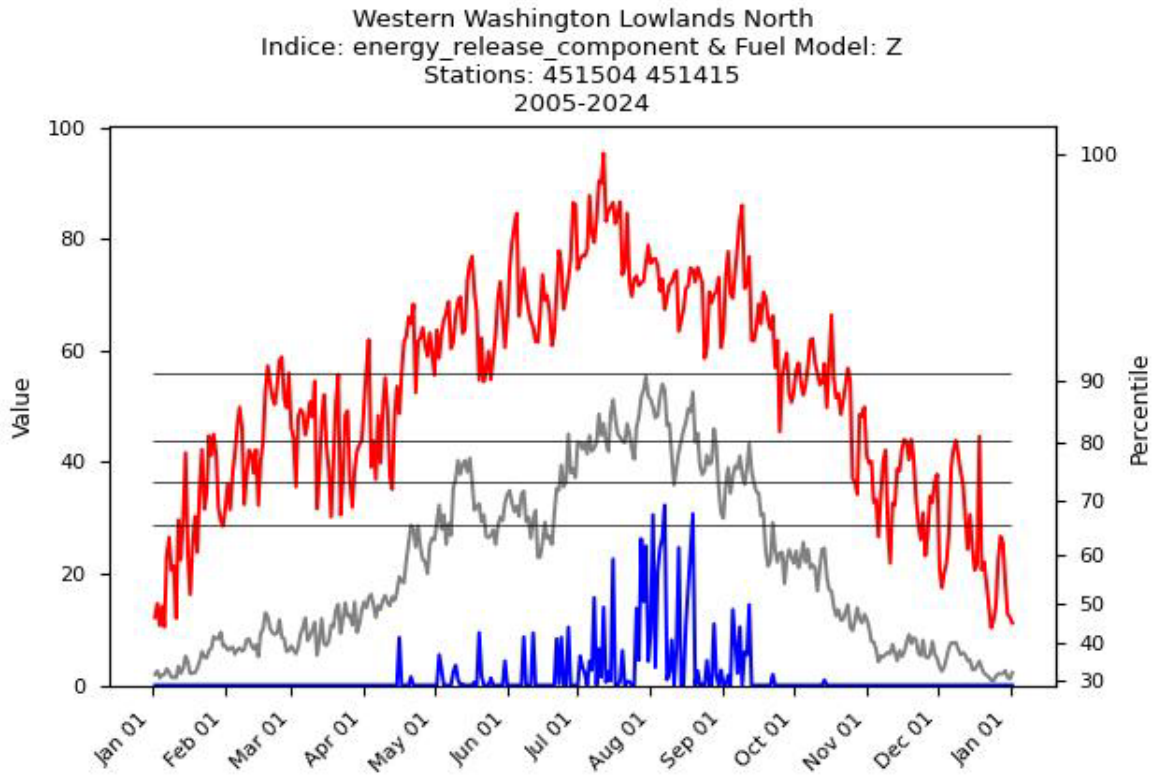


Figure 20. Lowlands North FDRA season trend graph with staffing level thresholds identified by horizontal lines.

Table 27. For each ERC bin as Class. Number of weather days or All Days (AD) expressed as the number of days in the analysis period and proportion of the analysis period. Number of fire days (FD) is the proportion of fire days, and proportion of all days within the given class with a fire day. Number of large fire days (LFD) is the proportion of fire days with a large fire, and the proportion of all days within the given class with a large fire. Number of days with multiple fires (MFD) is the proportion of multiple fire days, and the proportion of all days within the given class with multiple fire days.

Class	ERC Range	All Days (AD)		Fire Days (FD)			Large Fire Days (LFD)				Multiple Fire Days (MFD)			
		# AD	%AD	#FD	%FD	%AD	#LFD	%LFD	%FD	%AD	#MFD	%MFD	%FD	%AD
1	0-28.9	4423	61	107	12	2	1	8	1	0	16	7	15	0
2	28.9-36.4	488	7	44	5	9	0	0	0	0	7	3	16	1
3	36.4-43.7	441	6	56	6	13	0	0	0	0	4	2	7	1
4	43.7-55.9	766	10	177	20	23	4	33	2	1	47	20	27	6
5	55.9+	1182	16	500	57	42	7	58	1	1	157	68	31	13

Table 28. Staffing level response level and adjective rating by ERC-Z range for Lowlands North FDRA.

Staffing Level and Adjective Rating for Lowlands FDRA					
LONO ERC-Z	0-28.9	28.9-36.4	36.4-43.7	43.7-55.9	55.9+
LONO ERC-Z %	0-65.9	65.9-73.4	73.4-80.4	80.4-91.0	90.1+
Staffing Level	1	2	3	4	5
Adjective Rating	Low	Moderate	High	Very High	Extreme

4.5.6 Lowlands South FDRA

General Location: This area includes areas north of Clark and south of Thurston Counties. East of the Willapa Hills and west of the Cascade South FDRA.

Vegetation: A mix of timber types, including broad leaf and evergreen. Areas of harvest and plantations. Native and non-native vegetation within wildand urban interface.

Climate: Annual precipitation ranges between 40 inches and 170 inches with a median of 64 inches. The driest months are July through September. Some years may see the dry season carry on into October. Surface thermal troughs are most common in September through October; but may occur in any month.

Topography: Elevation ranges from just above sea-level to 4,000 feet near Mt St Helens. The median elevation is 921 feel. Terrain is relatively flat in the lowlands, becoming increasingly steep in the Cascade foothills.

Fire Occurrence

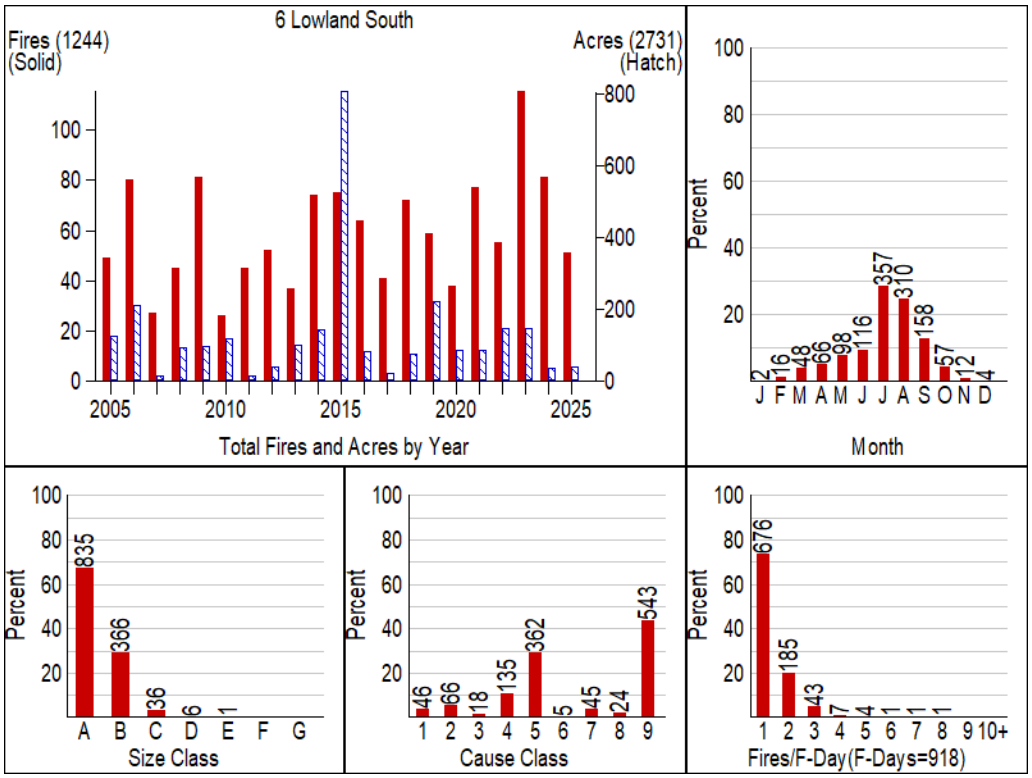


Figure 21. Fire occurrence summary graph data for the Lowlands South FDRA

Fire size class and cause definitions:
Size Classes: A - <= 0.25 acres, B - 0.26 to 9.9 acres, C - 10 to 99.9 acres, D - 100 to 299 acres, E - 300 to 999 acres, F - 1000 to 4999 acres, G - >= 5000 acres.

Cause Classes: 1 – Lightning, 2 - Equipment Use, 3 – Smoking, 4 – Campfire, 5 - Debris Burning, 6 – Railroad, 7 – Arson, 8 – Children, 9 – Miscellaneous

Table 29. Fire summary graph data for Lowlands South FDRA

Fire Cause Classes		Fires By Month Lightning vs Human			Fire Size Percentiles	
		Month	Lightning	Human	Percentile	Acres
1	Lightning	Jan	0	2	85	1.0
2	Equipment	Feb	0	16	90	2.0
3	Smoking	March	0	48	91	2.1
4	Campfire	April	0	59	92	2.6
5	Debris	May	4	88	93	3.1
6	Railroad	June	2	106	94	4.0
7	Arson	July	5	334	95	5.1
8	Children	August	27	271	96	7.0
9	Misc	Sept	6	152	97	11.0
		Oct	1	56	98	18.0
		Nov	0	12	99	57.3
		Dec	0	4	100	359.0

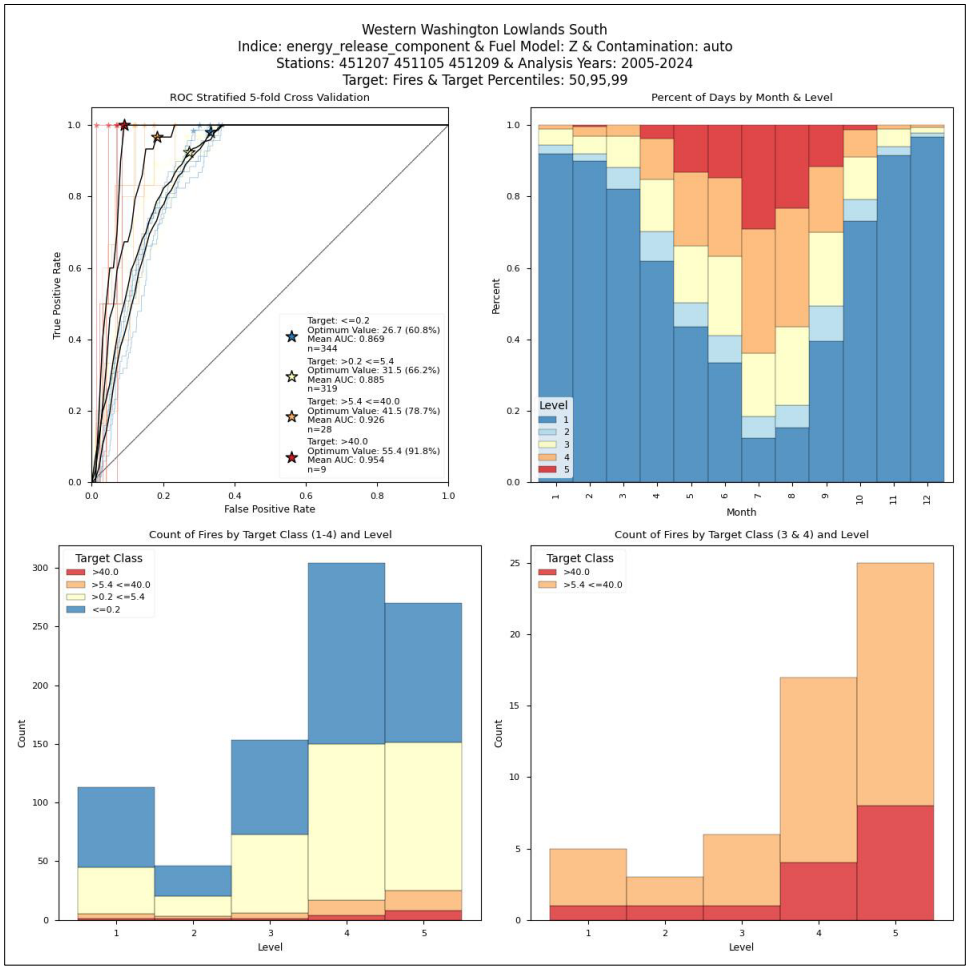


Figure 22. ROC chart with optimum values for fire danger thresholds on the upper left and graphical representation of the number of days each month that have historically fallen in each input staffing level on the upper right. Lower left shows number of fires in each class of day, by sizes. Lower right shows number of fires in each class of day as either large or small.

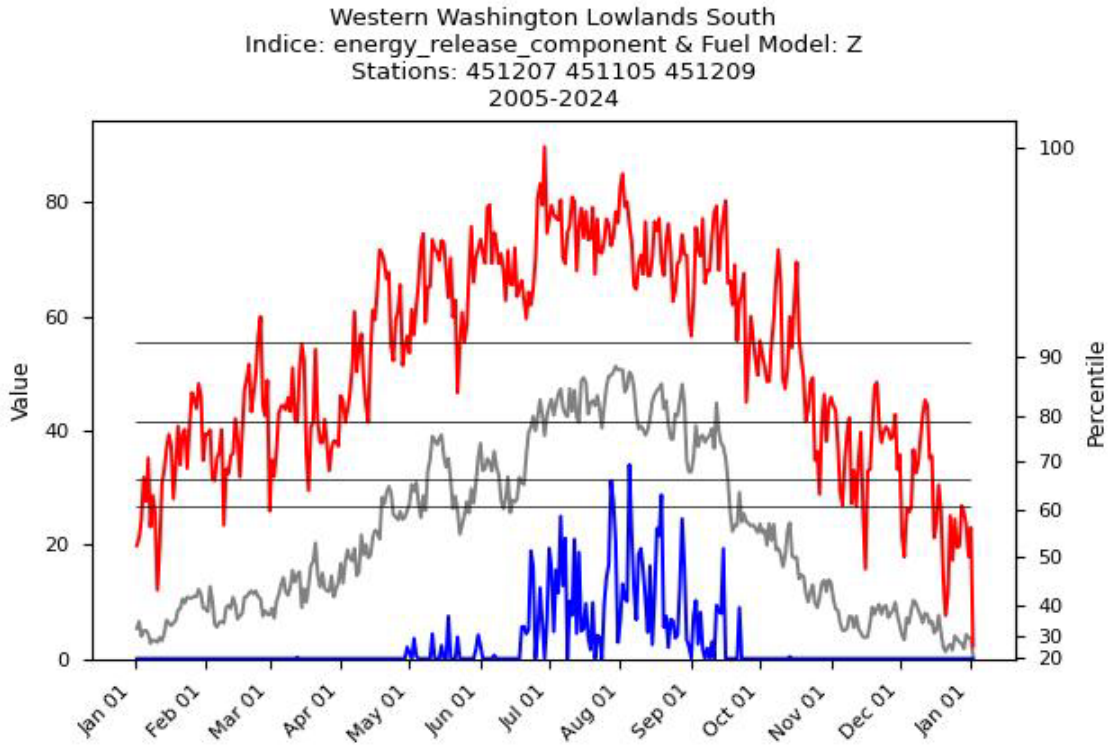


Figure 23. Lowlands South FDRA season trend graph with staffing level thresholds identified by horizontal lines.

Table 30. Number All Days (AD) expressed as the number of days in the analysis period and proportion of the analysis period. Number of fire days (FD) is the proportion of days with a fire. Large fire day (LFD) is the proportion of days that had a fire over 40 acres. Multiple fire days (MFD) is the proportion of days with more than 3 fires in a single day.

Class	ERC Range	All Days (AD)		Fire Days (FD)			Large Fire Days (LFD)				Multiple Fire Days (MFD)			
		# AD	%AD	#FD	%FD	%AD	#LFD	%LFD	%FD	%AD	#MFD	%MFD	%FD	%AD
1	0-28.7	4415	60	92	10	2	1	6	1	0	1	2	1	0
2	28.7-31.5	222	3	24	3	11	1	6	4	0	2	4	8	1
3	31.5-41.5	754	10	101	11	13	2	12	2	0	4	8	4	1
4	41.5-55.4	831	11	208	208	25	1	6	0	0	6	11	3	1
5	55.4+	1078	15	461	461	43	11	69	2	1	40	75	9	4

Table 31. Staffing level and adjective rating by ERC-Z range for Lowlands South in both value (ABS) and percentile.

Staffing Level and Adjective Rating for Lowlands South FDRA					
ERC-Z (ABS)	0-28.7	28.7-31.5	31.5-41.5	41.5-55.4	55.4+
ERC-Z %	0-60.8	60.8-66.2	66.2-78.7	78.7-91.8	91.8+
Staffing Level	1	2	3	4	5
Adjective Rating	Low	Moderate	High	Very High	Extreme

4.5.7 Cascade North FDRA

General Location: The Cascade North FDRA extends from the Canadian border to approximately the King Snohomish County line and includes a small portion of King county to avoid splitting the 658 IFPL zone.

Vegetation: Primarily heavy timber with Douglas Fir, cedar, and hemlock with an understory of rhododendron, vine maple and salal.

Climate: Annual precipitation ranges between 40 inches and 180 inches with a median of 110 inches. The driest months are July through September. Some years may see the dry season carry on into October. Surface thermal troughs are most common in September through October; but may occur in any month.

Topography: Elevation ranges from 700 feet to 7,500 feet. The median elevation is 3,533 feet. Terrain is heavily bisected by drainages and steep slopes.

Fire Occurrence

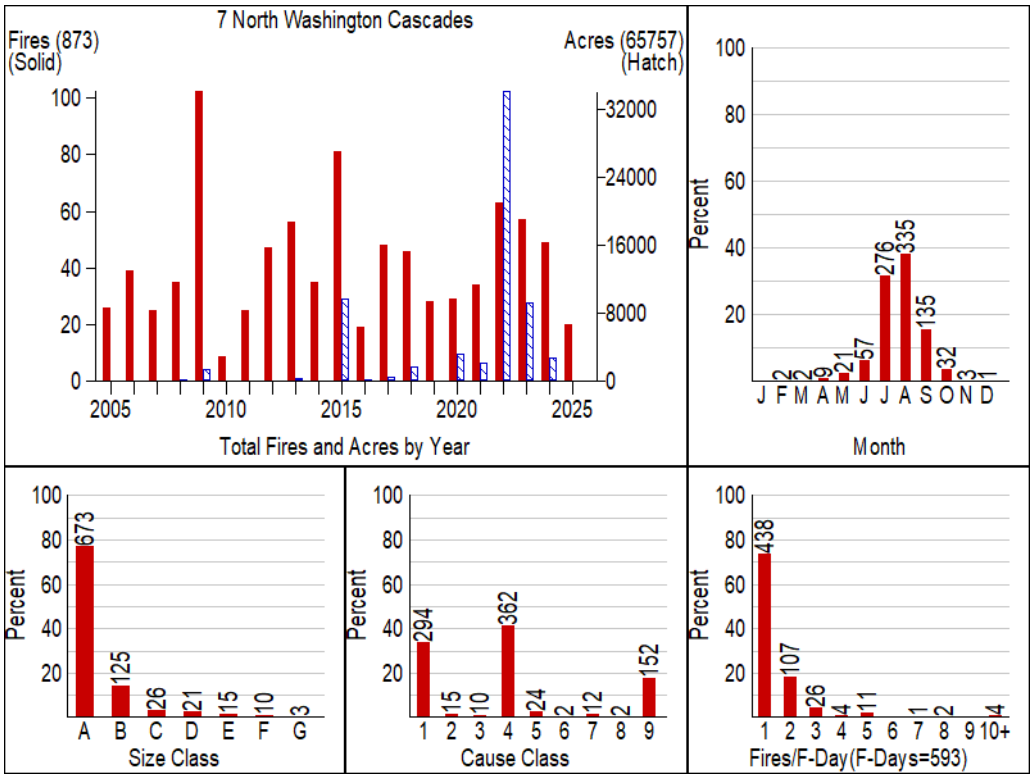


Figure 24. Fire occurrence summary graph data for the Cascade North FDRA

Fire size class and cause definitions:
Size Classes: A - <= 0.25 acres, B - 0.26 to 9.9 acres, C - 10 to 99.9 acres, D - 100 to 299 acres, E - 300 to 999 acres, F - 1000 to 4999 acres, G - >= 5000 acres.

Cause Classes: 1 – Lightning, 2 - Equipment Use, 3 – Smoking, 4 – Campfire, 5 - Debris Burning, 6 – Railroad, 7 – Arson, 8 – Children, 9 – Miscellaneous

Table 32. Fire summary graph data for Cascade North FDRA

Fire Cause Classes		Fires By Month Lightning vs Human			Fire Size Percentiles	
		Month	Lightning	Human	Percentile	Acres
1	Lightning	Jan	0	0	85	1.0
2	Equipment	Feb	0	2	90	5.0
3	Smoking	March	0	2	91	8.0
4	Campfire	April	0	8	92	17.0
5	Debris	May	7	14	93	30.0
6	Railroad	June	19	37	94	40.0
7	Arson	July	101	160	95	143.0
8	Children	August	140	192	96	200.0
9	Misc	Sept	24	111	97	310.0
		Oct	1	31	98	565.0
		Nov	0	3	99	1747.0
		Dec	0	1	100	7377.0

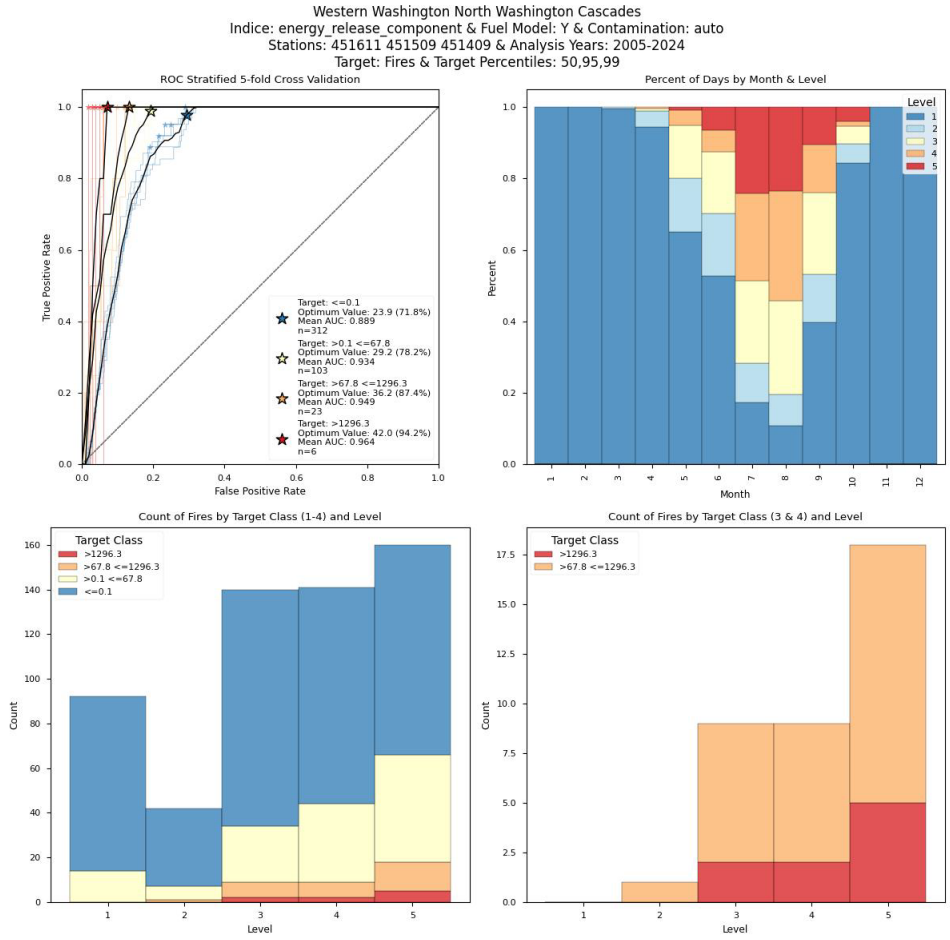


Figure 25. ROC chart with optimum values for fire danger thresholds on the upper left and graphical representation of the number of days each month that have historically fallen in each input staffing level on the upper right. Lower left shows number of fires in each class of day, by sizes. Lower right shows number of fires in each class of day as either large or small.

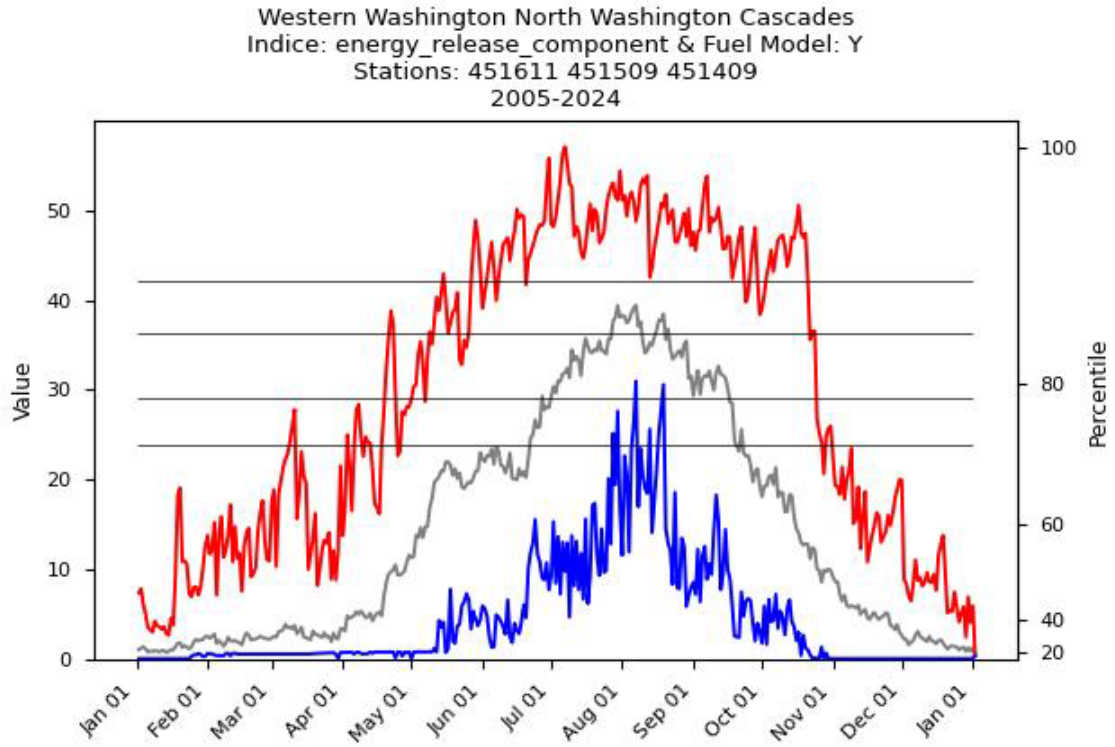


Figure 26. Cascade North FDRA season trend graph with staffing level thresholds identified by horizontal lines.

Table 33. Number All Days (AD) expressed as the number of days in the analysis period and proportion of the analysis period. Number of fire days (FD) is the proportion of days with a fire. Large fire day (LFD) is the proportion of days that had a fire over 68 acres. Multiple fire days (MFD) is the proportion of days with more than 3 fires in a single day.

Class	ERC Range	All Days (AD)		Fire Days (FD)			Large Fire Days (LFD)				Multiple Fire Days (MFD)			
		# AD	%AD	#FD	%FD	%AD	#LFD	%LFD	%FD	%AD	#MFD	%MFD	%FD	%AD
1	0-23.9	5071	69	73	13	1	0	0	0	0	1	2	1	0
2	23.9-29.2	375	5	30	5	8	1	3	3	0	2	4	7	1
3	29.2-36.2	513	7	62	11	12	1	3	2	0	2	4	3	0
4	36.2-42.0	478	7	115	20	24	8	22	7	2	4	8	3	1
5	42.0+	863	12	295	51	34	27	73	9	3	39	81	13	5

Table 34. Staffing level and adjective rating by ERC-Y range for Cascade North in both value (ABS) and percentile.

Staffing Level and Adjective Rating for Cascade North FDRA					
ERC-Y	0-23.9	23.9-29.2	29.2-36.2	36.2-42.0	42.0+
ERC-Y %	0-71.8	71.8-78.2	78.2-87.4	87.4-94.2	94.2+
Staffing Level	1	2	3	4	5
Adjective Rating	Low	Moderate	High	Very High	Extreme

4.5.8 Olympics FDRA

General Location: This area includes Olympic National Park and Forest.

Vegetation: A mix of timber types, including broad leaf and evergreen with subalpine types at highest elevations.

Climate: Annual precipitation ranges between 30 inches and 244 inches with a median of 127 inches. Areas east of the Olympics are in a rain shadow where precipitation totals are much lower than other parts of the FDRA. The driest months are July through September. Some years may see the dry season carry on into October. Surface thermal troughs are most common in September through October; but may occur in any month.

Topography: Elevation ranges from just above sea-level to nearly 8,000 feet on Mount Olympus. The median elevation is 2565 feet. Terrain is relatively flat in the lowlands, becoming increasingly steep in the Cascade foothills.

Fire Occurrence

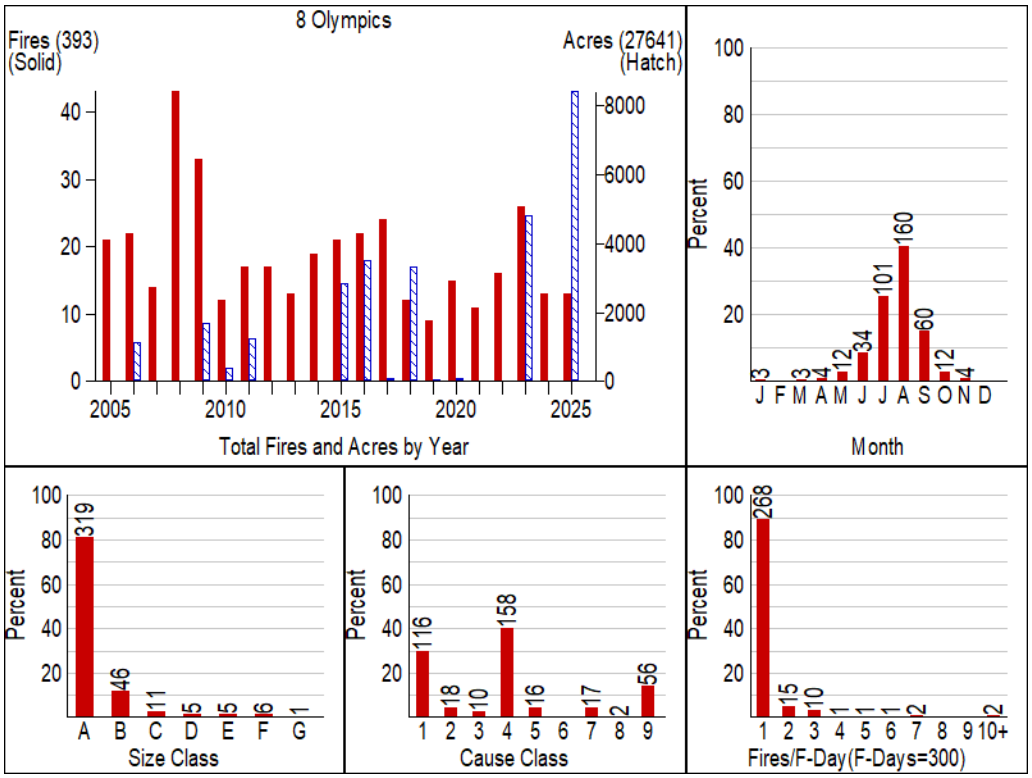


Figure 27. Fire occurrence summary graph data for the Olympics FDRA

Fire size class and cause definitions:
Size Classes: A - <= 0.25 acres, B - 0.26 to 9.9 acres, C - 10 to 99.9 acres, D - 100 to 299 acres, E - 300 to 999 acres, F - 1000 to 4999 acres, G - >= 5000 acres.

Cause Classes: 1 – Lightning, 2 - Equipment Use, 3 – Smoking, 4 – Campfire, 5 - Debris Burning, 6 – Railroad, 7 – Arson, 8 – Children, 9 - Miscellaneous

Table 35. Fire summary graph data for Olympics FDRA

Fire Cause Classes		Fires By Month Lightning vs Human			Fire Size Percentiles	
		Month	Lightning	Human	Percentile	Acres
1	Lightning	Jan	0	2	85	1.0
2	Equipment	Feb	0	0	90	2.5
3	Smoking	March	0	2	91	4.2
4	Campfire	April	0	2	92	7.0
5	Debris	May	0	9	93	12.0
6	Railroad	June	1	20	94	26.0
7	Arson	July	15	41	95	58.0
8	Children	August	32	46	96	84.0
9	Misc	Sept	11	27	97	122.8
		Oct	0	8	98	340.0
		Nov	0	2	99	2475.0
		Dec	0	0	100	4168.0

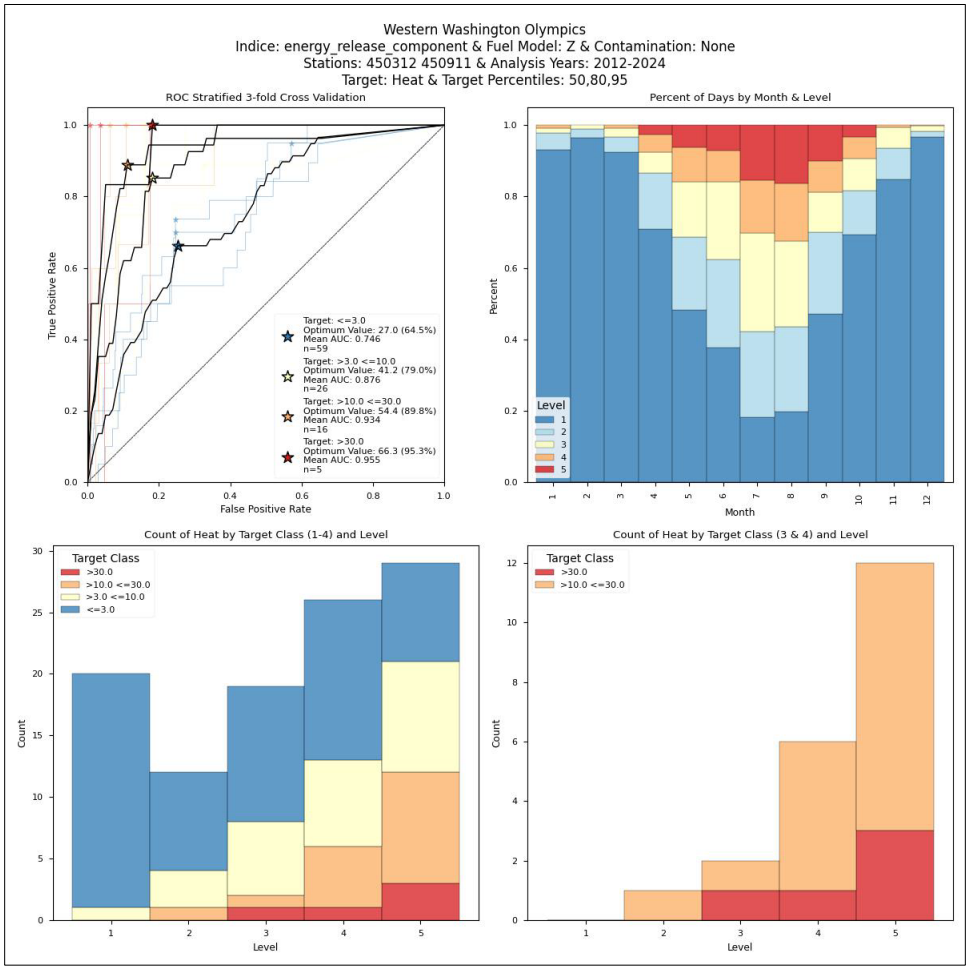


Figure 28. ROC chart with optimum values for fire danger thresholds on the upper left and graphical representation of the number of days each month that have historically fallen in each input staffing level on the upper right. Lower left shows number of fires in each class of day, by sizes. Lower right shows number of fires in each class of day as either large or small.

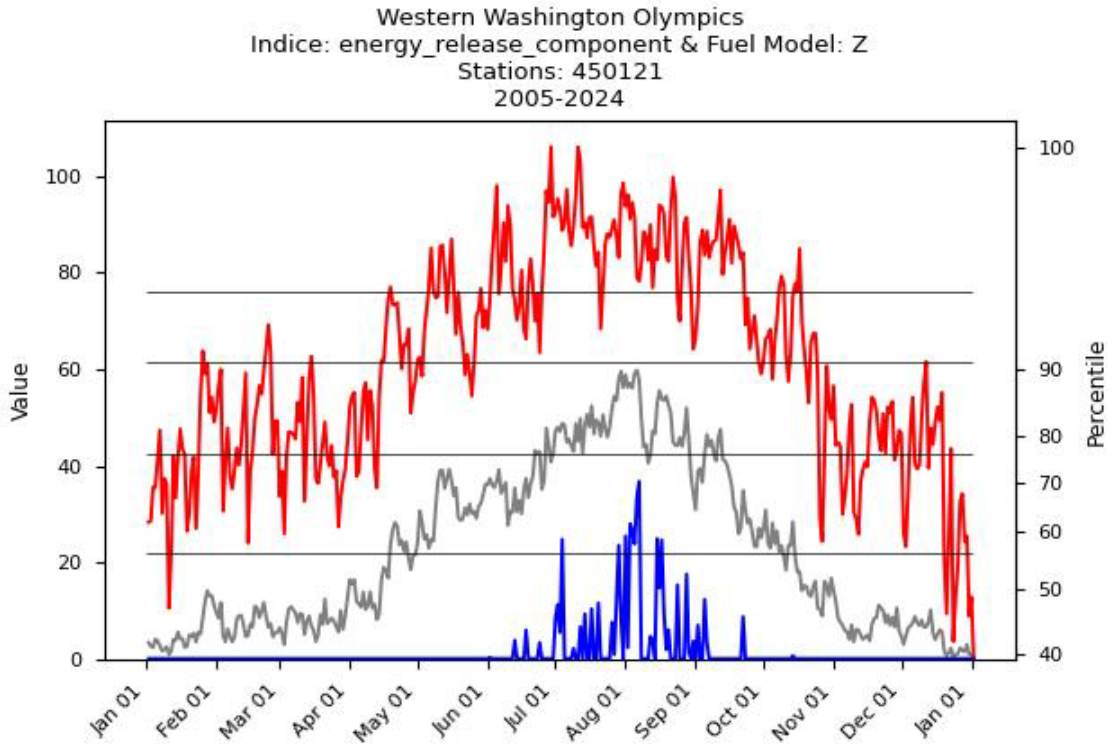


Figure 29. Olympic FDRA season trend graph with staffing level thresholds identified by horizontal lines.

Table 36. Number All Days (AD) expressed as the number of days in the analysis period and proportion of the analysis period. Number of fire days (FD) is the proportion of days with a heat detection. Large fire day (LFD) is the proportion of days that had more than 30 pixels detected. Multiple fire days (MFD) is the proportion of days with more than 3 fires in a single day.

Class	ERC Range	ERC Percentiles	Days January -December		MODIS January-December	
			# Days	% Days	Detections per Day	# Days
1	0-27.0	0-64.5	2971	63	0	2971
2	27.0-41.2	64.5-79.0	604	13	0-3	59
3	41.2-54.4	79.0-89.8	416	9	3-10	26
4	54.4-66.3	89.8-95.3	274	6	10-30	16
5	66.3+	95.3+	427	9	30+	5

Table 37. Staffing level and adjective rating by ERC-Z range for Olympics in both value (ABS) and percentile.

Staffing Level and Adjective Rating for Olympics FDRA					
ERC-Z	0-27.0	27.0-41.2	41.2-54.4	54.4-66.3	66.3+
ERC-Z %	0-64.5	64.5-79.0	79.0-89.8	89.8-95.3	95.3+
Staffing Level	1	2	3	4	5
Adjective Rating	Low	Moderate	High	Very High	Extreme

Table 38. Results from the ROC analysis using MODIS.

Id	FDRA	Index	Fuel Model	SIG	Modis	Level	Optimum Value	Percentile	Interval	ROC AUC
Olympics_10_Z_ERC	Olympics	ERC	Z	450312, 450911	3	1	27	64.5	64.5	0.74
Olympics_10_Z_ERC	Olympics	ERC	Z	450312, 450911	10	2	41	79.0	14.5	0.87
Olympics_10_Z_ERC	Olympics	ERC	Z	450312, 450911	30	3	54	89.8	10.8	0.93
Olympics_10_Z_ERC	Olympics	ERC	Z	450312, 450911	30	4	66	95.3	5.5	0.95

4.5.9 Cascade South FDRA

General Location: This area includes the western portions of the Gifford Pinchot National Forest and Mount Rainier National Park.

Vegetation: Primarily heavy timber with Douglas Fir, cedar, and hemlock with an understory of rhododendron, vine maple and salal.

Climate: The annual median precipitation 88 inches. The driest months are July through September. Some years may see the dry season carry on into October. Surface thermal troughs are most common in September through October; but may occur in any month.

Topography: Elevation ranges from approximately 1,000 feet to just over 14,000 feet. Terrain is heavily bisected by drainages and steep slopes. Portions of the landscape are dominated by previous volcanic activity.

Fire Occurrence

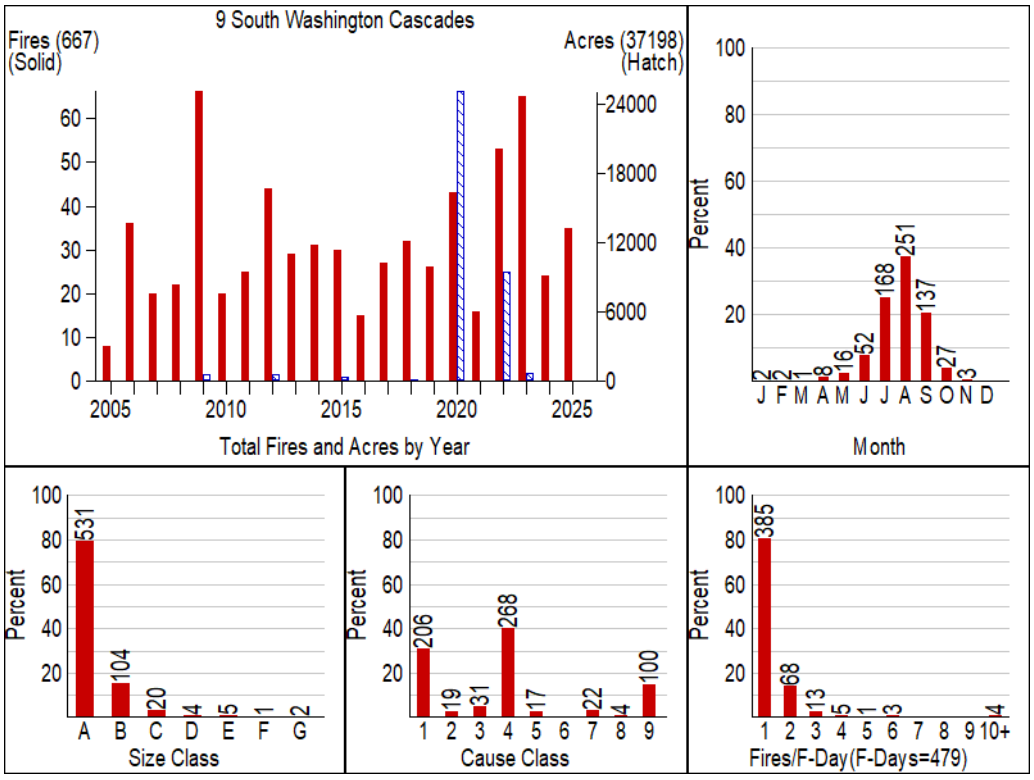


Figure 30. Fire occurrence summary graph data for the Cascade South FDRA

Fire size class and cause definitions:
Size Classes: A - <= 0.25 acres, B - 0.26 to 9.9 acres, C - 10 to 99.9 acres, D - 100 to 299 acres, E - 300 to 999 acres, F - 1000 to 4999 acres, G - >= 5000 acres.

Cause Classes: 1 – Lightning, 2 - Equipment Use, 3 – Smoking, 4 – Campfire, 5 - Debris Burning, 6 – Railroad, 7 – Arson, 8 – Children, 9 - Miscellaneous

Table 39. Fire summary graph data for Cascade South FDRA

Fire Cause Classes		Fires By Month Lightning vs Human			Fire Size Percentiles	
		Month	Lightning	Human	Percentile	Acres
1	Lightning	Jan	0	1	85	0.5
2	Equipment	Feb	0	1	90	1.8
3	Smoking	March	0	0	91	2.0
4	Campfire	April	1	4	92	4.0
5	Debris	May	2	10	93	5.0
6	Railroad	June	6	30	94	8.0
7	Arson	July	56	80	95	11.0
8	Children	August	91	122	96	20.0
9	Misc	Sept	26	87	97	31.7
		Oct	0	27	98	133.0
		Nov	0	2	99	341.0
		Dec	0	0	100	24995

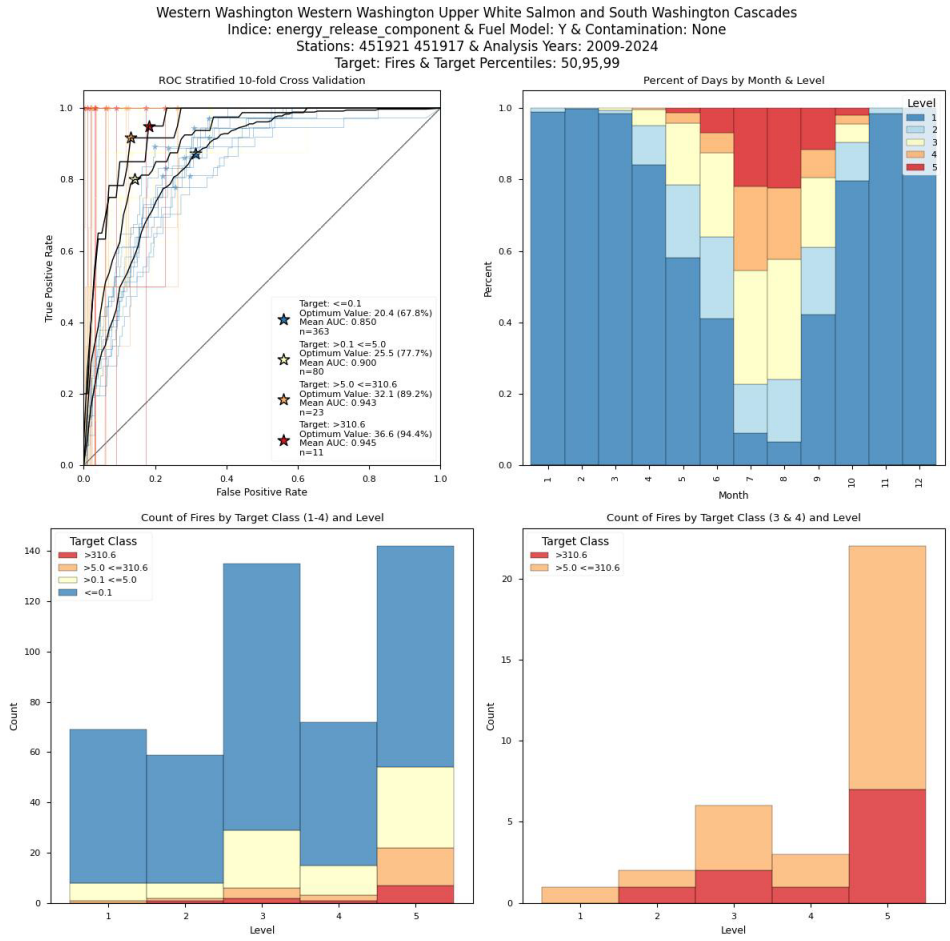


Figure 31. ROC chart with optimum values for fire danger thresholds on the upper left and graphical representation of the number of days each month that have historically fallen in each input staffing level on the upper right. Lower left shows number of fires in each class of day, by sizes. Lower right shows number of fires in each class of day as either large or small.

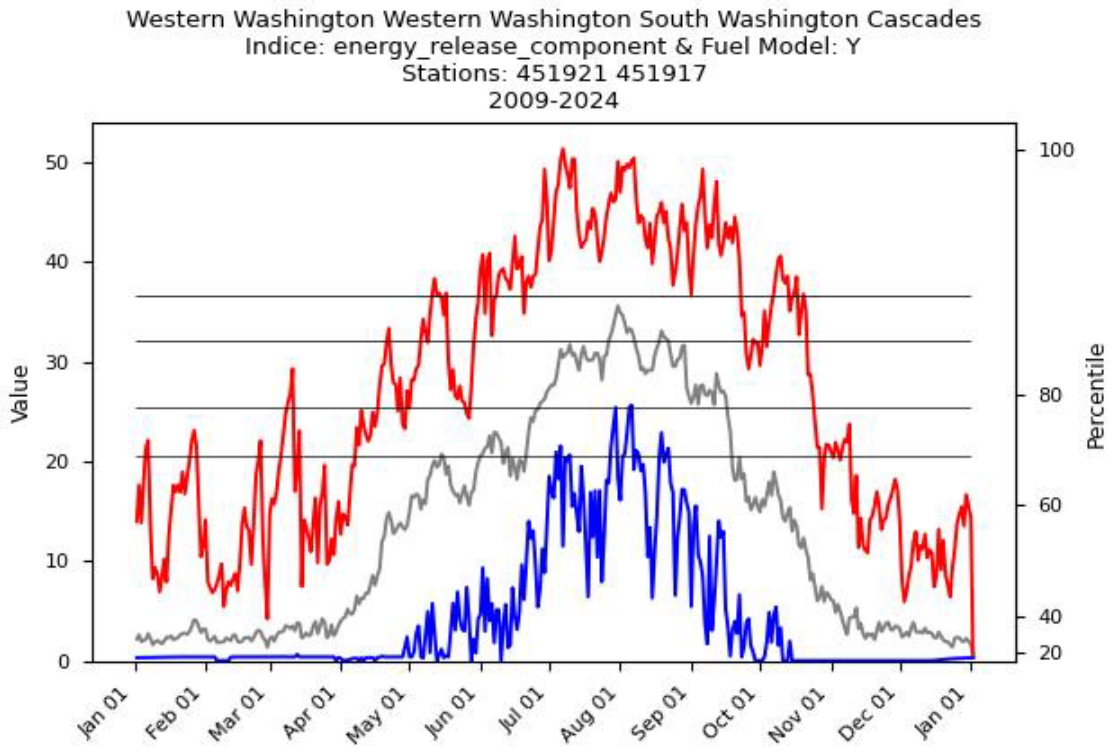


Figure 32. Cascade South FDRA season trend graph with staffing level thresholds identified by horizontal lines.

Table 40. Number All Days (AD) expressed as the number of days in the analysis period and proportion of the analysis period. Number of fire days (FD) is the proportion of days with a fire. Large fire day (LFD) is the proportion of days that had a fire over 3 acres. Multiple fire days (MFD) is the proportion of days with more than 3 fires in a single day.

Class	ERC Range	All Days (AD)		Fire Days (FD)			Large Fire Days (LFD)				Multiple Fire Days (MFD)			
		# AD	%AD	#FD	%FD	%AD	#LFD	%LFD	%FD	%AD	#MFD	%MFD	%FD	%AD
1	0-20.4	3773	65	40	10	1	0	0	0	0	0	0	0	0
2	20.4-25.5	558	10	31	8	6	0	0	0	0	1	4	3	0
3	25.5-32.1	547	9	71	19	13	2	25	3	0	5	21	7	1
4	32.1-36.6	346	6	65	17	19	0	0	0	0	3	12	5	1
5	36.6+	616	11	175	46	28	6	75	3	1	15	62	9	2

Table 41. Staffing level and adjective rating by ERC-Z range for Cascade South in both value (ABS) and percentile.

Staffing Level and Adjective Rating for Cascade South FDRA					
ERC-Y	0-20.4	20.4-25.5	25.5-32.1	32.1-36.6	36.6+
ERC-Y Percentile	0-67.8	67.8-77.7	77.7-89.2	89.2-94.4	94.4+
Staffing Level	1	2	3	4	5
Adjective Rating	Low	Moderate	High	Very High	Extreme

4.5.10 Upper White Salmon FDRA

General Location: This area includes the southeastern portions of the Gifford Pinchot National Forest.

Vegetation: Primarily heavy to moderate timber with Douglas Fir, ponderosa pine and white fir with an understory of vine maple and huckleberry at higher elevations.

Climate: The annual median precipitation is 83 inches but varies significantly across the FDRA with minimum annual precipitation reaching 44 inches on lower slopes. The driest months are July through September. Some years may see the dry season carry on into October. Surface thermal troughs are most common in September through October; but may occur in any month.

Topography: Elevation ranges from 1,500 feet to almost 10,000 feet on south slopes of Mt Adams. Terrain varies significantly with steep slopes somewhat less common that the rest of the Gifford Pinchot National Forest. Portions of the landscape are dominated by previous volcanic activity.

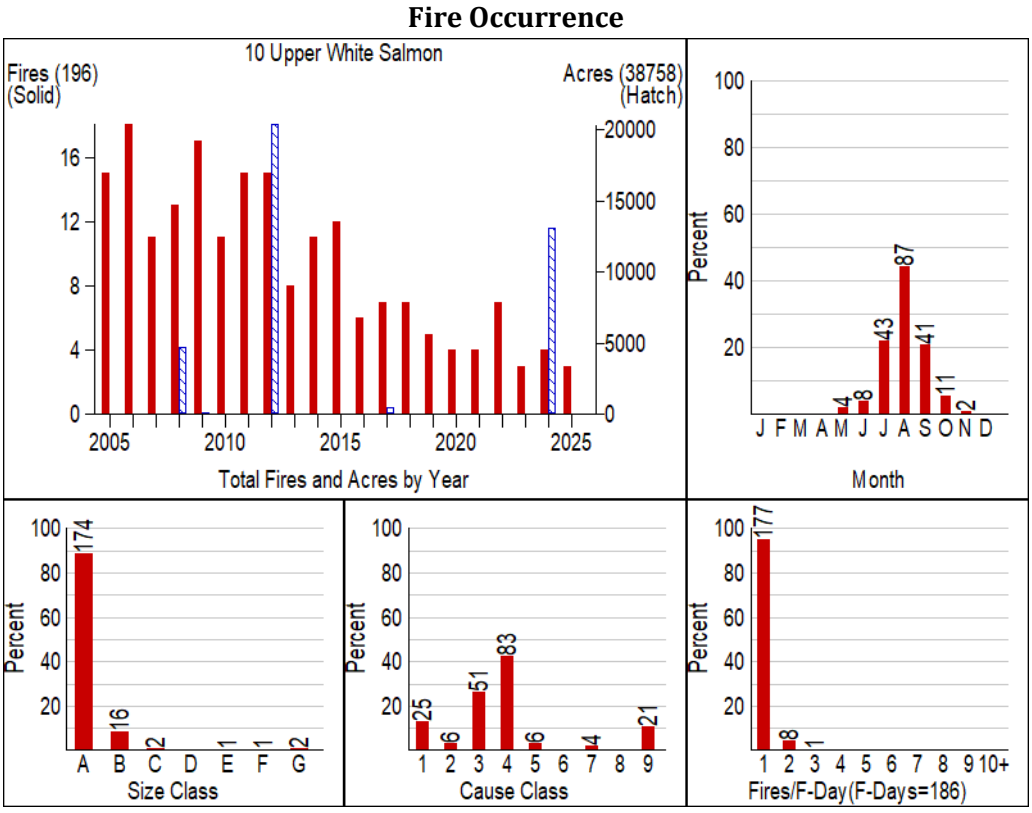


Figure 33. Fire occurrence summary graph data for the Upper White Salmon FDRA

Fire size class and cause definitions:
Size Classes: A - <= 0.25 acres, B - 0.26 to 9.9 acres, C - 10 to 99.9 acres, D - 100 to 299 acres, E - 300 to 999 acres, F - 1000 to 4999 acres, G - >= 5000 acres.

Cause Classes: 1 – Lightning, 2 - Equipment Use, 3 – Smoking, 4 – Campfire, 5 - Debris Burning, 6 – Railroad, 7 – Arson, 8 – Children, 9 - Miscellaneous

Table 42. Fire summary graph data for Upper White Salmon FDRA

Fire Cause Classes		Fires By Month Lightning vs Human			Fire Size Percentiles	
		Month	Lightning	Human	Percentile	Acres
1	Lightning	Jan	0	0	84	0.2
2	Equipment	Feb	0	0	90	0.2
3	Smoking	March	0	0	91	0.2
4	Campfire	April	0	0	92	0.3
5	Debris	May	1	2	93	0.3
6	Railroad	June	1	4	94	0.5
7	Arson	July	2	23	95	1.0
8	Children	August	7	57	96	1.0
9	Misc	Sept	5	25	97	4.0
		Oct	0	8	98	93.0
		Nov	0	1	99	483.0
		Dec	0	0	100	20296

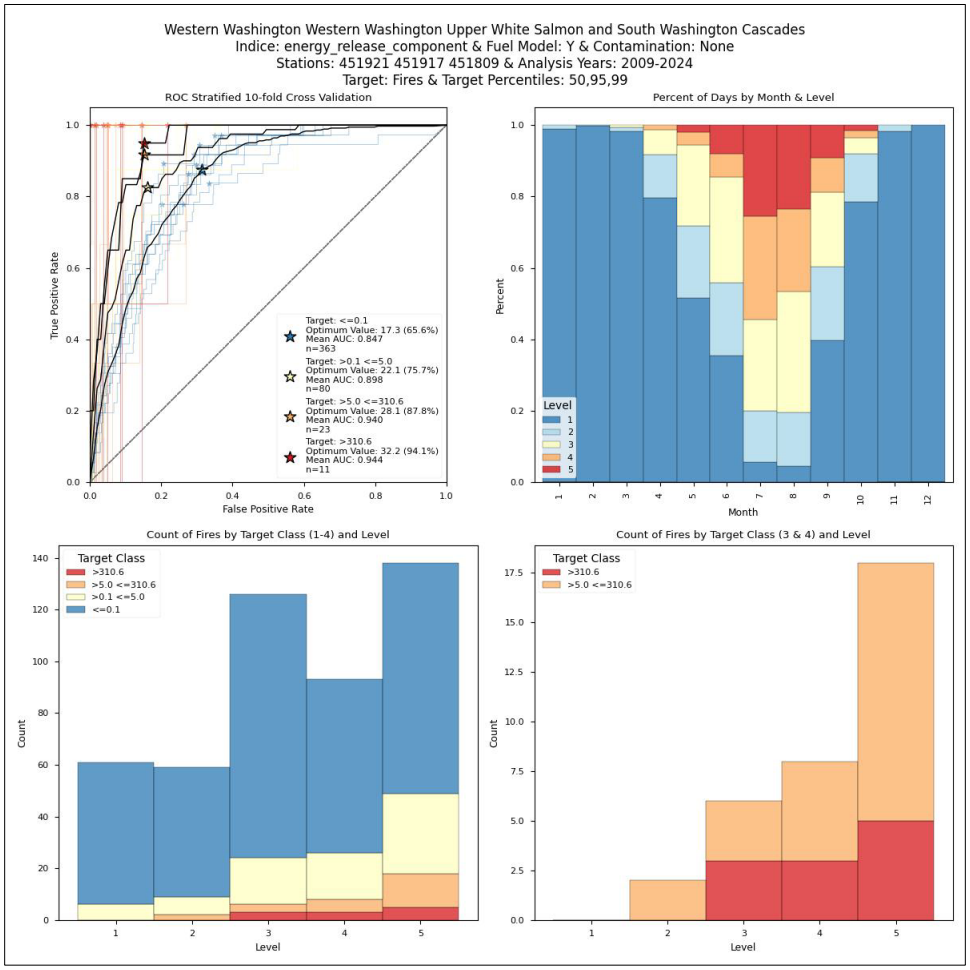


Figure 34. ROC chart with optimum values for fire danger thresholds on the upper left and graphical representation of the number of days each month that have historically fallen in each input staffing level on the upper right. Lower left shows number of fires in each class of day, by sizes. Lower right shows number of fires in each class of day as either large or small.

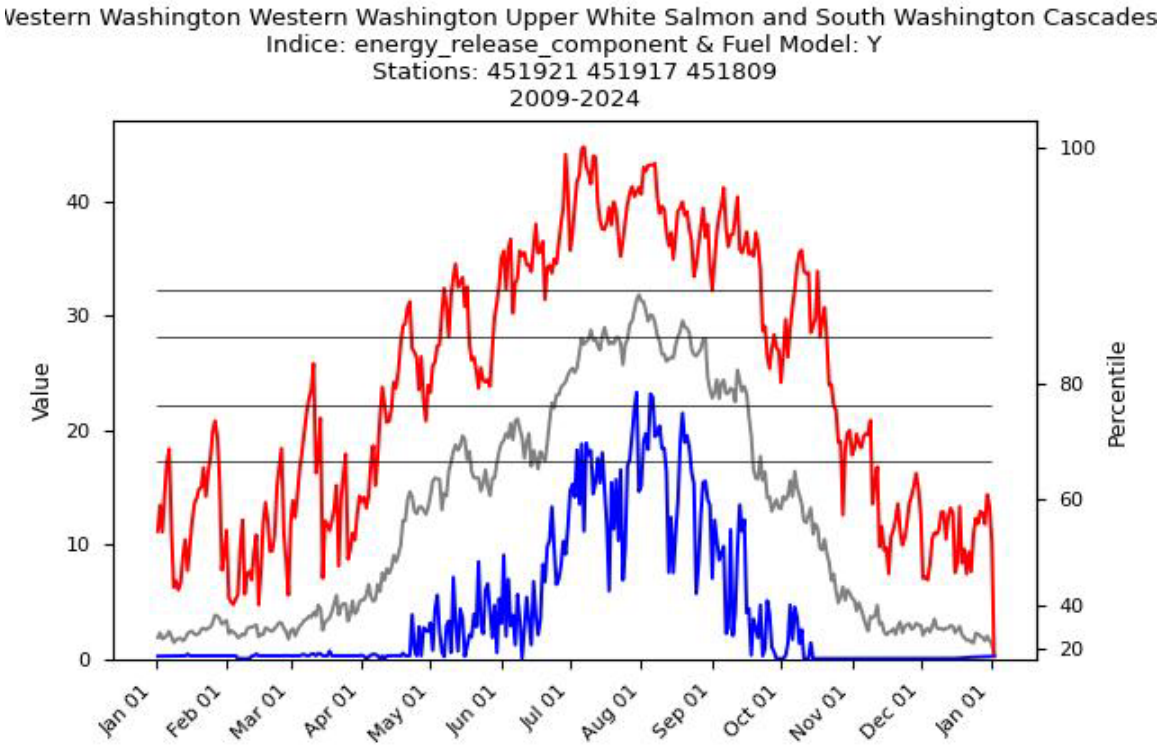


Figure 35. Upper White Salmon FDRA season trend graph with staffing level thresholds identified by horizontal lines.

Table 43. Number All Days (AD) expressed as the number of days in the analysis period and proportion of the analysis period. Number of fire days (FD) is the proportion of days with a fire. Large fire day (LFD) is the proportion of days that had a fire over 3 acres. Multiple fire days (MFD) is the proportion of days with more than 3 fires in a single day.

Class	ERC Range	All Days (AD)		Fire Days (FD)			Large Fire Days (LFD)				Multiple Fire Days (MFD)			
		# AD	%AD	#FD	%FD	%AD	#LFD	%LFD	%FD	%AD	#MFD	%MFD	%FD	%AD
1	0-17.3	3665	63	9	7	0	0	0	0	0	0	0	0	0
2	17.3 – 22.1	480	8	6	5	1	0	0	0	0	0	0	0	0
3	22.1 – 28.1	628	11	17	13	3	0	0	0	0	0	0	0	0
4	28.1 – 32.2	321	5	18	14	6	0	0	0	0	0	0	0	0
5	32.2+	746	13	79	61	11	3	100	4	0	6	100	8	1

Table 44. Staffing level and adjective rating by ERC-Z range for Upper White Salmon in both value (ABS) and percentile.

Staffing Level and Adjective Rating for Upper White Salmon FDRA					
ERC-Y	0 – 17.3	17.3 – 22.1	22.1 – 28.1	28.1 – 32.2	32.2+
ERC-Y Percentile	0 – 65.6	65.6 – 75.7	75.7 – 87.8	87.8 – 94.1	94.1+
Staffing Level	1	2	3	4	5
Adjective Rating	Low	Moderate	High	Very High	Extreme

4.5.11 Vancouver FDRA

General Location: The Vancouver FDRA covers Clark County and portions of Skamania County up the Lewis River Valley. It has the same footprint as fire weather zone 633.

Vegetation: Vegetation is primarily Maritime Mesic-Wet Douglas-fir-Western Hemlock forest with some Silver Fir-Western Hemlock in the higher elevations. Approaching the Portland/Vancouver metro area, agricultural and urban interface become most prevalent.

Climate: The Vancouver area is the warmest and driest FDRA within the Western Washington plan with the exception of the Gorge West FDRA. Annual precipitation ranges from 33 inches at the low end in the Portland Vancouver Metro area to over 100 inches of precipitation in the Cascade foothills. Annual mean temperature is 47-52 degrees.

Topography: Flat floodplain above the Columbia river covers the low elevation portions of the area with elevations from 200-500ft. Above 500 feet topography turns mountainous with very steep terrain topping out around 3200 feet at Larch Mountain

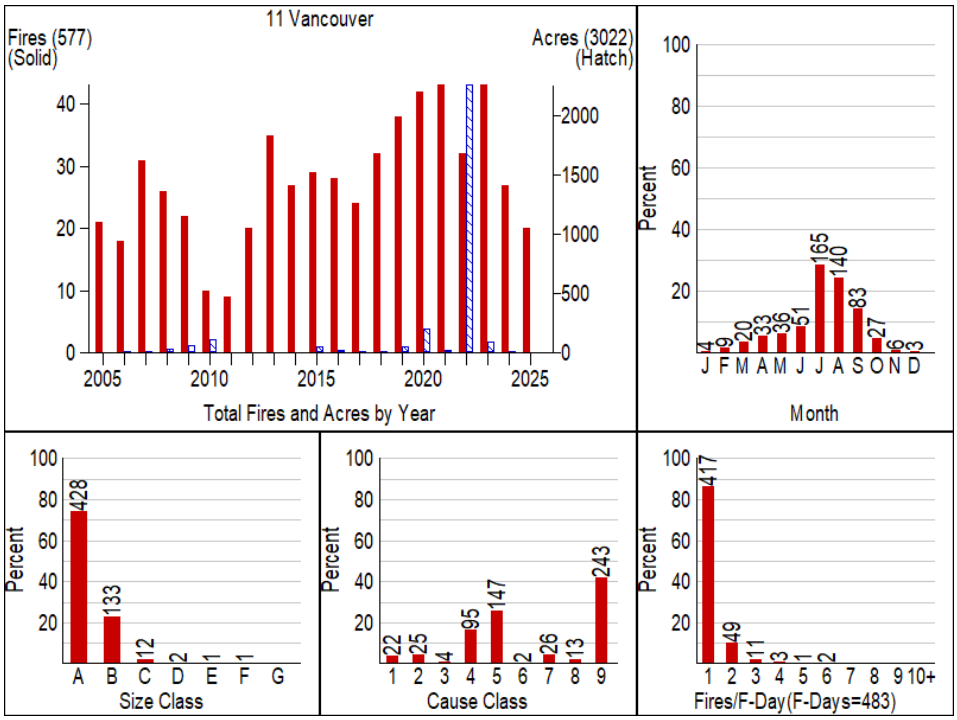


Figure 36. Fire Summary Graph for analysis years for the Vancouver FDRA.

Fire size class and cause definitions:
Size Classes: A - <= 0.25 acres, B - 0.26 to 9.9 acres, C - 10 to 99.9 acres, D - 100 to 299 acres, E - 300 to 999 acres, F - 1000 to 4999 acres, G - >= 5000 acres.

Cause Classes: 1 – Lightning, 2 - Equipment Use, 3 – Smoking, 4 – Campfire, 5 - Debris Burning, 6 – Railroad, 7 – Arson, 8 – Children, 9 - Miscellaneous

Table 45. Select Fire Summary graph data for Vancouver FDRA

Fire Cause Classes		Fires By Month Lightning vs Human			Fire Size Percentiles	
		Month	Lightning	Human	Percentile	Acres
1	Lightning	Jan	0	3	85	1.0
2	Equipment	Feb	0	9	90	1.7
3	Smoking	March	0	20	91	2.0
4	Campfire	April	0	32	92	2.3
5	Debris	May	1	34	93	2.5
6	Railroad	June	1	46	94	3.0
7	Arson	July	3	151	95	3.9
8	Children	August	12	126	96	4.9
9	Misc	Sept	3	80	97	6.0
		Oct	2	25	98	12.0
		Nov	0	6	99	34.5
		Dec	0	3	100	1918.0

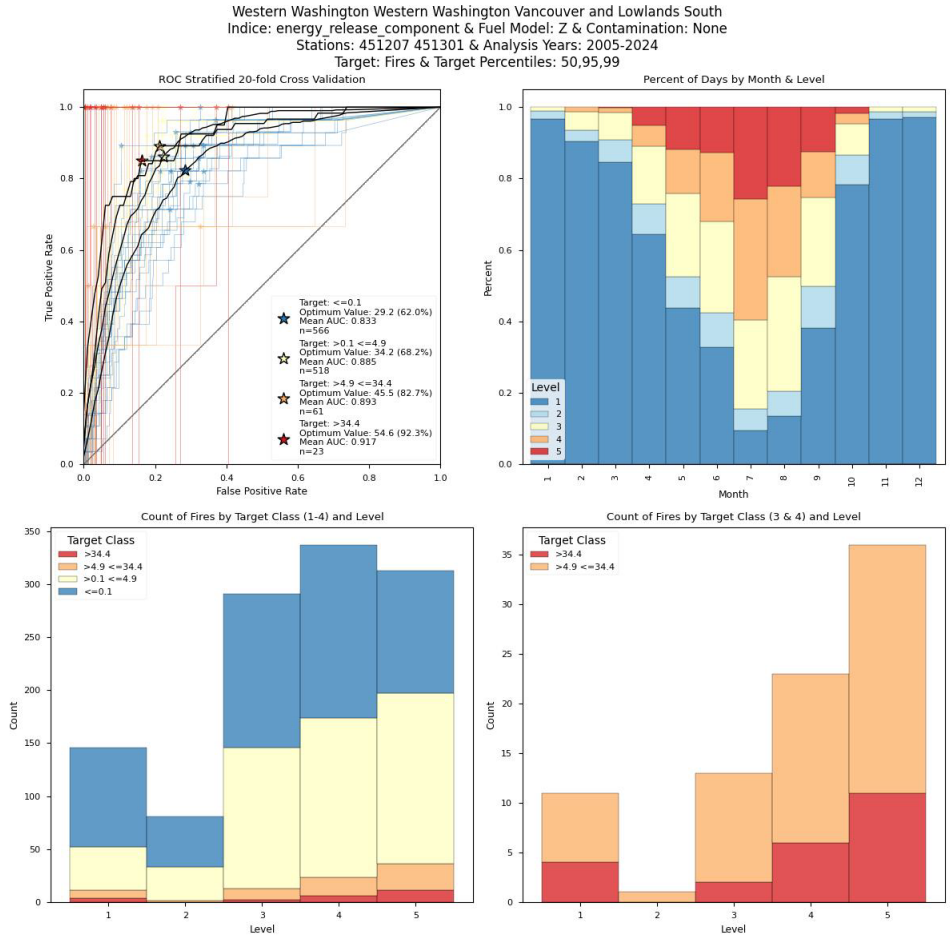


Figure 37. ROC chart with optimum values for fire danger thresholds on the upper left and graphical representation of the number of days each month that have historically fallen in each input staffing level on the upper right. Lower left shows number of fires in each class of day, by sizes. Lower right shows number of fires in each class of day as either large or small.

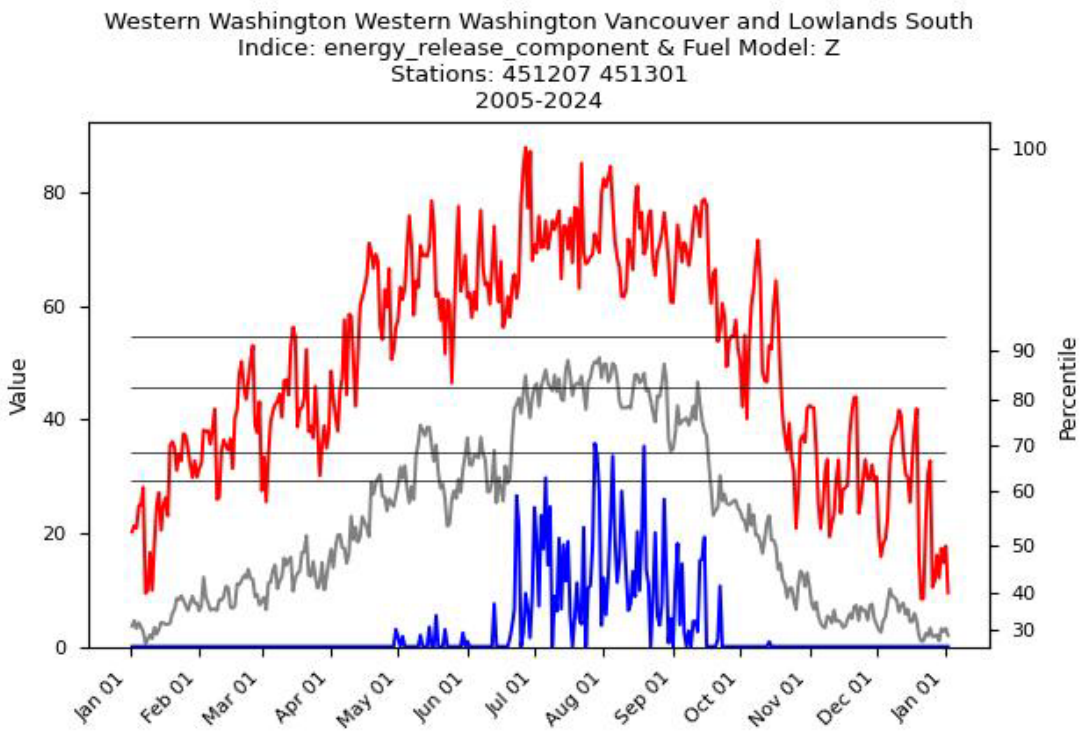


Figure 38. Vancouver FDRA season trend graph with staffing level thresholds identified by horizontal lines.

Table 46. For each ERC bin as Class. Number of weather days or All Days (AD) expressed as the number of days in the analysis period and proportion of the analysis period. Number of fire days (FD) is the proportion of fire days, and proportion of all days within the given class with a fire day. Number of large fire days (LFD) is the proportion of fire days with a large fire, and the proportion of all days within the given class with a large fire. Number of days with multiple fires (MFD) is the proportion of multiple fire days, and the proportion of all days within the given class with multiple fire days.

Class	ERC Range	All Days (AD)		Fire Days (FD)			Large Fire Days (LFD)				Multiple Fire Days (MFD)			
		# AD	%AD	#FD	%FD	%AD	#LFD	%LFD	%FD	%AD	#MFD	%MFD	%FD	%AD
1	0 – 29.2	4361	59	39	8	1	0	0	0	0	0	0	0	0
2	29.2 – 34.2	363	5	16	3	4.	0	0	0	0	0	0	0	0
3	34.2 – 45.5	786	11	70	15	9	1	14	1	0	1	6	1	0
4	45.5 – 54.6	693	9	85	18	12	0	0	0	0	2	12	2	0
5	54.6+	1117	15	254	55	23	6	86	2	1	14	82	6	1

Table 47. Staffing level response level and adjective rating by BI-Y range for Vancouver FDRA.

Staffing Level and Adjective Rating for Lowlands FDRA					
ERC - Y	0 – 29.2	29.2 – 34.2	34.2 – 45.5	45.5 – 54.6	54.6+
ERC – Y %	0 – 62.0	62.0 – 68.2	68.2 – 82.7	82.7 – 92.3	92.3+
Staffing/Response Level	1	2	3	4	5
Adjective Rating	Low	Moderate	High	Very High	Extreme

5.0 Communication of Fire Danger

5.1 Percentiles

This FDOP uses percentiles for communication of fire danger (note, this is not the same as using percentiles based on climatology to set decision points). Percentiles are preferable for communication of fire danger because they put disparate fuel model and index values on the same scale.

5.2 Fire Danger Level Calculation

Fire danger will be calculated using the weather station(s) documented in section 2.3.1, the fuel model selection in section 4.4, and the areas identified in section 2.2. The decision points in section 4.4 form the basis for the following fire danger level calculations.

5.2.1 Staffing Level

Calculation and Communication will be managed at the local level with an expectation of coordination between centers. The staffing level forms the basis for decisions regarding the degree of readiness of initial attack (IA) and support resources. Staffing Levels are expressed as numeric values where 1 represents the low end of the fire danger continuum and 5 the high end. Staffing level is intended to provide fire managers with day-to-day decision support regarding staffing of suppression resources such as employee overtime associated with working people beyond their normal schedules and extended staffing of shared resources such as air tankers, helicopters, hotshot crews and other large fire support resources.

The process for determining local staffing levels is not the same as staffing level calculated directly from WIMS. WIMS calculates staffing level on climatological breakpoints; For 2024 Individual Dispatch Centers will calculate their respective staffing levels, with an expectation of coordination with adjacent or overlapping centers. Dispatch centers will calculate staffing level based on decision points identified in their own staffing plans and unit fire staff will check correlation with this plan and use that as a communication tool between units. This graph is to be utilized as an example and a starting point for further discussion and refinement.

STAFFING INPUT VALUE	1	2		3		4		5	
RED FLAG WARNING, FIRE WEATHER WATCH, IA ACTIVITY?	↓	No	Yes	No	Yes	No	Yes	No	Yes
STAFFING OUTPUT VALUE	I	II		III		IV		V	

The primary input is the forecast or observed staffing level based on the decision points defined in this plan. The secondary input is specific to the respective dispatch area, and may include inputs such as red flag warnings, fire weather watches or warnings, public use triggers like holidays, offshore flow, thermal trough in place, predicted lightning etc. These secondary inputs may increase or decrease the staffing level from the primary input.

5.2.2 Response Level

Calculation and Communication will be managed at the local level with an expectation of coordination between centers.

STAFFING LEVEL	RESPONSE LEVEL
1	1
2	
3	
4	2
5	3

Response (or dispatch) levels are pre-planned actions which identify the number and type of resources (engines, crews, aircraft, etc.) initially dispatched to a reported wildland fire based upon fire danger criteria. Dispatch levels are established to assist fire managers with decisions regarding the most appropriate response to an initial fire report until a qualified Incident Commander arrives at the incident. Response level in this plan is a direct function of staffing level.

5.2.3 Preparedness Level

Calculation and Communication will be managed at the local level with an expectation of coordination between centers. The preparedness level is a five-tier (1-5) fire danger rating decision tool that is based on NFDRS output(s) (energy release component, Y) and other mid- to long-term indicators of fire business such as fine fuel loading or drought. Preparedness levels are established to assist fire managers with weekly or monthly planning decisions.

The preparedness level worksheet below is presented as an example. Units should document specific preparedness level procedures, including calculation frequency, in unit preparedness plans.

Variable	Response	Adjustment
Staffing Level	Staffing Level 1-5	1-5
IA Commitment	Yes	Add .25
	No	Subtract .25
Extended Attack	Yes	Add .25
	No	Subtract .25
7 day Fire Potential PSAs-NW01, NW02	Mod or High Risk	Add .25
	Low or No Risk	Subtract .25
GACC PL	Increasing	Add .25
	Holding Steady	No Change
	Decreasing	Subtract .25

The preparedness input value should be an average, or weighted average, of the forecast preparedness level and trend pertinent to the unit. For example, Northwest DNR may

choose to use the average of the Cascades and Lowland fire danger rating area current/forecast trend value as the input since these cover most of their response area of concern.

5.2.4 Adjective Level

Informed by Staffing level value calculated, published, and broadcast twice daily by the communications centers. Actual value is set weekly during fire season based on discussion with agency or unit representatives.

In 1974, the USFS, BLM and state forestry organizations established five standard adjective fire danger rating levels descriptions for public information and signing. For this purpose, only, fire danger is expressed using the national adjective descriptions and color codes.

Although NFDRS processors (e.g., WIMS) automatically calculate the adjective rating based on climatology, units participating in this plan will use FDRA preparedness level (ERC-Y) thresholds/breakpoints defined in this plan as the basis for discussions with cooperators for setting FDRA adjective rating level.

5.2.5 Public Use Restrictions

Set by the unit, ideally informed by adjective rating or unit calculated preparedness value. Public use restrictions are implemented and set by the individual agencies participating in this plan. Currently there is not a coordinated interagency set of restrictions/levels (or actions) used by participants in this plan.

Ideally units will set public use restrictions based on, or informed by, adjective rating (less risk tolerant) or unit calculated preparedness level (more risk tolerant). Number of levels, actions, and basis for decision making will be defined in unit prevention plans or public use restrictions plans.

5.2.6 Industrial Fire Precaution Level

DNR, U.S. Forest Service, Bureau of Land management and Bureau of Indian Affairs all use the same four-level industrial regulation system. This system, which helps prevent wildfires by regulating work in the woods, is known as the Industrial Fire Precaution Level (IFPL) system. More information on IFPL in Washington can be found on the Washington Department of Natural Resources page here.

Like other indices that use NFDRS, the calculated values value of IFPL is used to inform decision making by the agencies responsible for managing each of the IFPL zones. It is expected that participants in this plan will coordinate IFPL restrictions. IFPL ratings are all based on the NFDRS fuel model Y using both the Energy Release Component (ERC) and Ignition Component (IC). To calculate the suggested IFPL for any western Washington RAWS station, the following equation must be used: (ERC-Y)*(IC-Y)*0.1. The resulting raw value is then binned to determine the suggested IFPL. Forecast and observed values should be taken at 1300, to maintain consistency with previous methods for determining IFPL.

IFPL 1 <= 8
IFPL 2 >8, <= 22.8
IFPL 3 >22.8, <= 54.9
IFPL 4 > 54.9

Appendices

A.1.0 FDRA Delineation Maps

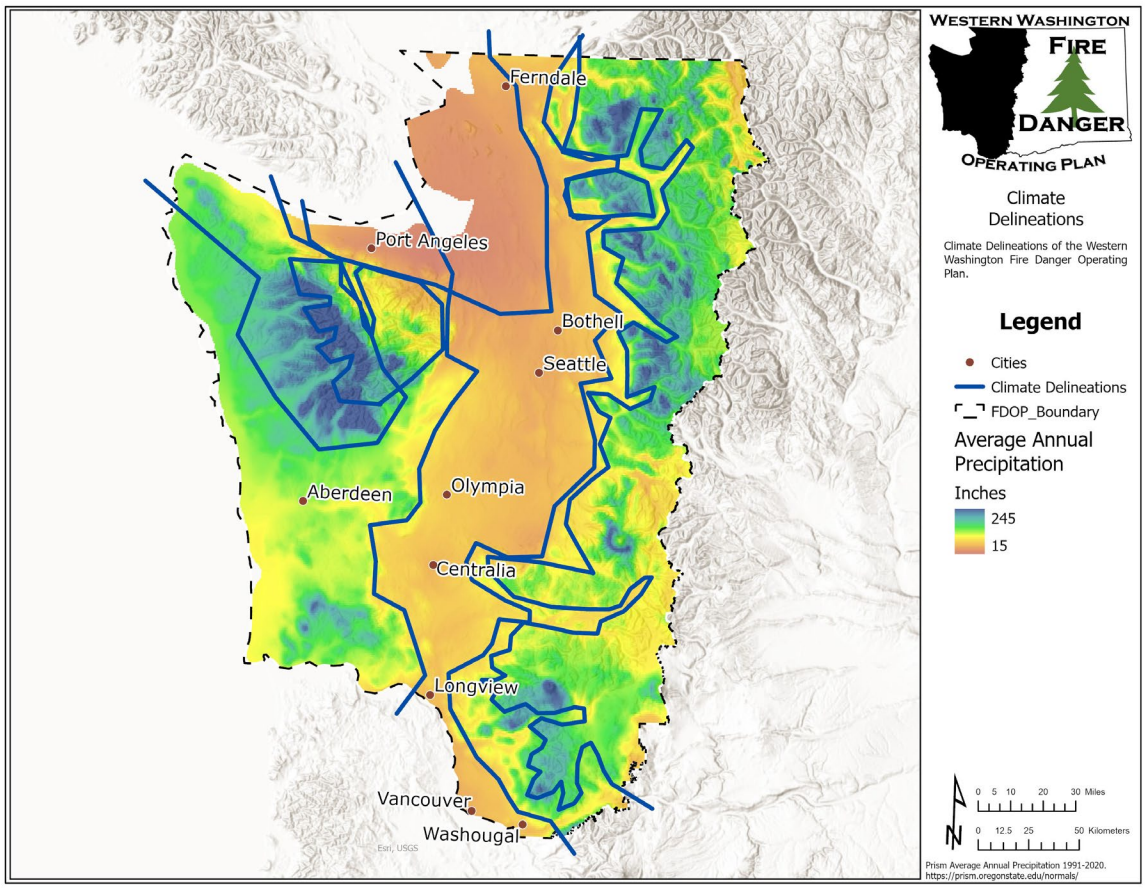


Figure 39. Climate delineations showing average annual precipitation in the Western Washington Fire Danger Operating Plan area.

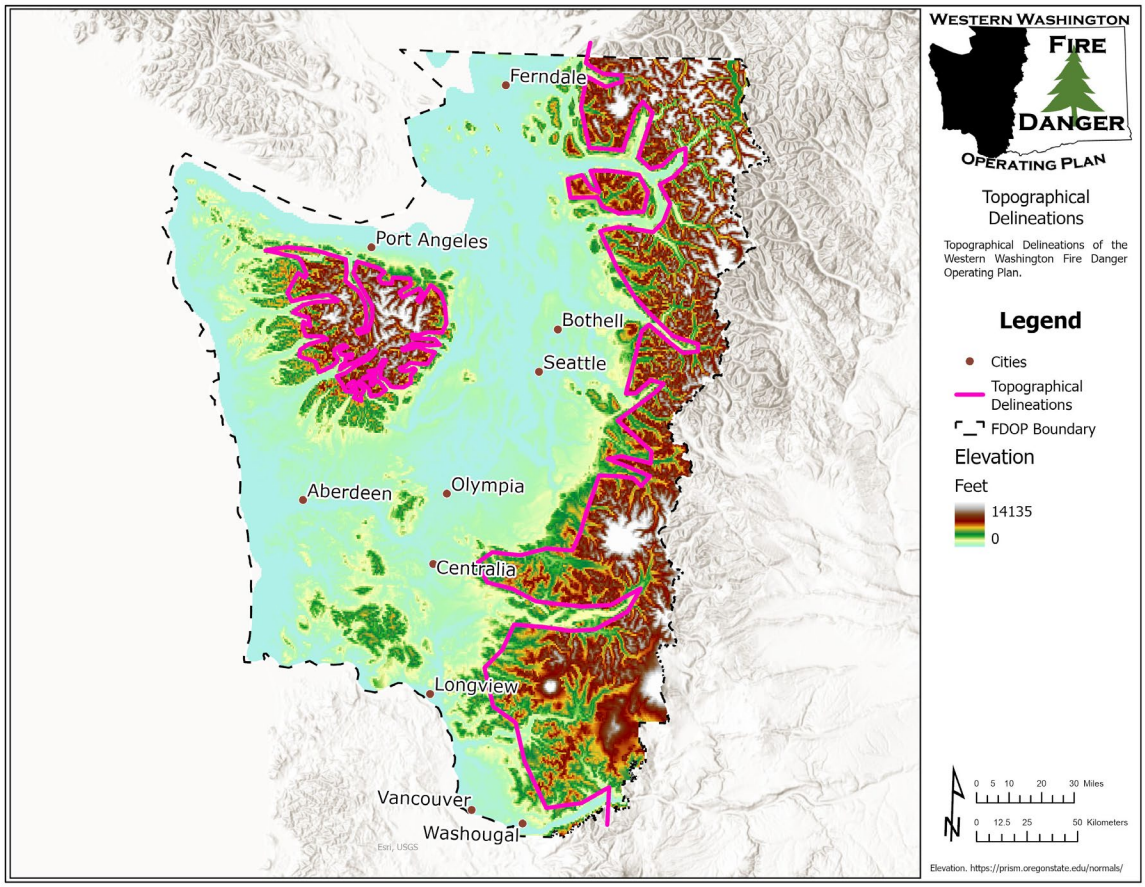


Figure 40. Topographic delineations showing elevations in the Western Washington Fire Danger Operating Plan area.

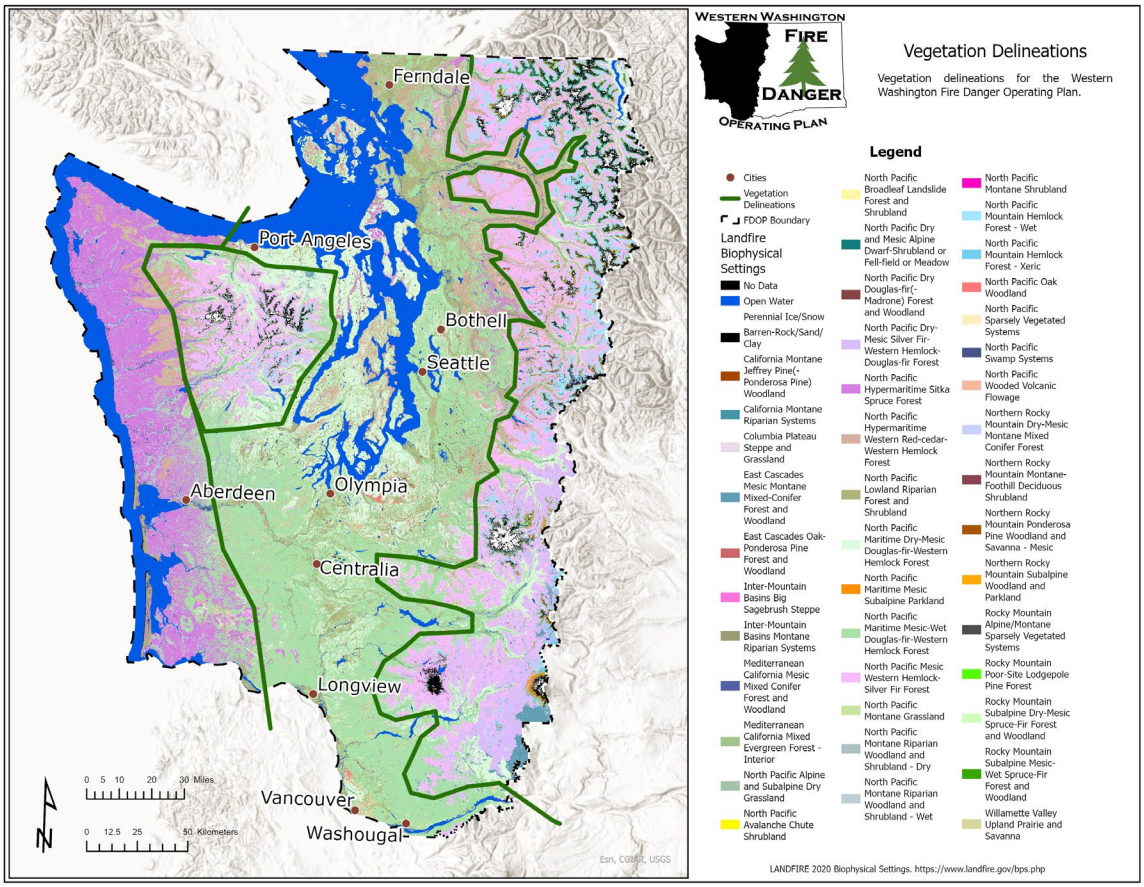


Figure 41. Vegetation delineations showing vegetation types in the Western Washington Fire Danger Operating Plan area.

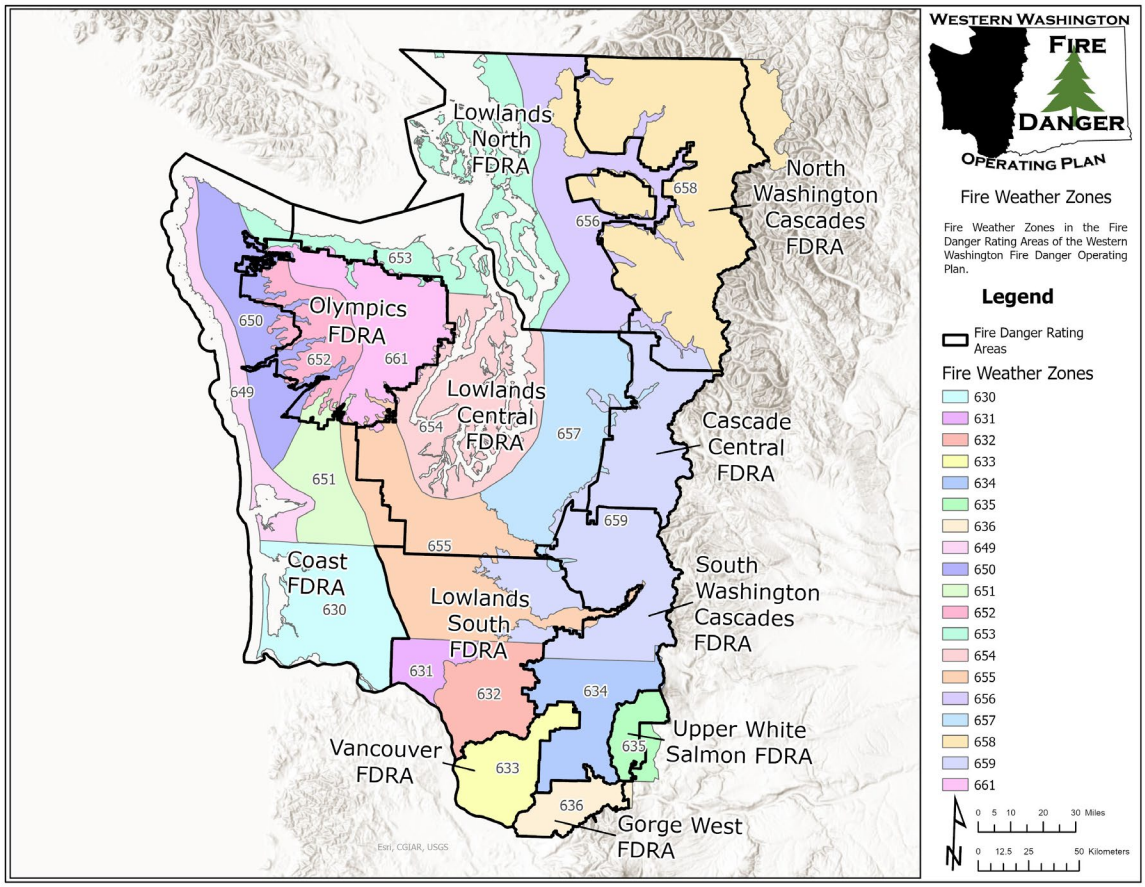


Figure 42. Fire weather zones within the Western Washington Fire Danger Operating Plan area.

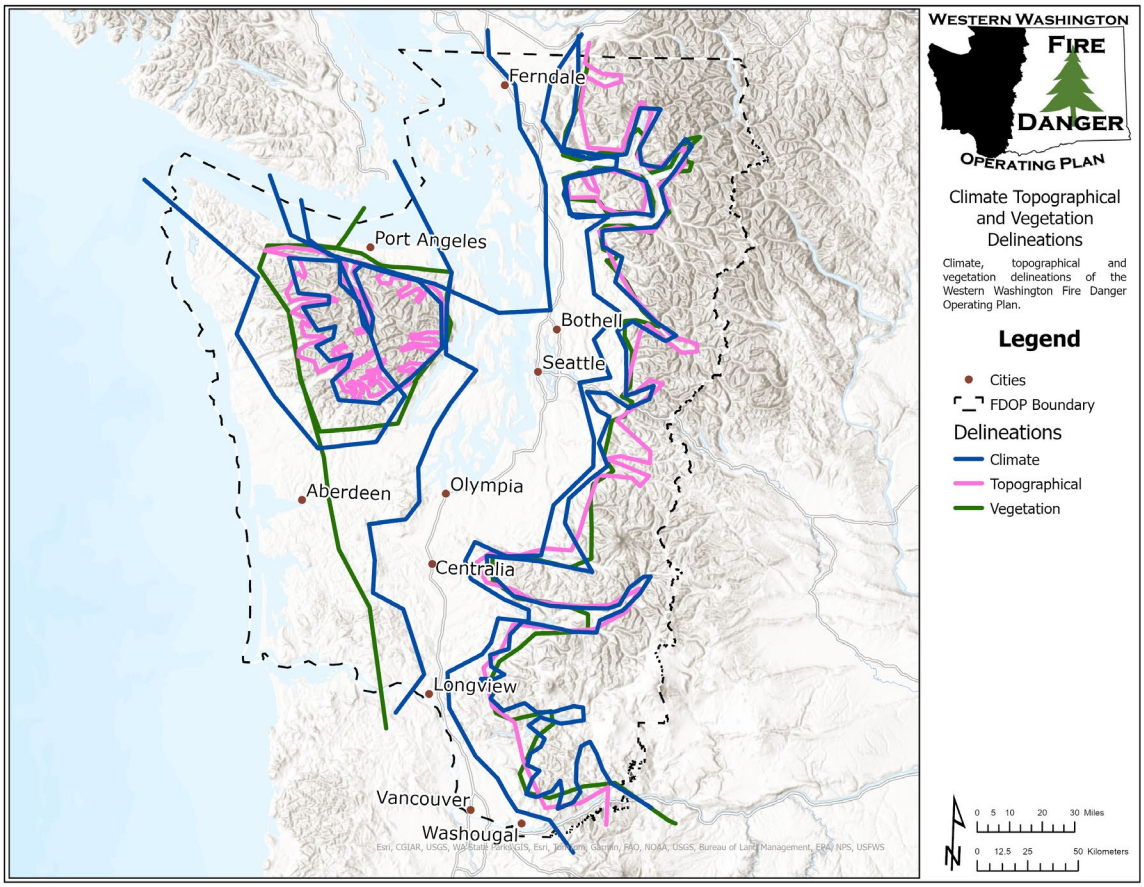
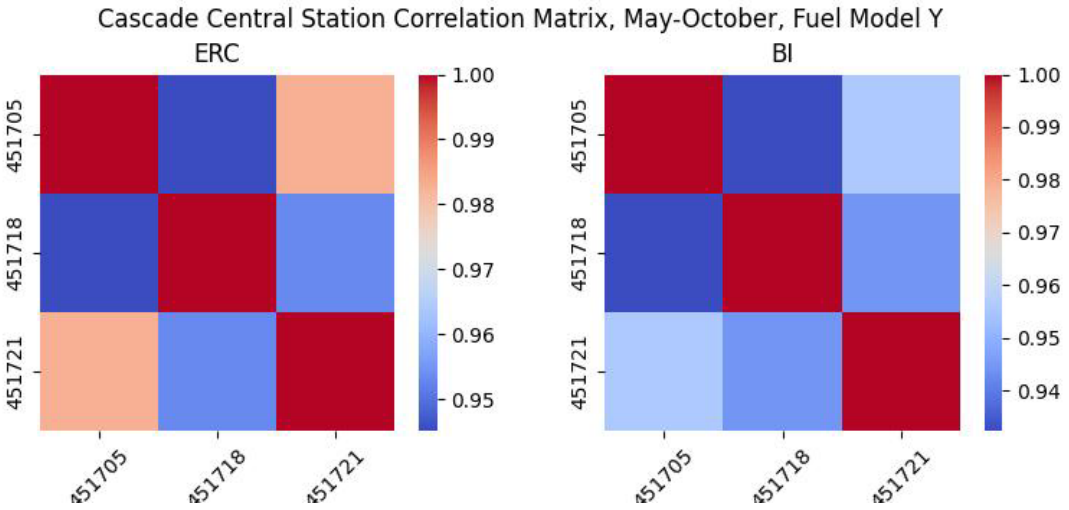
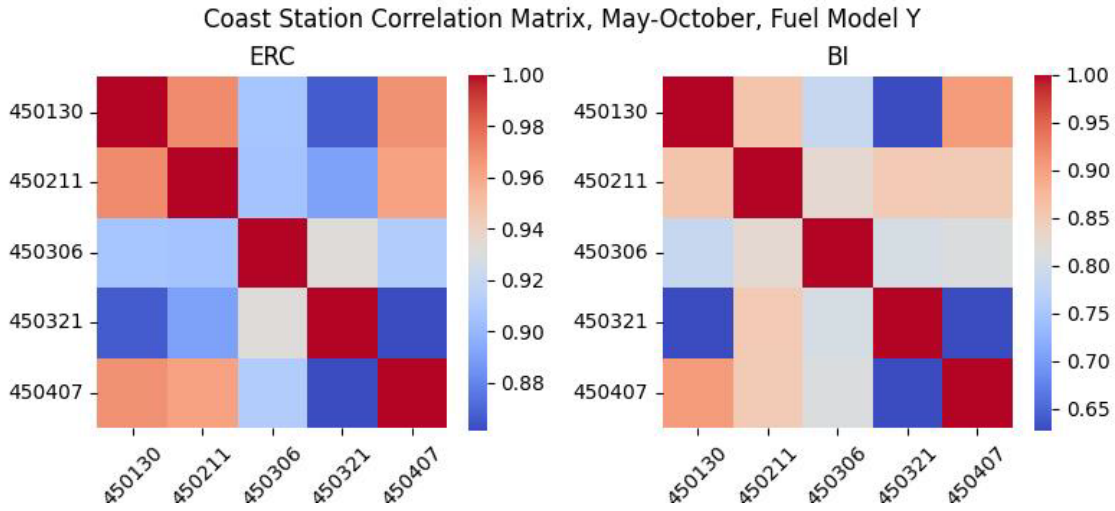


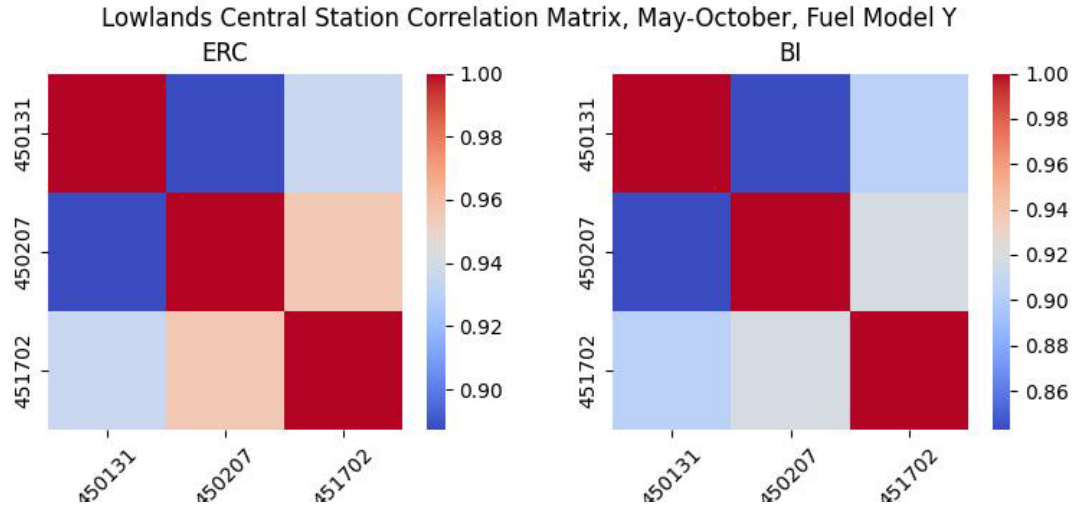
Figure 43. Climate, topography, and vegetation type combined delineations.

A.2.0 Weather Stations Correlation Matrix

Station correlation matrix to aid in SIG selection when fire business is not considered.




Coast Station Correlation Matrix, May-October, Fuel Model Y
ERC
BI
450130
450211
450306
450321
450407
1.00
0.98
0.96
0.94
0.92
0.90
0.88
0.95
0.85
0.80
0.75
0.70
0.65


Lowlands Central Station Correlation Matrix, May-October, Fuel Model Y
ERC
BI
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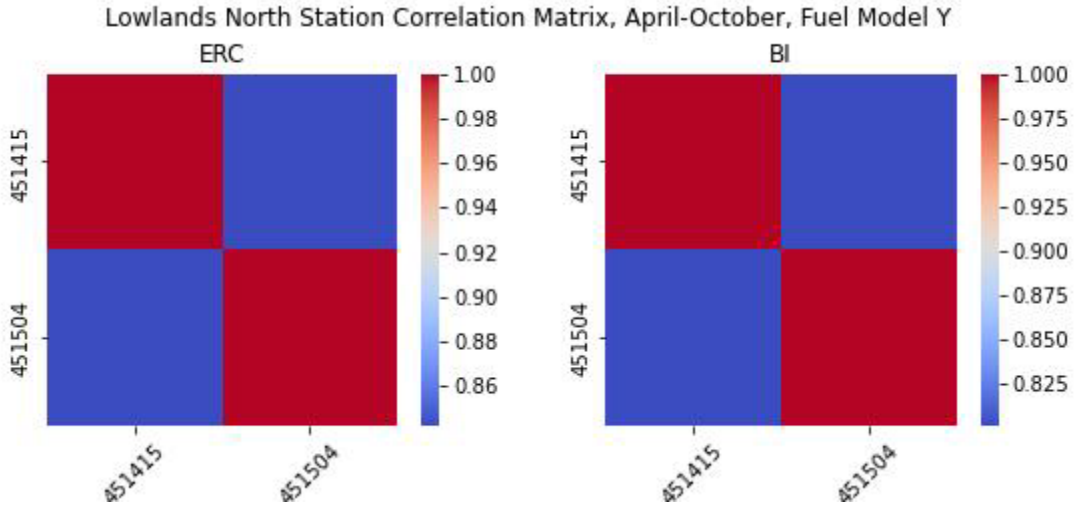
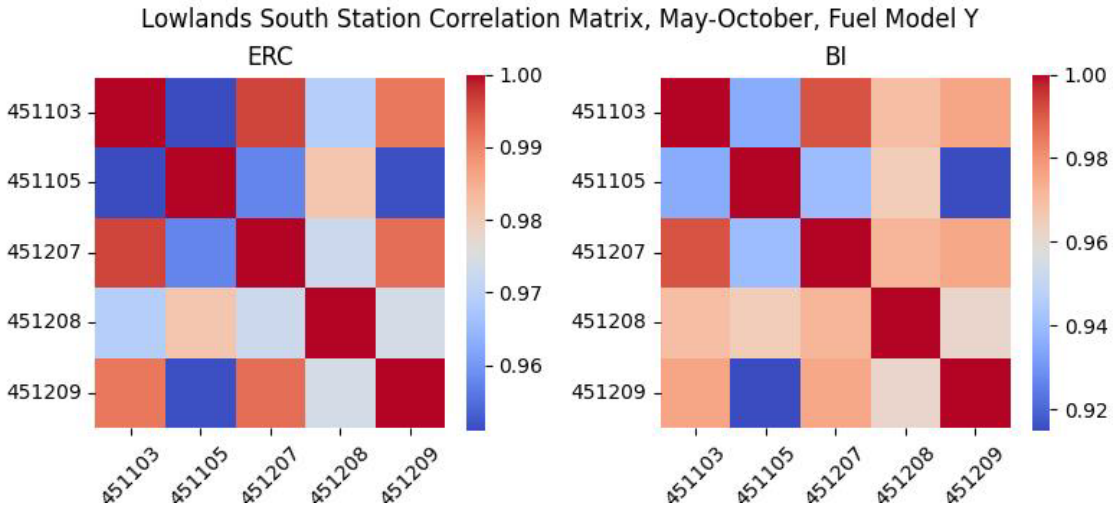
450207
451702
1.00
0.98
0.96
0.94
0.92
0.90
0.88
0.86


Lowlands North Station Correlation Matrix, April-October, Fuel Model Y
ERC
BI
451415
451504
1.00
0.98
0.96
0.94
0.92
0.90
0.88
0.86
1.000
0.975
0.950
0.925
0.900
0.875
0.850
0.825


Lowlands South Station Correlation Matrix, May-October, Fuel Model Y
ERC
BI
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451208
451209
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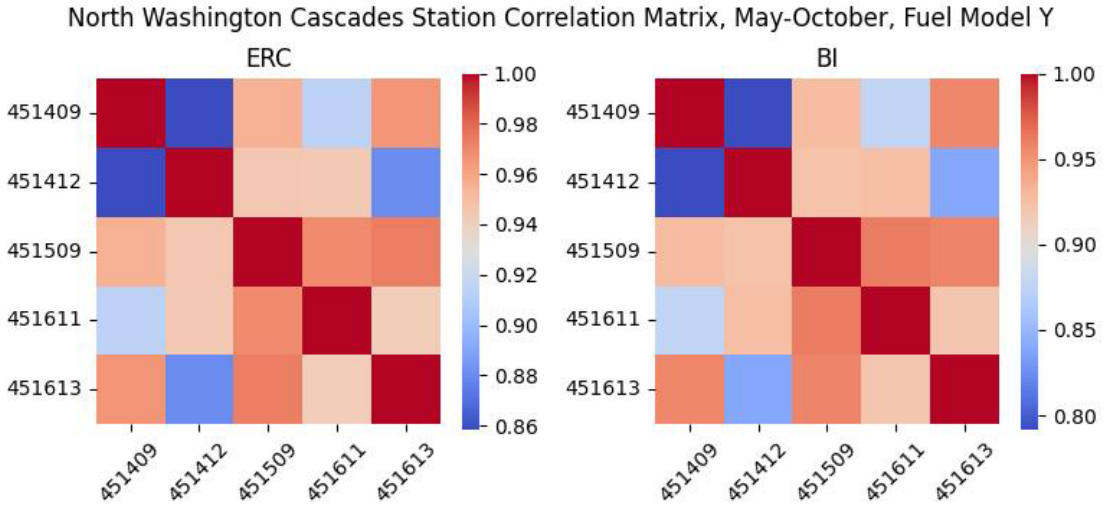
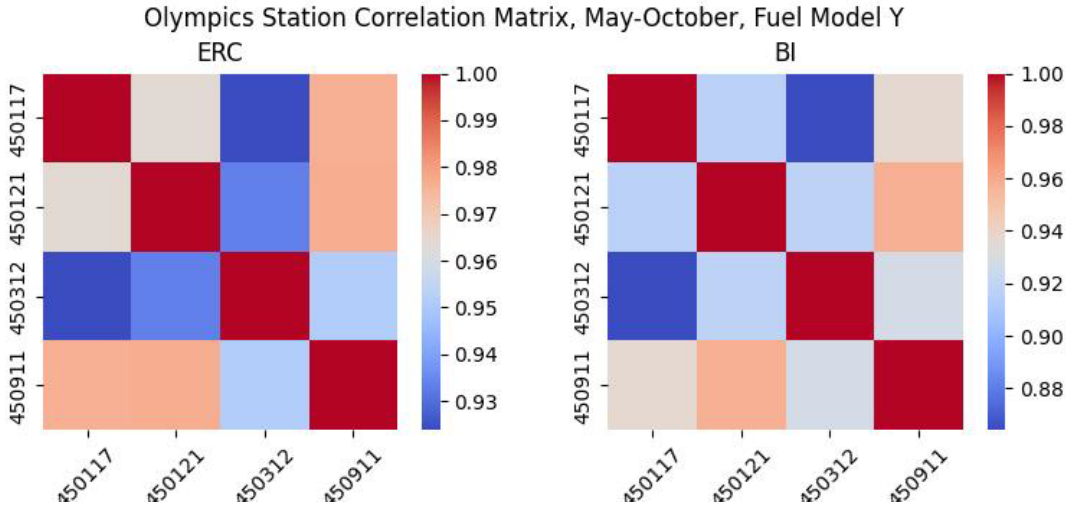
0.98
0.97
0.96
0.94
0.92


North Washington Cascades Station Correlation Matrix, May-October, Fuel Model Y
ERC
BI
451409
451412
451509
451611
451613
1.00
0.98
0.96
0.94
0.92
0.90
0.88
0.86
0.95
0.85
0.80


Olympics Station Correlation Matrix, May-October, Fuel Model Y
ERC
BI
450117
450121
450312
450911
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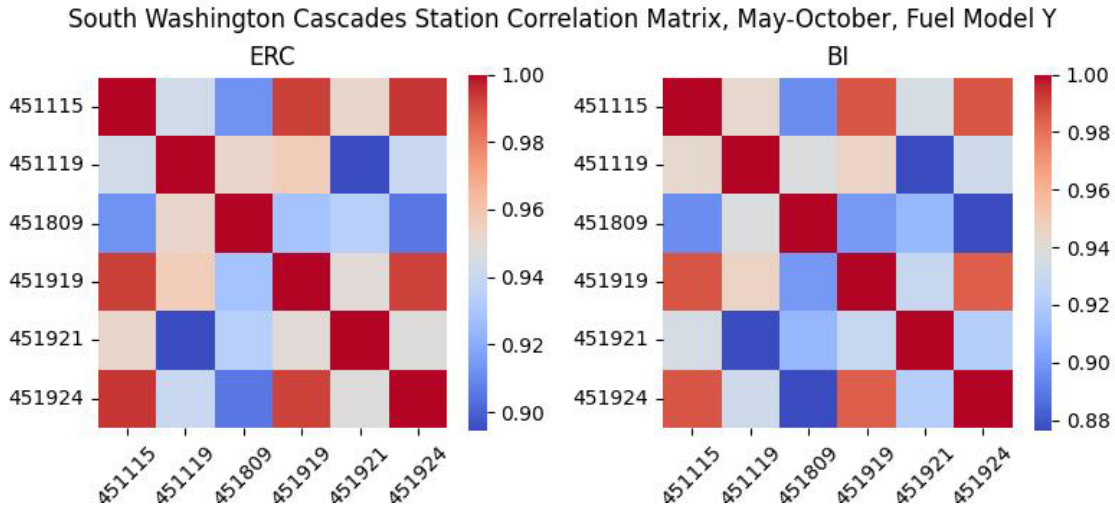
0.98
0.97
0.96
0.95
0.94
0.93
0.92
0.90
0.88



A.3.0 Fire Business Thresholds

A.3.1 Fire Size Percentiles

FDRA fire occurrence size percentiles (final size, acres).

FDRA	50	90	97
Cascade Central	0.1	0.5	3.0
Coast	0.1	3.0	16.0
Gorge West	0.1	1.0	6.8
Lowlands Central	0.1	2.0	10.2
Lowlands North	0.1	1.5	6.7
Lowlands South	0.1	2.0	11.0
Cascade North	0.1	5.0	304.0
Olympics	0.1	2.0	299.0
Cascade South	0.1	1.5	20.0
Upper White Salmon	0.1	0.3	8.0
Vancouver	0.1	1.7	6.0

A.4.0 Seasonal Risk Analysis Fire Occurrence Start and End Dates

FDRA fire discovery start and end dates by percentile fire size.

FDRA	Size	Percentile	Min	Max
Cascade Central	0.5	90	May 08	September 22
Cascade Central	4.7	97	May 31	September 09
Cascade Central	59.1	99	July 24	September 09
Coast	3.2	90	February 22	November 27
Coast	20.0	97	March 19	November 27
Coast	85.0	99	March 19	November 27
Gorge West	1.0	90	February 07	October 06
Gorge West	6.3	97	May 04	October 06
Gorge West	120.3	99	September 02	October 06
Lowlands Central	2.0	90	March 20	December 06
Lowlands Central	10.2	97	March 20	December 06
Lowlands Central	35.1	99	March 20	November 16
Lowlands North	1.8	90	January 06	October 10
Lowlands North	7.0	97	March 18	October 07
Lowlands North	21.0	99	March 31	October 07
Lowlands South	2.0	90	January 28	December 05

Lowlands South	10.9	97	March 12	December 05
Lowlands South	64.4	99	March 19	December 05
Cascade North	5.5	90	April 16	October 15
Cascade North	408.0	97	July 30	August 17
Cascade North	2243.5	99	August 10	August 17
Olympics	5.4	90	June 15	October 29
Olympics	384.6	97	June 15	September 01
Olympics	2587.2	99	June 15	August 04
Cascade South	2.0	90	January 24	October 27
Cascade South	33.5	97	January 24	September 20
Cascade South	454.5	99	July 28	September 20
Upper White Salmon	0.2	90	May 03	September 29
Upper White Salmon	4.0	97	August 19	September 10
Upper White Salmon	362.1	99	September 03	September 10
Vancouver	1.7	90	March 20	October 30
Vancouver	9.7	97	June 11	October 30
Vancouver	51.0	99	August 14	October 11

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