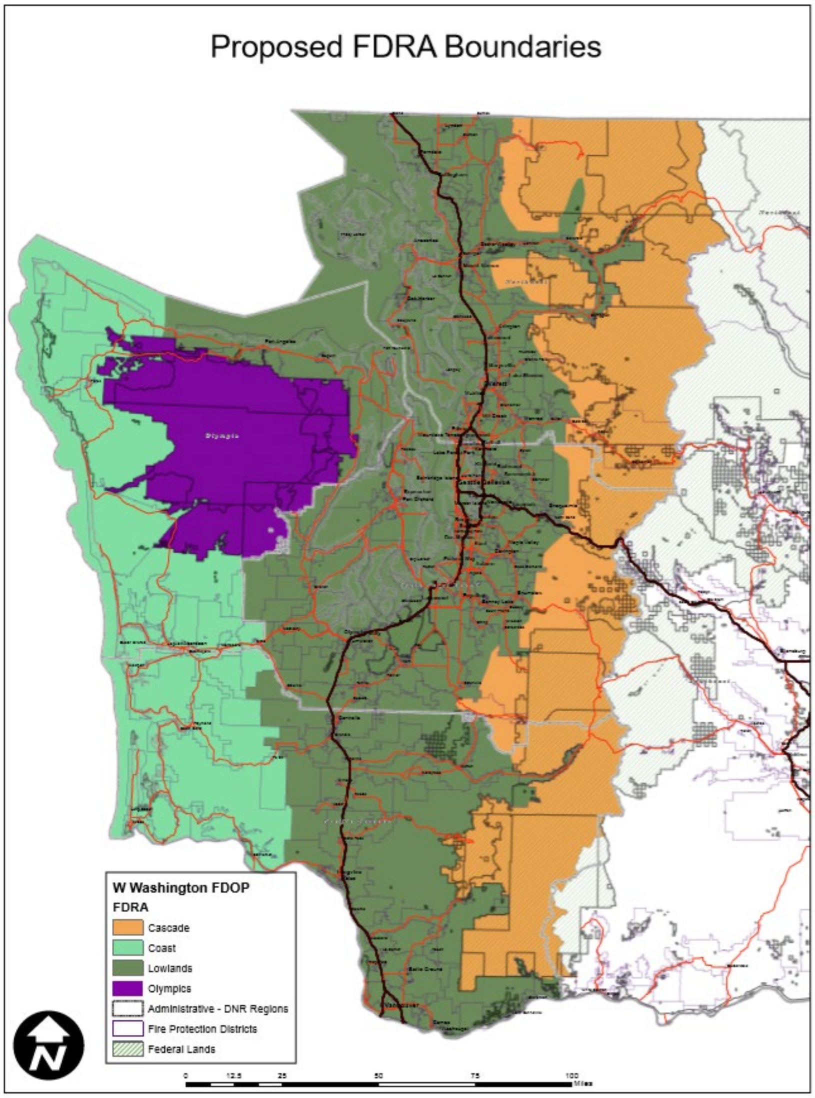
Western Washington

Interagency Fire Danger Operating Plan

FINAL DRAFT 2020



Version: 04/29/2020

This plan is compatible with NFDRS 2016 and to be used for comparison purposes only in 2020.

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Western Washington

Interagency Fire Danger Operating Plan

Approved by:

Signatories to this plan include the following agencies.

Washington State Department of Natural Resources, Northwest Region
Washington State Department of Natural Resources, South Puget Region
Washington State Department of Natural Resources, Pacific Cascades Region
Washington State Department of Natural Resources, Olympic Region
National Park Service, Olympic National Park
National Park Service, North Cascades National Park
National Park Service, Mount Rainer National Park
National Park Service, San Juan Island National Historical Park
US Forest Service, Olympic National Forest
US Forest Service, Mount Baker-Snoqualmie National Forest
US Forest Service, Gifford Pinchot National Forest
US Fish and Wildlife Service, Western Washington Zone
Bureau of Land Management, Spokane District
Bureau of Indian Affairs, Northwest Region

For simplicity's sake, each agency will be responsible for maintaining a signed hardcopy on file.

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Contents

Executive Summary

The intent of this 2020 Western Washington Fire Danger Operating Plan (WWFDOP) is to allow agency administrators, dispatch centers, and fire managers in Western Washington the opportunity to "test" the 2016 NFDRS models side by side with the original NFDRS system that has been used in the past. This will allow a gradual transition to NFDRS 2016 which is mandated in January 2021 and provide time to calibrate and adjust to the new models. **For 2020, this plan is not to be fully adopted,** but rather will be used in conjunction with the plans/system that are currently in place. A fully revised and updated WWFDOP will be required in 2021.

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 document a decision-making process for agency administrators, fire management personnel, communication center personnel, and agency co-operators by establishing interagency planning and response levels based upon an assessment of vegetation, climate, and topography utilizing the national fire danger rating system (NFDRS).

This plan provides science-based rationale to support decisions which have the potential to significantly compromise safety and control of wildland fires. This is achieved using the best available scientific methods and an analysis of historical weather and fire data.

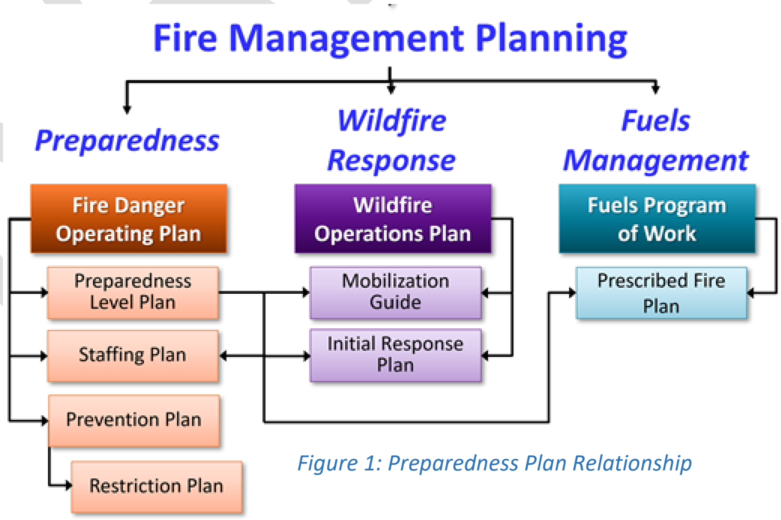


Figure 1: Preparedness Plan Relationship

1.1.1 Preparedness Plan

Interagency policy and guidance require numerous unit plans and guides in order to meet preparedness objectives. Some of these plans and guides are inter-related or provide the basis for other plans/guides, as shown in Figure 1.

This FDOP guides the application of information from decision support tools (such as NFDRS) at the local level. This FDOP is supplemental to any Fire Management Plan that may exist within the individual units; it documents the establishment and management of a fire weather station network and describes how fire danger ratings will be applied to local unit fire management decisions. The actual implementation of the fire business thresholds is described in the following supplemental action plans. The decision points are identified and documented in the Fire Danger Operating Plan.

1.1.1.1 Preparedness Plan

Preparedness plans provide management direction given identified levels of burning conditions, fire activity, and resource commitment. Preparedness levels (1 to 5) are determined by incremental measures of fire danger, fire activity, and resource commitment. The preparedness levels are identified and documented in this FDOP; the associated decisions and planned actions are located with the individual agency-unit.

1.1.1.2 Staffing Plan

The staffing plan describes daily resource availability/capability to respond to unplanned ignitions. Mitigating actions are designed to enhance the unit's fire management capability during short periods or other pre-identified events, where normal staffing cannot meet initial attack, prevention, or detection needs. The decision points are identified and documented in this FDOP; the associated decisions and planned actions are located with the individual agency-unit.

1.1.1.3 Prevention Plan – Fire Danger Components

Prevention plans document the wildland fire problems identified by a prevention analysis. This analysis will not only examine human-caused fires, but also the risks, hazards, and values for the planning unit. Components of the plan include mitigation (actions initiated to reduce impacts of wildland fire to communities), prevention (of unwanted human-caused fires), education (facilitating and promoting awareness and understanding of wildland fire), enforcement (actions necessary to establish and carry out regulations, restrictions, and closures), and administration of the prevention program. The analysis of fire problems and associated target groups are documented in this Fire Danger Operating Plan; the associated decisions and planned actions are in located with the individual agency and/or units.

1.1.1.4 Public Fire Restriction Plan

A restriction plan is a document that outlines agency coordination efforts regarding fire restrictions and closures. An interagency approach for initiating restrictions or closures helps provide consistency among the land management partners, while defining the restriction boundaries so they are easily distinguishable to the public. Based on the fire danger, managers may impose fire restrictions or emergency closures to public lands. Decision points when restrictions and/or closures should be considered are identified and documented in this FDOP; the associated decisions and planned actions are located with the individual agency-unit.

1.1.2 Wildfire Response

1.1.2.1 Initial Response Plan

Initial response plans, also referred to as run cards or pre-planned response plans, specify the fire management response (e.g. number and type of suppression assets to dispatch) within a defined geographic area to an unplanned ignition based on fire weather, fuel conditions, fire management objectives, and resource availability. Response levels are identified and documented in the Fire Danger Operating Plan. The number and type of suppression resources dispatched to a reported fire is developed by local agency units and located within the individual dispatch centers.

1.1.2.2 Local Mobilization Plan

The mobilization plan identifies standard procedures, which guide the operations of multi-agency logistical support activity throughout the coordination system. The mobilization plan is intended to facilitate interagency dispatch coordination, ensuring the timeliest and most cost-effective incident support services available are provided. Communication between units, GACCs, state, regional offices and other cooperative agencies are addressed. The mobilization plan is updated annually and distributed to fire managers and posted on the local dispatch office website and/or distribution list.

1.2 Policy and Guidance

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). Agency specific direction can be found in:

U.S. Forest Service – Manual 5120 - Fire Management - Preparedness
Bureau of Land Management – Manual 9211 - 1 - Fire Planning Handbook
National Park Service - National Park Service – Manual 18, Chapter 5 – Preparedness
Fish and Wildlife Service – Fire Management Handbook, Chapter 10 - Preparedness
Bureau of Indian Affairs – Wildland Fire and Aviation Program Management Operations Guide

1.3 Operating Plan Objectives

1. Provide a tool for agency administrators, fire managers, dispatchers, agency co-operators, and firefighters to correlate fire danger ratings with appropriate fire business decisions in fire danger planning area.
2. Delineate fire danger rating areas (FDRAs) with similar climate, vegetation, and topography.
3. Establish an interagency fire weather-monitoring network consisting of remote automated weather stations (RAWS) which comply with NFDRS weather station standards (PMS 426-3).
4. Define climatological breakpoints and fire business decision thresholds using the Weather Information Management System (WIMS), National Fire Danger Rating System

(NFDRS), and Fire Family Plus software to analyse and summarize an integrated database of historical fire weather and fire occurrence data. Identify seasonal risk analysis criteria and establish general fire severity thresholds.

5. Define roles and responsibilities to make fire preparedness decisions, manage weather information, and brief fire suppression personnel regarding current and potential fire danger.
6. Improve communication methods for fire managers to communicate potential fire danger to cooperating agencies, industry, and the public.
7. Provide guidance to interagency personnel outlining specific daily actions and considerations at each preparedness level.
8. Identify the development and distribution of fire danger pocket cards to all personnel involved with fire suppression within the fire danger planning area.
9. Provide a framework that units may use to evaluate their implementation of the plan and identify program needs.

2.0 Fire Danger Planning Area Inventory and Analysis

2.1 Administrative Units

This document supports the consistent and effective application of fire danger decisions applied across multiple jurisdictional boundaries within Western Washington. Wildland fire management and suppression responsibilities are shared among Federal, State, and local co-operators.

Figure 2: Overview Map

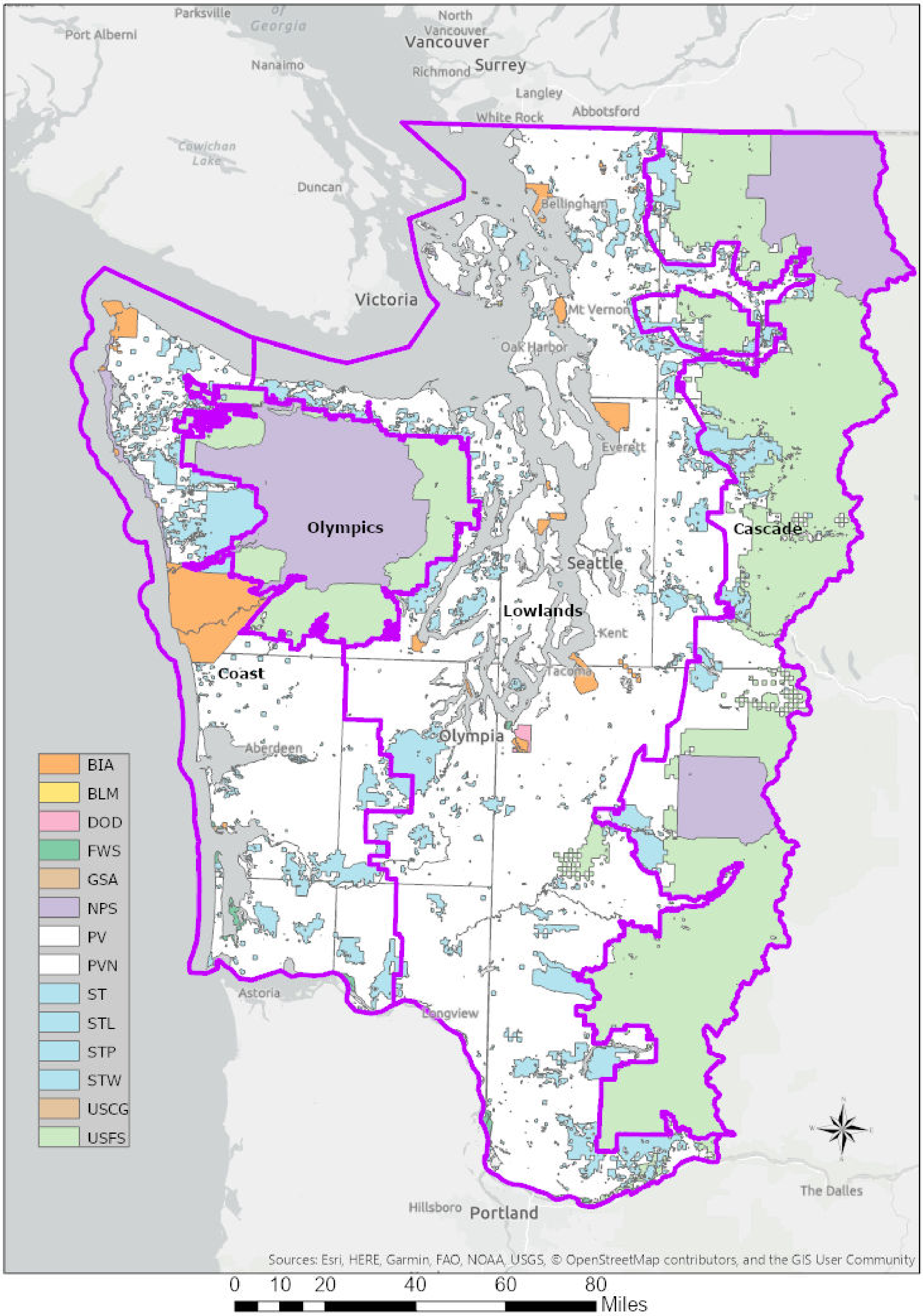


Table 1: Ownership Table

Agency	Approx. Acreage
WA-DNR	**1,528,958**
USFS	**3,606,335**
BLM	**3,045**
NPS	**1,677,676**
FWS	**24,048**
BIA	**322,386**
OTHER STATE LANDS	**107,146**
PRIVATE	**8,280,541**
DOD	**8,308**

2.2 Weather Stations

All RAWS used in this plan to produce NFDR outputs comply with the National Wildfire Coordinating Group (NWCG) weather station standards and guidelines (PMS 426-3). Each RAWS receives, at a minimum, one annual on-site maintenance visit by either the local user or contracted personnel to ensure sensors are within calibration standards and to verify site and station conditions.

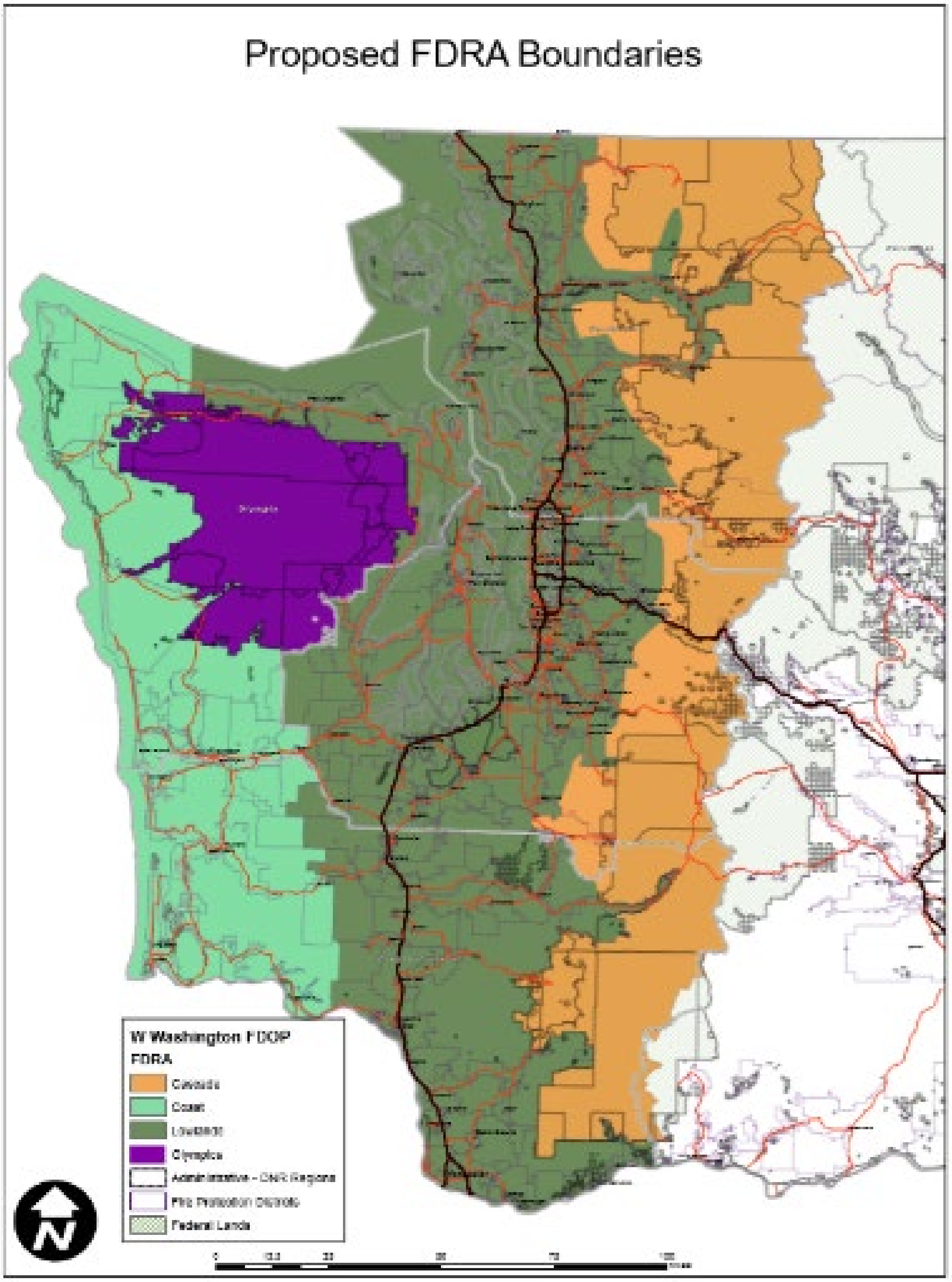
2.3 Fire Danger Rating Areas

A fire danger rating area (FDRA) is defined as a large geographic area relatively homogenous with respect to climate, vegetation and topography. Because of these similarities, it can be assumed that the fire danger within a FDRA is relatively uniform. FDRA were delineated based upon an analysis of these three factors; climate, vegetation, and topography. Delineations are depicted in Appendix C with specific analysis of each area in Appendix B.

After these environmental factors were considered, the draft FDRAs were edge-matched to existing administrative boundaries. Primarily local fire district boundaries where available and a combination of major roads/river/ridges and administrative boundaries (mostly legal lines) elsewhere.

Communications center response area boundaries, although typically aggregated to form FDRAs, were not used. Some response areas such as local fire district boundaries were not split by FDRAs to avoid additional workload and confusion for operational personnel. The final FDRA delineation is depicted below and described below in section 2.3.1.

Figure 3: Proposed FDRA boundaries



2.3.1 FDRA Descriptions

The following descriptions describe the general areas within each FDRA. More detailed information can be obtained at the Western Region Climate Center state climate narratives, https://wrcc.dri.edu/Climate/narrative_wa.php.

2.3.1.1 *Olympics FDRA*

General Location: This area includes the Olympic Mountains on the Olympic Peninsula.

Vegetation: Primarily Timber with understory.

Climate: Annual precipitation ranges from 70 to 100 inches over the lower western slopes of the Olympics to 150 inches or more along the windward slopes of the mountains. A significant rain shadow causes a dramatic decrease in precipitation on the east side of the Olympics with as little as 15-18 inches rain in some areas.

Topography: Terrain is extremely steep and rugged in the Olympics. Elevation varies from approximately 1,000 feet in the lower river valleys to 7500' in the higher peaks of the Olympics.

2.3.1.2 Lowlands FDRA

General Location: The Puget Sound Lowlands extending from the Columbia River to the Canadian border. The I-5 corridor bisects the FDRA with 30-40 miles extending on either side. It includes the San Juan Islands and the lower elevation of the northern Olympic Peninsula.

Vegetation: Timber, Grass and Brush.

Climate: This is the warmest, driest, and most densely populated region of western Washington. 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. For the rest of the Lowlands FDRA from Mt Vernon and Quilcene, south to the Columbia River, annual precipitation ranges from 32 to 45 inches of precipitation with average summertime highs from 73° to 78° F.

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.

2.3.1.3 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.

2.3.1.4 Cascades FDRA

General Location: This area includes the western slope of the Cascade Range from an elevation of approximately 1,000 feet to the crest of the Cascades and extending from the Columbia River to the Canadian Border.

Vegetation: Timber.

Climate: The annual precipitation ranges from 60 to 100 inches or more. Indications are that the heaviest precipitation probably occurs along the slopes of east-west mountain valleys which become narrower as the elevation increases along the windward slopes of the Cascades. Annual precipitation in some of the wetter areas has reached 140 inches in one out of ten years.

Topography: The Cascades range has extremely steep, rugged terrain. Elevation ranges from approximately 1000" in the foothills to over 7000'.

3.0 Fire Danger Problem Analysis

In order 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 Fire Occurrence

Ten years (from 2009 to 2019) of fire occurrence data were used for the analysis in this FDOP. Data was obtained from the spatial wildfire occurrence data for the United States dataset. Fires are considered without regard to agency affiliation. Fire occurrence charts by FDRA can be found in Appendix B.

Due to the low occurrence of large fires in the Olympics and Cascades along with the low correlation between fire discovery date and large fire growth events, the fire data were modified in order to facilitate the fire occurrence analysis. The methodology included taking a long duration, large fire event (mainly for the Olympics and North Cascades) and defining large fire growth days or active fire behaviour periods during the life of the incident. Each of these dates was recorded separately in order to "correct" the data to represent each time the fire exhibited active fire behavior and/or large fire growth. The justification for this adjustment is that many of the fires are managed using a monitor or confinement strategy and can remain on the landscape for long periods of time without having significant activity. By defining the large fire growth days, there can be a better analysis for the indices that best correlate to the "active" fire periods.

3.2 Identification/Definition of the Fire Problem(s)

The ability to regulate, educate, or change behaviour within a user group will be based upon the interface method and how quickly they can react to the action taken. Consequently, the most appropriate decision tool would depend upon the sensitivity of the target group to the implementation of the action. In addition, each action will result in positive and/or negative impacts to a user group.

In selecting a component and/or index, several factors must be considered:

Affected Target Group: The group of people commonly associated with the problem (e.g., agency, industry, or public).

Agency: Employees of the federal, state, and local governments involved in the cooperative effort to suppress wildland fires. This includes Federal, State, and County land management employees, along with volunteer fire departments who share a similar protection mission to manage wildland fires.
Industry: Employees affiliated with organizations which utilize natural resources and/or obtain permits or leases to conduct commercial activities on federal, state, or private lands. These entities or activities could include ranchers, wilderness camps, railroads, mines, timber harvesting, filming, building construction, oil and gas, electric generation, guiding services, etc.
Public: Individuals who use public lands for non-commercial purposes such as off-highway vehicle use, camping, hiking, hunting, fishing, skiing, firewood gathering, agriculture, mountain biking, general travel and recreation. This group also includes those living within the wildland urban interface.

Problem Definition: This is the problem specific to the area of concern and includes ignition causes. The problem is framed to focus on the wildland fire management issue associated with a specific target group.
Degree of Control: This is a general description of how much control the fire management agencies have over the target group (High to Low). This is a measure of how quickly the affected target group can respond to changing fire danger levels.
Communication: Various methods of communication are utilized to influence an affected target group to change their behavior. Depending upon the specific target group, communication may include face-to-face verbal conversations, radio, telephone, email, newspaper, television, signing/posting, text messages, etc.
Component/Index: Sensitivity of the NFDRS outputs should be commensurate with the ability to react (or communicate) to the target group.
Management Action: The actions or applications are pre-defined and taken at breakpoints determined through an analysis of fire danger indices and fire occurrence. Collectively the decision points represent levels of fire danger applied as a communication mechanism to specific target groups. The intent is to minimize the risk of a fire ignition problem by controlling or influencing a specific target group (Agency, Public, and Industry).

Figure 4: Fire Summary for Western Washington FDOP

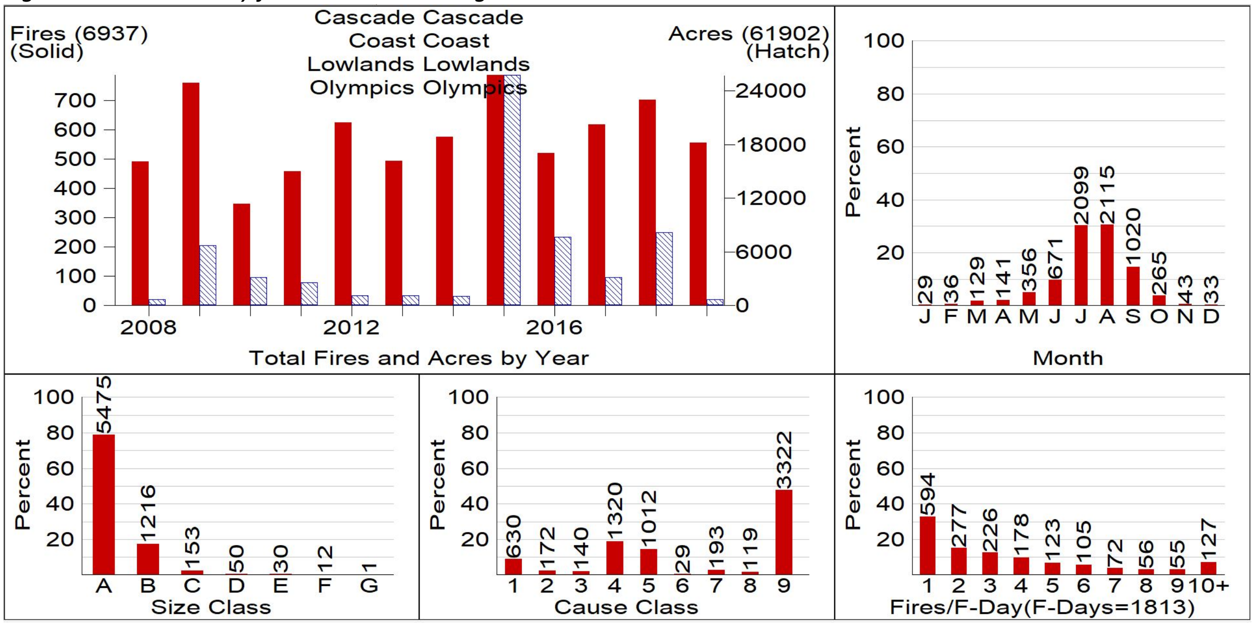


Table 2: Identification and definition of the fire problem in Western Washington.

TARGET GROUP		IGNITIONS CAUSE		RELATIVE DEGREE OF CONTROL	COMMUNICATION METHODS	PROBLEM
General	*Specific*	*General*	*Specific*			
Agency	Agency suppression resources and fire managers	1 - Lightning	Lightning	High	Dispatch centers communicate fire weather (LAL) and fire danger (SL and PL)	Fires which exceed the units capability to manage due to growth on the discovery day
Agency	Agency suppression resources and fire managers	1 - Lightning	Abundant Lightning	High	Dispatch centers communicates fire weather (LAL) and fire danger (SL and PL)	Fires which exceed the units ability to manage because the number of ignitions exceeds initial attack capability and/or fires escape initial attack on subsequent days
Public	Public using overnight developed recreation sites	4 - Campfire	Unattended (and escaped) campfires	High	PIO/Prevention Radio, media broadcast, news release and internet. Smokey Arm, adj. signs and prevention patrols	Campfires in developed recreation areas that escape and become large fires or tie up agency resources allowing other fires to grow and escape initial attack
Public	Public using agency lands for day use or undeveloped overnight use	4 - Campfire	Unattended (and escaped) campfires	Low	PIO/Prevention Radio, media broadcast, news release and internet. Smokey Arm, adj. signs and prevention patrols	Campfires in undeveloped or day use recreation sites that escape and become large fires or tie up agency resources allowing other fires to grow and escape initial attack
Industry	Woods workers and Industrial forest users	2 - Equipment	Any ignition associated with the target group	Moderate	Dispatch centers communicate IFPL for agency	Ignitions which become large fires resulting from industrial

	operating on public lands		from chainsaws to yarding		personnel, state posts on internet for public	forest operations (equipment and smoking)
Public	Private Landowners	5 - Debris Burning	Escaped debris burns	Low	Burn restrictions posted on the dispatch website, Radio, media broadcast, news release and internet	Escaped debris burns which become large fires or tie up agency resources

4.0 Fire Danger Threshold/Decision Analysis

Decision points can be based upon either:

- Climatological Breakpoints, or
- Fire Business Thresholds.

The FDOP will be used to support fire management decisions made at specific decision points. A decision point is a point along the range of possible output values where a decision shifts from one choice to another. 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 identified for selected indices and levels within each FDRA.

4.1 Climatological Breakpoints

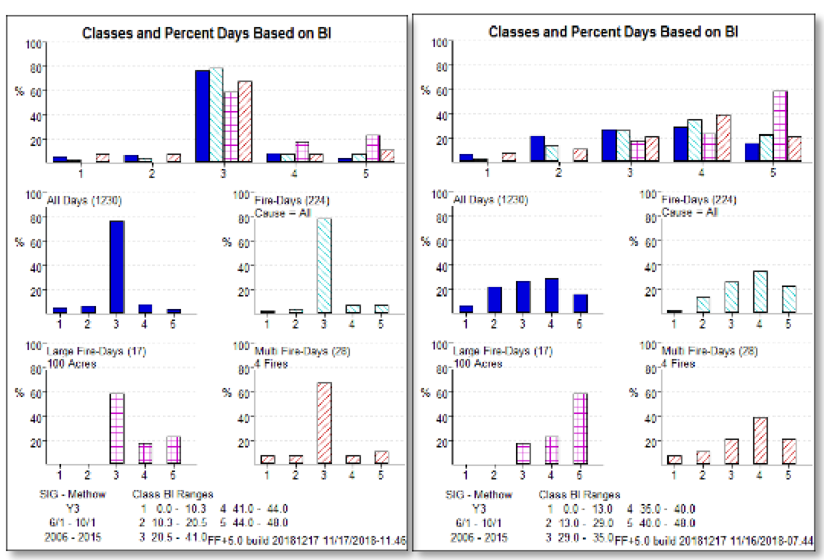
Climatological breakpoints are points on the cumulative distribution curve of a fire danger indices computed from climatology (weather). For example, the value at the 90th percentile ERC is the climatological breakpoint at which only 10 percent of the ERC values are greater in value. Climatological percentiles were originally developed for budgetary decisions by federal agencies, *without regard for associated fire occurrence*, and are predetermined by agency directive, as exemplified below:

BLM: 80th and 95th percentiles
FWS, NPS, USFS: 90th and 97th percentiles

When using climatology, it is important to identify the period of record used to determine the agency percentiles. The percentile values for the calendar year will be different from the percentile values for the fire season.

Where possible the decision thresholds identified in this FDOP are based upon the statistical correlation of historical fire occurrence and weather data and, therefore, do not utilize climatological percentiles for decision points. Note the fire business charts to the right showing climatological breakpoints on the left and fire business thresholds on the right. Increased preparedness actions taken at levels 4/5 have little potential to affect outcomes using traditional climatological breakpoints

Figure 5: Climatological Breakpoints Example



since most of the fire problems occur at level 3.

4.2 Weather Station Analysis

Remote Automated Weather Stations (RAWS) in different geographical locations with common sensitivity to NFDRS model inputs can be grouped together to form a special interest group (SIG). Refer to the Appendix B for details regarding the weather station analysis. The stations and SIGs below were chosen based on location, station and data quality, and the statistical correlation to the fire problem in section 4.3 below.

Many stations at the higher elevations suffer outages in the winter due to snow loading or are difficult to repair timely because of access issues. This has created significant gaps in the data for many stations and limited the number of stations available for analysis. When data gaps can be filled, SIGS and FDRA's should be re-analyzed to ensure the validity of the data. The impacts of having corrected manual observations without the remaining 23 hours of data provides a case where the data counts appear complete, but the other 23 hours of missing data is causing a misrepresentation of the indices.

4.2.1 NFDR Stations and Special Interest Groups (SIGS)

Table 3: FDRA RAWS stations list

FDRA	Station	Station Name	Owner	WIMS Ann Prec
Coast	450130	Ellis Mt	WA-DNR	106
	450306	Minot LO	WA-DNR	100
	450312	Humptulips	WA-OLF	160
	450407	Huckleberry	WA-DNR	120
Lowlands	450207	Quilcene	WA-OLF	45
	451207	Castle Rock	WA-DNR	45
	451507	Sedro Woolley	WA-DNR	47
	451702	Enumclaw	WA-DNR	49
	451103	Chehalis	WA-DNR	46
Olympic	450117	Cougar	WA-OLF	50
	450121	Tom Creek	WA-OLF	100
	450124	Hurricane	WA-OLP	74
	450911	Jefferson	WA-OLF	90
Cascade	451115	HAGER	WA-GPF	50
	451613	GOLD MT	WA-MBF	70
	451718	GREENWATER	WA-DNR	140
	451721	FIRE ACADEMY	WA-MBF	64
	451924	DRYCR	WA-GPF	70

4.3 Fire Business Analysis

A statistical correlation of fire occurrence with fire danger indices, weather stations, and fuel models was used in conjunction with the fire problem analysis table in Section 3.2 above to determine the best combination for predicting the fire problem in each FDRA.

All 5 NFDR fuel models were given a cursory examination however the use of GSI for NFDR in this area needs further consideration and adjustment at this time as live fuels are not curing during the fire season under current vapor pressure deficit settings. Fuel model Y contains no live fuels and often had better statistical results than others, perhaps in part to the aforementioned GSI issue. Statistical results of chosen combinations are included in the FDRA information sheets in Appendix B.

4.4 Parameters Used to Calculate Fire Danger

Large fires, multiple fire days, and herb type were determined through analysis and participant input. KBDI and precipitation are both required to run NFDR 2016. KBDI, used to adjust for drought fuels, was left at the default of 100. Annual precipitation from the PRISM dataset, shown in the previous table, was used instead of a GIS precipitation analysis, this may or may not be desirable with NFDR 2016 and should be further explored.

Table 4:

FDRA	Station ID	Name	Analysis Years	Analysis Time of Year	NFDRS Fuel Model	Slope Class	Avg Precip	Initial KBDI	Max SC	Herb Annual	Station Weight
Cascade	451115	Hager	2010-2019	June 15-Sept 30	Y	3	50	100	5	N	1
	451509	Finney	2010-2019	June 15-Sept 30	Y	3	90	100	5	N	1
	451718	Greenwater	2010-2019	June 15-Sept 30	Y	4	140	100	5	N	1
	451721	Fire Academy	2010-2019	June 15-Sept 30	Y	3	64	100	5	N	1
	451924	Dry Creek	2010-2019	June 15-Sept 30	Y	3	70	100	5	N	1
Coast	450130	Ellis Mt	2008-2019	June 1 - Oct 1	Y	3	106	100	5	N	1
	450306	Minot LO	2008-2019	June 1 - Oct 1	Y	2	100	100	5	N	1
	450312	Humptulips	2008-2019	June 1 - Oct 1	Y	4	160	100	5	N	1
	450407	Huckleberry	2008-2019	June 1 - Oct 1	Y	4	120	100	5	N	1
Lowland	450207	Quilcene	2008-2019	May 1 – Sept 30	Y	3	45	100	5	N	1
	451207	Castle Rock	2008-2019	May 1 – Sept 30	Y	2	45	100	5	N	1
	451507	Sedro Woolley	2008-2019	May 1 – Sept 30	Y	2	47	100	5	N	1
	451702	Enumclaw	2008-2019	May 1 – Sept 30	Y	2	49	100	5	N	1
	451103	Chehalis	2008-2019	May 1 – Sept 30	Y	2	46	100	5	N	1

Olympic	450117	Cougar	2008-2019	June 15-Sept 30	Y	4	50	100	5	N	1
	450121	Tom Creek	2008-2019	June 15-Sept 30	Y	4	100	100	5	N	1
	450124	Hurricane	2008-2019	June 15-Sept 30	Y	4	74	100	5	N	1
	450911	Jefferson	2008-2019	June 15-Sept 30	Y	4	90	100	5	N	1

4.5 Decision Points

Using Fire Family Plus software (5.0), NFDRS decision points have been identified where changes in fire business should occur, as illustrated in the chart below. Threshold charts for all FDRAs are included in the Appendix B. Energy release component 10HR fuel moisture and burning index were carried forward from the analysis for use in this plan as the basis for setting fire danger levels. Decision points based on fire business analysis are available in Appendix B within each FDRA's Information Sheet.

Figure 6: Example of Decision breakpoints

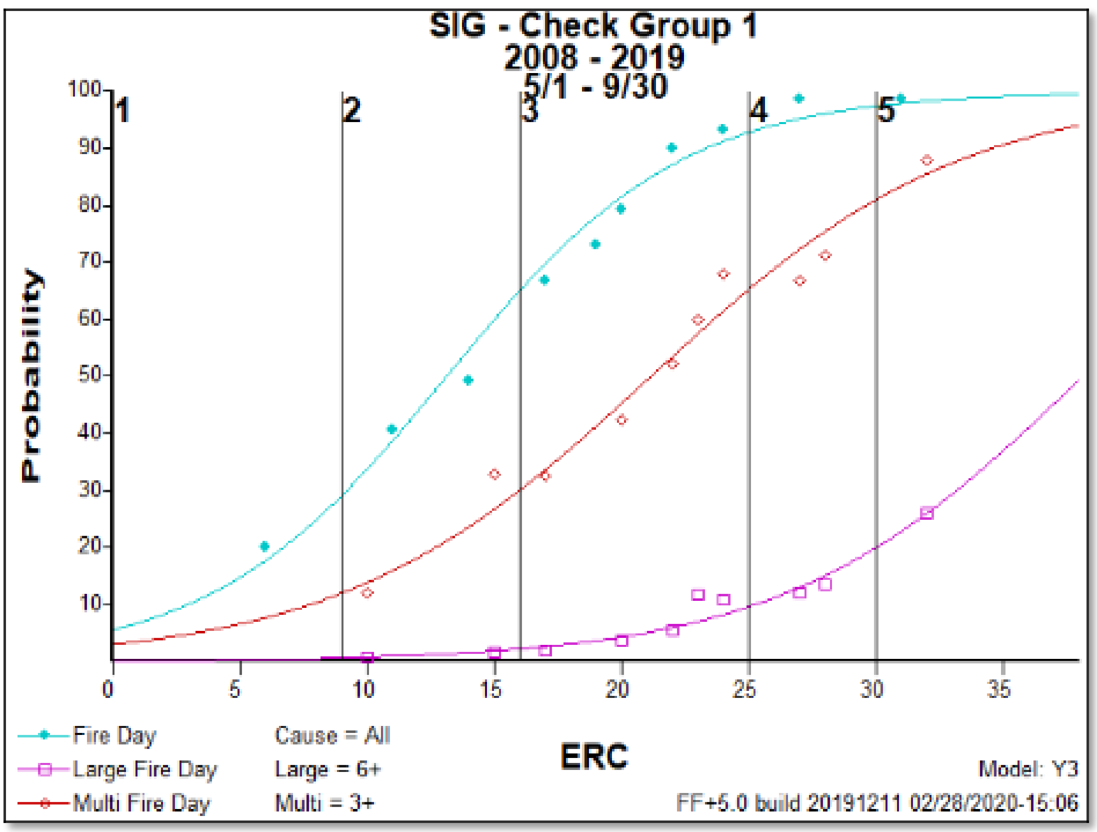


Table 5: Fire Business Decision Summary Table

TARGET GROUP	DECISION POINTS	INDEX	FUEL MODEL	SUBORDINATE PLAN USED TO MODIFY TARGET GROUP BEHAVIOR
Agency	5	ERC	Y	Staffing Plan
Agency	3	10HR, Burning Index, ERC	Y	Response Plan
Agency	5	ERC	Y	Preparedness Plan
Public	5	ERC	Y	Prevention Plan (Adjective Rating)
Public	TBD by Unit	ERC	Y	Prevention Plan or Public Use Restriction Plan
Industry	4	IFPL	Y	Industry/Public Use Restriction Plan

5.0 Fire Danger Rating Level Decisions

The NFDRS utilizes the WIMS processor to manipulate weather and forecast data stored in the National Interagency Fire Management Integrated Database (NIFMID) to produce fire danger ratings for corresponding weather stations. The NFDRS outputs from the WIMS processor can be used to determine various levels of fire danger rating to address the fire problems identified previously in the Fire Problem Analysis Chart. The system is designed to model worst-case fire danger scenario. The NFDRS, along with other decision support tools, will be utilized to produce levels (thresholds) of fire business to address local fire problems by targeting public, industrial, or agency groups.

The NFDRS will be utilized to produce outputs to assist fire managers with six sets of decisions.

For the 2020 Fire season Response levels, Staffing Levels, and Preparedness Levels will be calculated by individual dispatch centers, with an expectation of coordination with adjacent or overlapping centers. The Adjective Rating level will be discussed with a representative from all units on a weekly phone call during fire season at a minimum.

- **Response Levels** will be used as a decision tool for dispatchers to assign initial attack resources to a fire reported in a specific dispatch zone.
- **Staffing Levels** will be used for appropriate day-to-day suppression resource staffing.
- **Preparedness Levels** will assist fire managers with more long-term (or seasonal) decisions with respect to fire danger.

- **Adjective Rating Level** will be used to communicate fire danger to the public.
- **Industrial Fire Precaution Level** will be used to curtail preventable industrial ignitions.
- **Public Use Restriction Level** will be used to curtail public ignitions.

5.1 Response (or Dispatch) Level

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

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 Staffing 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

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 2020 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.

5.3 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	Factor
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	Yes	Add .25
	No	Subtract 0
GACC PL	Increasing	Add .25
	Holding Steady	0
	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 this covers most of their response area of concern.

5.4 Adjective Fire Danger Rating Level

Informed by Staffing level value calculated, published and broadcast twice daily by the communications centers. Actual value 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 colour 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.

ERC Breakpoint	Adjective Rating
1	Low
2	Moderate
3	High
4	Very High
5	Extreme

5.5 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.

5.6 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.

IFPL for Fuel Model Y Proposed Splits

		IC															
	ERC/IC	0-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80
ERC	0-5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	6-10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	11-15	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	16-20	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2
	21-25	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2
	26-30	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2
	31-35	1	1	1	1	1	2	2	2	2	3	3	3	3	3	3	3
	36-40	1	1	1	1	2	2	2	2	3	3	3	3	3	3	3	3
	41-45	1	1	1	1	2	2	2	3	3	3	3	3	3	3	3	3
	46-50	1	1	1	2	2	2	3	3	3	3	3	3	3	3	3	3
	51-55	1	1	1	2	2	2	3	3	3	4	4	4	4	4	4	4
	56-60	1	1	1	2	2	2	3	3	3	4	4	4	4	4	4	4
	61-65	1	1	1	2	2	2	3	3	3	4	4	4	4	4	4	4
	66-70	1	1	1	2	2	2	3	3	3	4	4	4	4	4	4	4
	71-75	1	1	1	2	2	2	3	3	3	4	4	4	4	4	4	4
	76-80	1	1	1	2	2	2	3	3	3	4	4	4	4	4	4	4

Figure 7: IFPL Lookup Table

The model above is being tested as a replacement for the 1978 precaution value for determining IFPL. The model uses ERC-Y and IC-Y index values for the IFPL zone SIG. Development is ongoing and any future iterations will be incorporated in this document as they are developed and approved. The publicly posted IFPL value will be determined through regular fire danger coordination that includes the respective land management agencies with jurisdiction for each IFPL zone.

6.0 Fire Danger Operating Procedures

6.1 Roles and Responsibilities

6.1.1 Agency Administrators

Agency Administrators will use this plan to coordinate with fire management officers on fire business related decisions.

6.1.2 Fire Program Managers

Fire program managers (FMOs) will use this FDOP and NFDRS outputs as a tool to coordinate and to make informed fire business decisions. The fire program manager is ultimately responsible for ensuring this plan is maintained, utilized, and communicated.

Fire program managers will ensure that their stations are maintained to NFDRS standards.

6.1.3 Fire Danger Technical Group

Each participating agency will be responsible for providing an NFDRS technical specialist to participate in the maintenance, review, and update of this plan. These individuals are listed in front of the table of contents.

Members of the Fire Danger Technical Group will monitor NFDRS to ensure validity, coordinate/communicate any problems identified, review plan implementation, coordinate plan revisions, present the plan, and be available for NFDRS technical consultation. The technical group will coordinate with fire managers from their unit for updates and additions to the plan. The technical group will coordinate annually to review plan implementation, decide if revisions are necessary, and accomplish revisions.

6.1.4 Fire Weather Station Owners/Managers

The station owners will ensure appropriate editing of the RAWS catalogues to match this plan and maintain *current* primary and secondary contacts for stations. Station owners will maintain stations in accordance with NWCG PMS 426-3 and ensure a timely response when notified of an unexpected need for repair.

6.1.5 Communication Center

The dispatch centers will ensure that the daily NFDRS indices are retrieved and that the daily staffing and preparedness levels are calculated, communicated, and made available during fire season, April 1st through October or season end, and as requested by participants in this plan due to extenuating factors.

The dispatch centers will monitor RAWS daily for unusual readings that may suggest an issue needing attention and contact the station owners to arrange resolution and notify agency fire program managers (FMO).

The dispatch centers will give WIMS the proper seasonal care and inputs required to run NFDR 2016, including setting snow flags and starting KBDI. Dispatch centers will be responsible for the RAWS stations under their jurisdiction. For example, PSICC will monitor and maintain inputs for Stations owned by the Mt Baker Snoqualmie NF and North Cascades National Park within the Cascade FDRA. Columbia Cascade will monitor stations and inputs for stations on the

Gifford Pinchot portion of the FDRA, and DNR dispatch centers will do the same for all DNR owned stations.

6.1.6 Duty Officers

A duty officer from each agency will be identified to the appropriate dispatch center throughout the fire season. It is the duty officer role to interpret and modify the daily staffing and preparedness levels (if warranted) by extenuating factors not addressed by this plan to make fire business decisions.

6.1.7 National Weather Service

Weather forecasts and products for the area are provided by the National Weather Service, Seattle and Portland offices. The annual Northwest Fire Weather Operating Plan contains contact information and product listing (including NFDRS point and trend forecast products) and can be found on the Northwest Coordination Center Website.

6.2 Daily Schedule

The intent is to provide web based NFDRS products from which dispatchers and managers can quickly and easily obtain the needed information to calculate and communicate fire danger levels. This information has previously been hosted externally and communication centers should be prepared to obtain the outputs from WIMS and using the tables and worksheets in this plan. **The link to this website will be distributed to the participating dispatch centers by May 15, 2020.**

Dispatch centers will use the current day's forecasted indices for the morning fire weather broadcast. Those will be in effect until the afternoon fire weather broadcast that will communicate the observed indices for the day.

Morning and afternoon broadcasts **will** include the observed and predicted ERC, when available, as well as predicted Staffing Level.

6.3 Critical Fire Danger

Critical fire danger events such as thermal pressure troughs, offshore flow/east winds, and dry cold front winds will be typically captured by National Weather Service meteorologists in red flag warnings or fire weather watches. Warm, dry, unstable conditions can exacerbate fire danger conditions in Western Washington and cause active fire behavior during times when fuels are not critically dry. The moss and lichen component within timber fuels contributes greatly to this effect.

Poor nighttime humidity recoveries below approximately 60 percent combined with more than 14 days without wetting rain and temperatures above 72 degrees is generally a threshold for increased fire activity. Effects of prolonged periods of poor humidity recovery on heavy fuels can persist for one to two days after onshore flow returns.

For more information see the publication Critical Weather Patterns of the United States as well as other weather conditions can be found on the NWCC website here. Information on past large fire growth days can be found in the Appendix F.

6.4 Season Ending Event

The NWCC conducted a season ending event analysis by predictive services area which can be found on their fire analysis page. Experience has shown locally that season ending analysis conducted in the traditional manner for individual fires or by FDRA come within a week or so either side of the NWCC analysis.

6.5 Fire Danger Pocket Cards/Seasonal Risk Analysis

The fire danger pocket card is a tool which can aid fire suppression personnel to interpret NFDRS outputs and understand local fire danger thresholds for a local area. Pocket cards can relate current NFDRS outputs with the historical average and worst-case values in a specific geographic location. Visiting resources can use the pocket card to familiarize themselves with local fire danger conditions. The pocket cards meet NWCG guidelines and are posted on the NWCG website. Seasonal risk analysis (pocket cards with updated daily values) will be linked on the dispatch center websites. For 2020, pocket cards will reflect the original NFDRS model, not the NFDRS 2016 model.

6.6 Weather Station Maintenance

Each agency is responsible for the annual maintenance and calibration of their RAWS used in this plan. Specifics regarding NWCG weather station standards and guidelines can be found in PMS 426-3 here.

Appendices

Appendix A: Primary Distribution List

This list indicates key personnel associated with this plan at this time.

Washington State Department of Natural Resources
DNR Northwest Region Dispatch and Fire Managers
DNR Olympic Region Dispatch and Fire Managers
DNR South Puget Sound Region Dispatch and Fire Managers
DNR Pacific Cascade Region Dispatch and Fire Managers
Coordination Centers
Puget Sound Interagency Coordination Center
Columbia Cascade Interagency Coordination Center
National Park Service
North Cascades National Park FMO
Olympic National Park FMO
Mt. Rainier National Park FMO
Forest Service
Mount Baker Snoqualmie National Forest FMO
Olympic National Forest FMO
Gifford Pinchot National Forest FMO

Appendix B: Fire Danger Rating Area Analysis – Western Washington FDOP

B-1: Olympic FDRA Analysis

Olympics

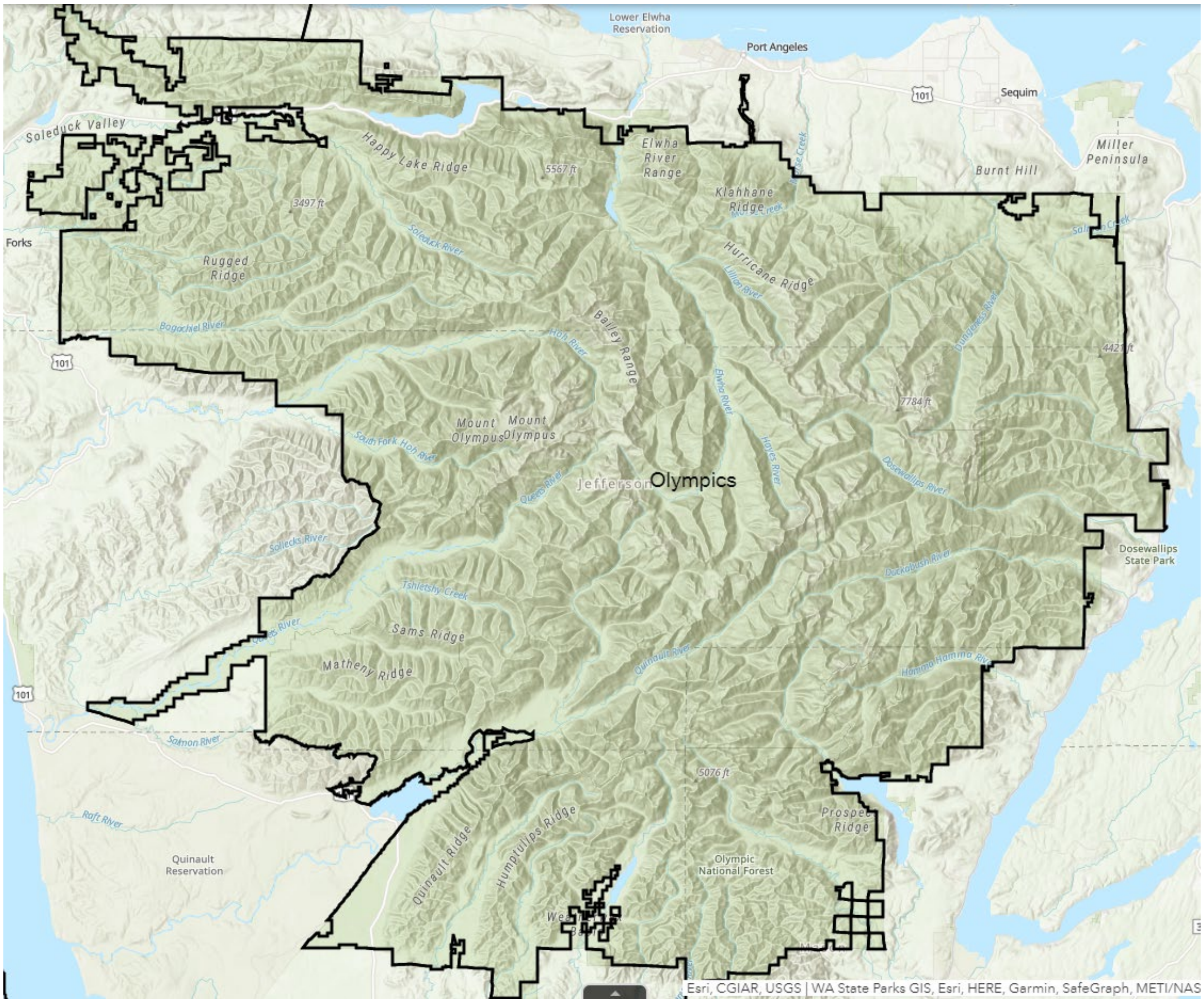


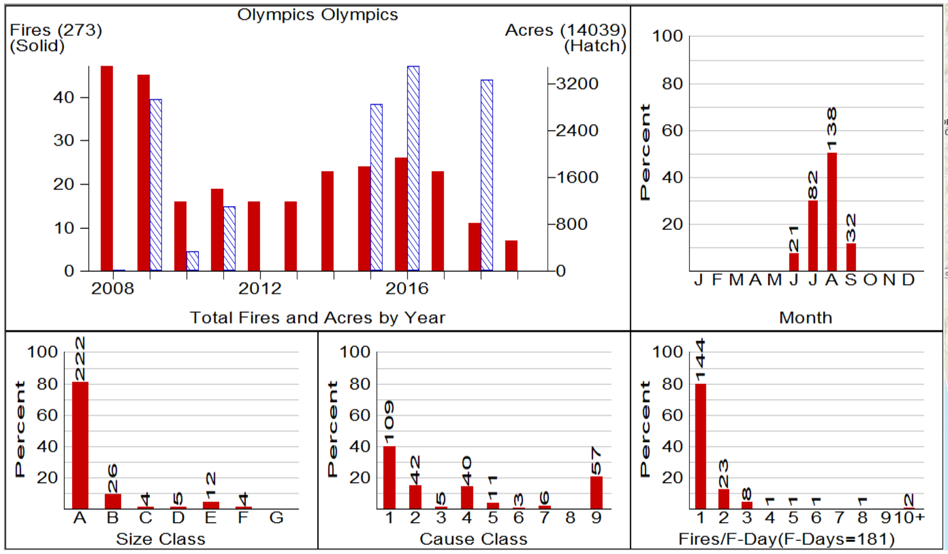
Figure B1.1: Overview map of Olympics FDRA.

General Location: This area includes the Olympic Mountains on the Olympic Peninsula.

Vegetation: Primarily Timber with understory.

Climate: Annual precipitation ranges from 70 to 100 inches over the lower western slopes of the Olympics to 150 inches or more along the windward slopes of the mountains. A significant rain shadow causes a dramatic decrease in precipitation on the east side of the Olympics with as little as 15-18 inches rain in some areas.

Topography: Terrain is extremely steep and rugged in the Olympics. Elevation varies from approximately 1,000 feet in the lower river valleys to 7500’ in the higher peaks of the Olympics.



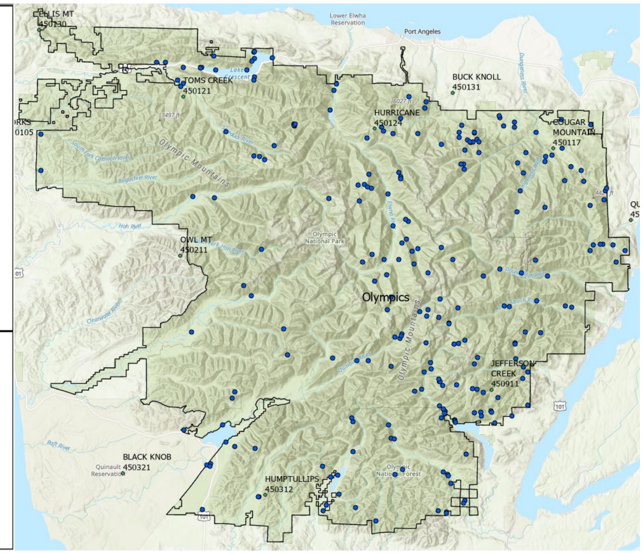


Figure B1.2: Fire Summary Graph for analysis months and years for Olympics FDRA

Figure B1.3. Map of fires used for Olympics analysis

Table B1.1: Select fire summary graph data for Cascade FDRA.

Fire Cause Classes		Fires By Month Lightning vs Human			Fire Size Percentiles	
1	Lightning	Month	Lightning	Human	Percentile	Acres
2	Equipment	June (15th)	4	17	100	2300
3	Smoking	July	36	46	99	1100
4	Campfire	August	63	75	98	805
5	Debris	Sept	6	26	97	653
6	Railroad				96	443
7	Arson				95	368
8	Children				90	3
9	Misc				80	0.2

Season and Size determination

Table B1.2: Season, large fire size in acres, and multiple fire day used in analysis for Olympic FDRA.

Season	Large Fire	Multiple Fire Day
June 15th-Sept 30th	3 acres	3 fires

Fire Danger Decision Analysis

Table B1.3: The season, large fire, and multiple fire day as defined in the fire problem analysis for Cascade FDRA and the number of qualifying weather days, fire days, large fire days, and multiple fire days used in correlation analysis for Olympic FDRA.

Season	Large Fire	Multiple Fire Day	Number of fire Weather days	Number of Fire Days	Number of Large Fires	Number of Multiple Fire Days
June 15th-Sept 30th	3 acres	3 fires	1296	344	41	21

SIG Catalog

Table B1.4: Final SIG station parameters as determined through correlation analysis for Olympic FDRA.

Station ID	Name	Analysis Years	Analysis Time of Year	NFDRS Fuel Model	Slope Class	Avg Precip	Initial KBDI	Max SC	Herb Annual	Station Weight
450117	Cougar	2008-2019	June 15th-Sept 30th	Y	4	50	100	5	N	1
450121	Tom Creek	2008-2019	June 15th-Sept 30th	Y	4	100	100	5	N	1
450124	Hurricane	2008-2019	June 15th-Sept 30th	Y	4	74	100	5	N	1
450911	Jefferson	2008-2019	June 15th-Sept 30th	Y	4	90	100	5	N	1

Correlation Analysis Table

Table B1.5: Correlation values for Olympic FDRA.

SIG/Station	Variable	Model	Greenup	Freeze	FD Type	FD R^2	FD Chi^2	FD P-Val	FD P-Range	LFD	LFD R^2	LFD Chi^2	LFD P-Val	LFD P-Range	MFD	MFD R^2	MFD Chi^2	MFD P-Val	MFD P-Range
450117	ERC	Y4P4	13-Jun	31-Dec	All	0.69	13.21	0.1047	0.06 - 0.32	3 (C)	0.45	6.19	0.6264	0.04 - 0.29	3 (C)	0.57	2.63	0.9552	0.02 - 0.19
450121	ERC	Y4P4	15-May	31-Dec	All	0.61	13.04	0.1106	0.07 - 0.31	3 (C)	0.53	5.57	0.6952	0.03 - 0.36	3 (C)	0.27	13.48	0.0964	0.02 - 0.23
450124	ERC	Y4P3	17-Jul	31-Dec	All	0.87	4.76	0.783	0.05 - 0.36	3 (C)	0.25	11.04	0.1992	0.04 - 0.32	3 (C)	0.2	7.32	0.503	0.02 - 0.21
450911	ERC	Y4P4	13-Jun	31-Dec	All	0.74	11.4	0.18	0.06 - 0.39	3 (C)	0.59	3.22	0.9196	0.04 - 0.33	3 (C)	0.12	14.42	0.0714	0.03 - 0.19
SIG - CTHJ	ERC	Y4	13-Jun	31-Dec	All	0.75	11.02	0.2004	0.05 - 0.36	3 (C)	0.5	6.48	0.5935	0.04 - 0.34	3 (C)	0.34	5.55	0.6971	0.02 - 0.22

Decision Points

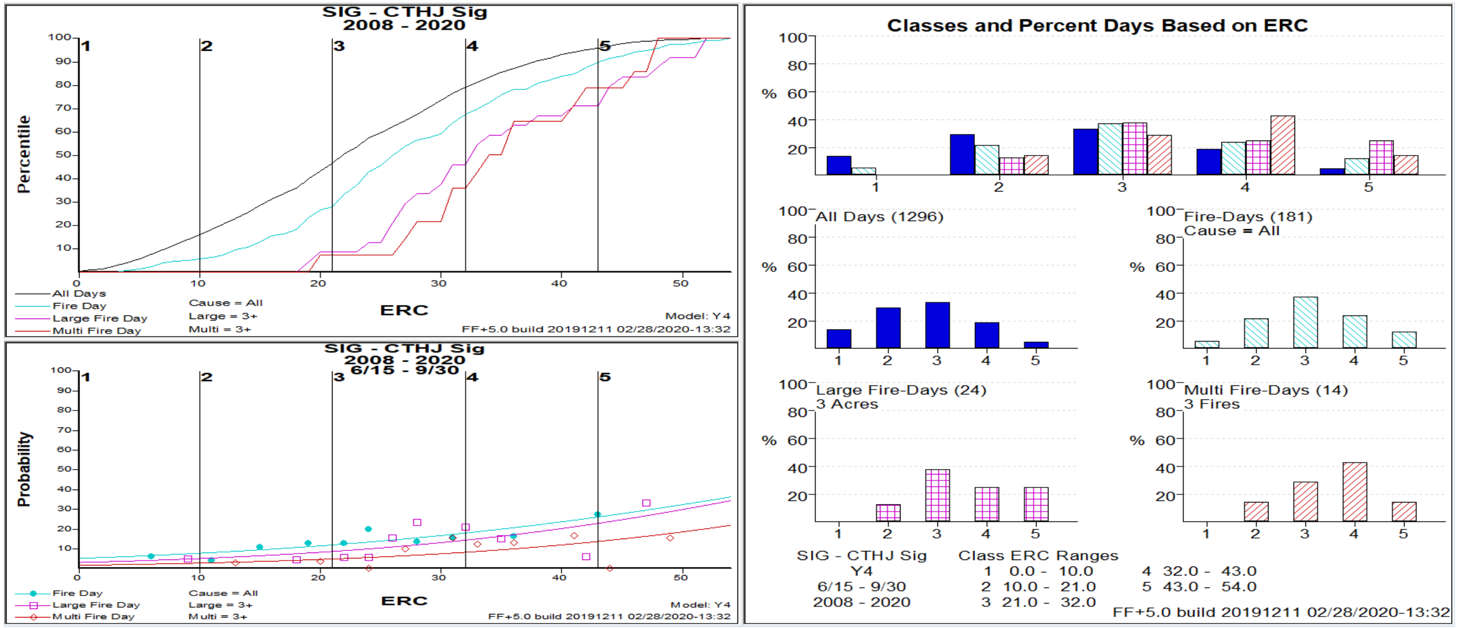


Figure B1.3: ERC-Y Breakpoints for Olympic FDRA

Table B1.6: 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	All Days (AD)		Fire Days (FD)			Large Fire Days (LFD)				Multiple Fire Days (MFD)			
	Range	# AD	% AD	# FD	% FD	% AD	# LFD	% LFD	% FD	% AD	# MFD	% MFD	% FD	% AD
1	0-9	181	14	10	6	6	0	0	0	0	0	0	0	0
2	10-20	379	29	39	22	10	3	13	8	1	2	14	5	1
3	21-31	430	33	67	37	16	9	38	13	2	4	29	6	1
4	32-42	241	19	43	24	18	6	25	14	2	6	43	14	2
5	42-53	65	5	22	12	34	6	25	27	3	2	14	9	3

B-2: Lowlands FDRA Analysis

Description

General Location: The Puget Sound lowlands extending from the Canadian border to the Columbia River between the coastal hills and the Cascade foothills. It includes the San Juan Islands and the lower elevations of the eastern half of the Olympic Peninsula.

Vegetation: Timber Grass and Brush.

Climate: This is the warmest, driest, and most densely populated region of western Washington. 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. For the rest of the Lowlands FDRA from Mt Vernon and Quilcene, south to the Columbia River, annual precipitation ranges from 32 to 45 inches of precipitation with average summertime highs from 73° to 78° F.

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 B2.1: Overview map of Lowlands FDRA.

Fire Danger Problem Analysis

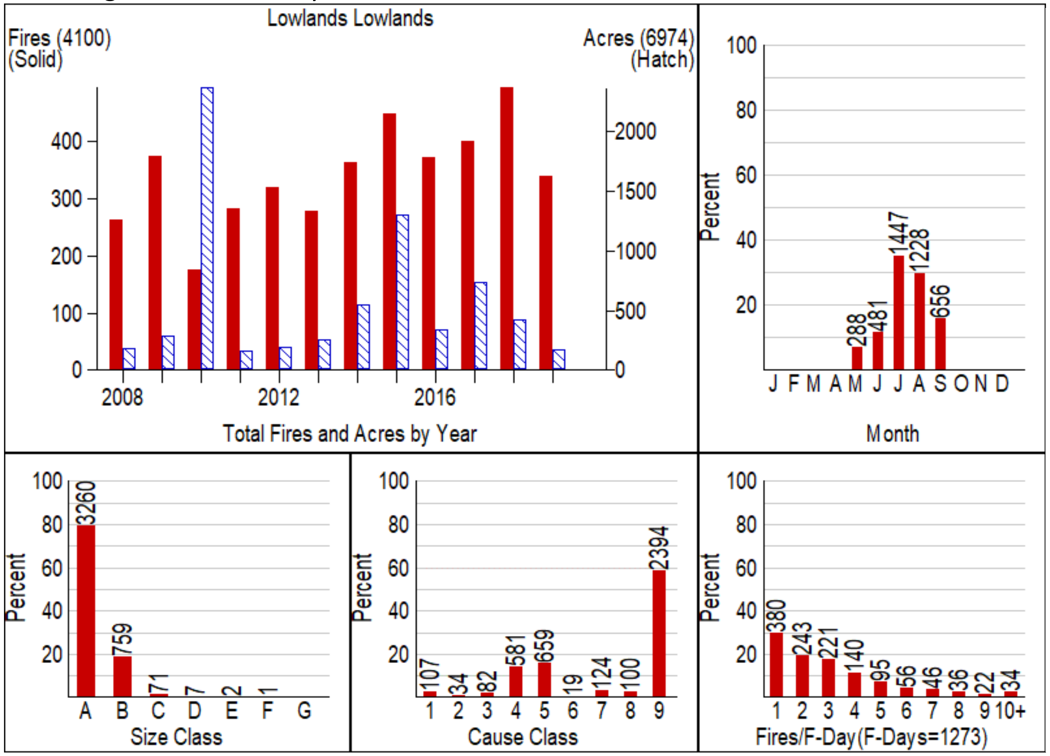


Figure B2.2: Fire Summary Graph for analysis months and years for Lowlands FDRA

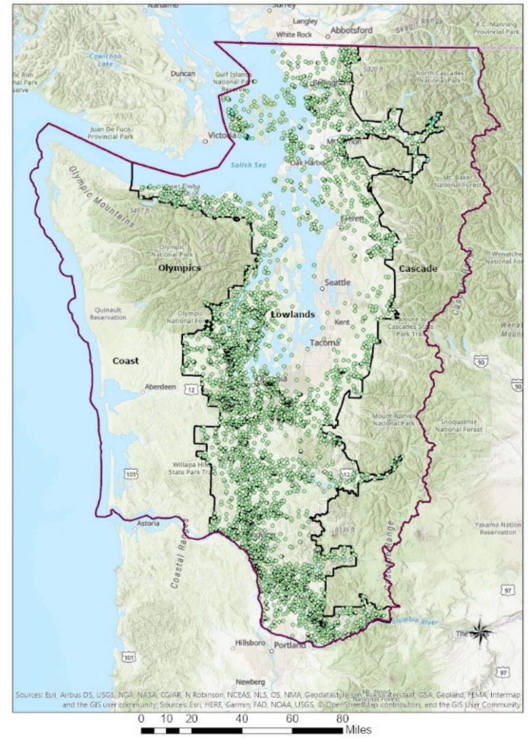


Figure B2.3: Map of fires used for Lowlands analysis

Table B2.1: Select fire summary graph data for Lowlands FDRA.

Fire Cause Classes		Fires By Month Lightning vs Human			Fire Size Percentiles	
1	Lightning	Month	Lightning	Human	Percentile	Acres
2	Equipment				100	2018
3	Smoking	May	3	285	99	21.7
4	Campfire	June	10	471	98	11
5	Debris	July	25	1422	97	6.9
6	Railroad	August	52	1176	95	3.3
7	Arson	Sept	19	637	90	1
8	Children				80	0.3
9	Misc				70	0.2

Season and Size Determination

Table B2.2: Season, large fire size in acres, and multiple fire day used in analysis for Lowlands FDRA.

Season	Large Fire	Multiple Fire Day
May 1st – Sept 30th	6	3

Fire Danger Decision Analysis

Table B2.3: The season, large fire, and multiple fire day as defined in the fire problem analysis for Lowlands FDRA and the number of qualifying weather days, fire days, large fire days, and multiple fire days used in correlation analysis for Lowlands FDRA.

Season	**Large Fire**	**Multi Fire Day**	**Number of Weather Days**	**Number of Fire Days**	**Number of Large Fire Days**	**Number of Multi Fire Days**
May 1-Sept 30	6 acres	3 or more fires	1806	1260	104	647

Sig Catalog

TableB2.4: Final SIG station parameters as determined through correlation analysis for Lowlands FDRA.

Station ID	**Name**	**Analysis Years**	**Season**	**NFDRS Fuel Model**	**Slope Class**	**Average Precip**	**Max SC**	**Station Weight**
450207	Quilcene	2008-2019	May 1 – Sept 30	Y	3	45	5	1
451207	Castle Rock	2008-2019	May 1 – Sept 30	Y	2	45	5	1
451507	Sedro Woolley	2008-2019	May 1 – Sept 30	Y	2	47	5	1
451702	Enumclaw	2008-2019	May 1 – Sept 30	Y	2	49	5	1
451103	Chehalis	2008-2019	May 1 – Sept 30	Y	2	46	5	1

Correlation Analysis Table

Table B2.5: Correlation values for Lowlands FDRA. Conditional probability analysis was used in the Correlation table, but not for ERC breakpoints for Staffing and Adjective Ratings.

SIG/Station#	Variable	Model	Greenup	Freeze	FD Type	FD R^2	FD Chi^2	FD P-Val	FD P-Range	LFD	LFD R^2	LFD Chi^2	LFD P-Val	LFD P-Range	MFD	MFD R^2	MFD Chi^2	MFD P-Val	MFD P-Range
SIG - Lowlands	ERC	Y3	16-May	31-Dec	All	0.98	14.28	0.0747	0.06 - 1.00	6 (C)	0.94	5.56	0.6967	0.00 - 0.50	3 (C)	0.96	9.58	0.2956	0.04 - 0.94
450207	ERC	Y3P3	16-May	31-Dec	All	0.97	7.28	0.5066	0.06 - 0.85	5	0.85	5.65	0.6866	0.00 - 0.27	5	0.54	2.31	0.3147	0.00 - 0.02
451103	ERC	Y2P3	15-May	31-Dec	All	0.95	27.26	0.0006	0.06 - 0.99	5 (C)	0.87	11.95	0.1533	0.00 - 0.54	5 (C)	0.98	3.12	0.9266	0.00 - 0.85
451207	ERC	Y2P3	16-May	31-Dec	All	0.94	34.23	0	0.06 - 0.99	5 (C)	0.94	5.95	0.6523	0.00 - 0.57	5 (C)	0.99	2.35	0.9684	0.00 - 0.85
451507	ERC	Y2P3	18-May	31-Dec	All	0.92	19.64	0.0118	0.23 - 0.97	5 (C)	0.9	5.59	0.6929	0.01 - 0.40	5 (C)	0.89	14.74	0.0643	0.02 - 0.71
451702	ERC	Y2P3	20-May	31-Dec	All	0.97	4.36	0.8236	0.04 - 0.76	5	0.45	8.03	0.2357	0.00 - 0.06	3	0.69	10.44	0.2352	0.00 - 0.21
SIG - Lowlands	FM10	Y3	16-May	31-Dec	All	0.98	5.06	0.7511	0.10 - 0.94	6 (C)	0.94	3.28	0.9152	0.00 - 0.40	3 (C)	0.94	5.16	0.7408	0.11 - 0.79
450207	FM10	Y3P3	16-May	31-Dec	All	0.94	4.54	0.8055	0.09 - 0.64	5	0.67	5.37	0.7174	0.00 - 0.16	5	0.12	2.26	0.3226	0.00 - 0.01
451103	FM10	Y2P3	15-May	31-Dec	All	0.97	7.25	0.5095	0.13 - 0.93	5 (C)	0.78	16.7	0.0334	0.00 - 0.43	5 (C)	0.96	3.68	0.8845	0.00 - 0.64
451207	FM10	Y2P3	16-May	31-Dec	All	0.95	11.25	0.1878	0.15 - 0.93	5 (C)	0.65	22.81	0.0036	0.00 - 0.38	5 (C)	0.91	6.22	0.6227	0.01 - 0.56
451507	FM10	Y2P3	18-May	31-Dec	All	0.89	9.34	0.3143	0.35 - 0.89	5 (C)	0.75	7.8	0.4537	0.01 - 0.31	5 (C)	0.72	15.34	0.0528	0.04 - 0.55
451702	FM10	Y2P3	20-May	31-Dec	All	0.78	16.54	0.0353	0.05 - 0.46	5	0.62	2.84	0.5847	0.00 - 0.04	3	0.48	6.21	0.5158	0.00 - 0.06

Decision Points

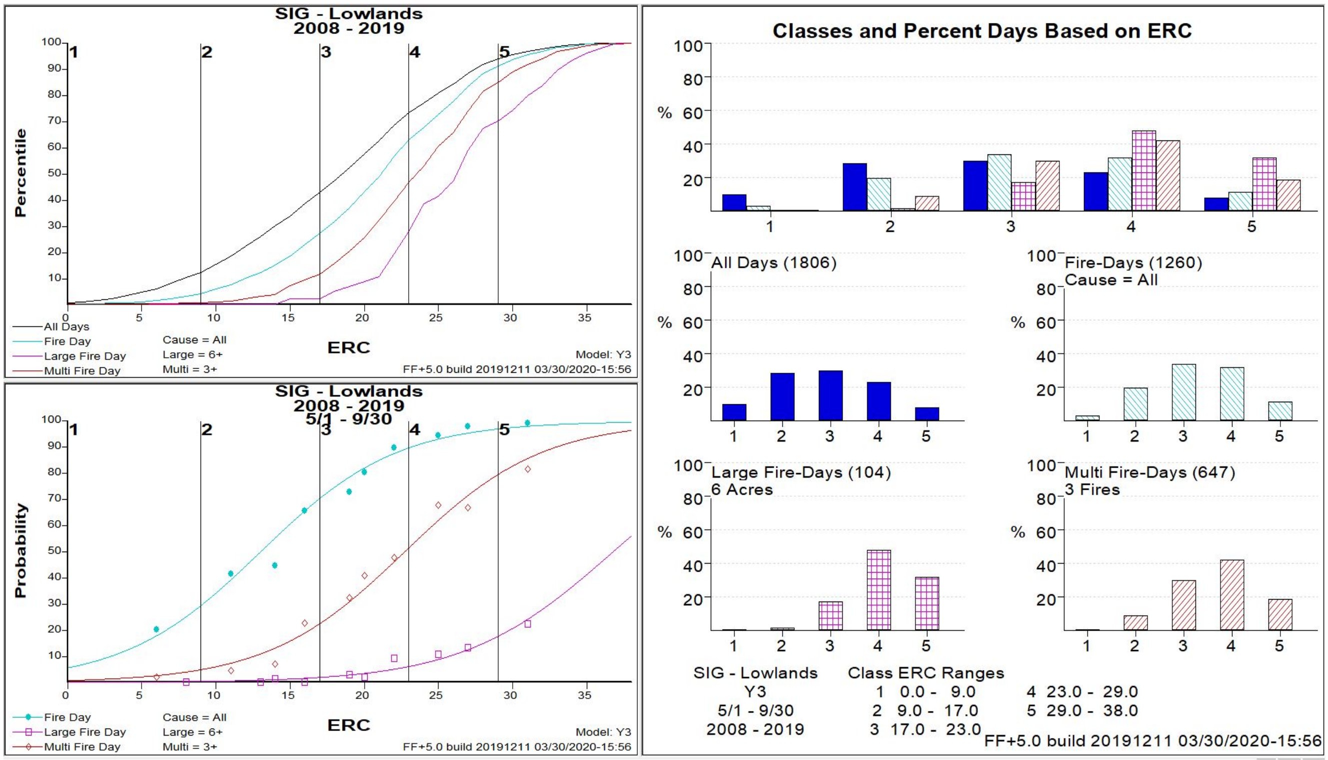


Figure B2.4: ERC-Y Breakpoints for Lowlands FDRA

Table B2.6: 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. Conditional probability analysis was not used for these breakpoints.

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	0-9	184	10	37	3	20	1	1	3	1	4	1	11	2
2	9-17	513	28	251	20	49	2	2	1	0	57	9	23	11
3	17-23	540	30	425	34	79	18	17	4	3	194	30	46	36
4	23-29	422	23	401	32	95	50	48	12	12	272	42	68	64
5	29-38	147	8	146	12	99	33	32	23	22	120	19	82	82

Table B2.7: Staffing level and adjective rating by ERC-Y range for Lowlands.

Staffing Level and Adjective Rating for Lowlands FDRA					
Lowlands ERC-Y	0-9	9-17	17-23	23-29	29-38
Staffing Level	1	2	3	4	5
Adjective Rating	Low	Moderate	High	Very High	Extreme

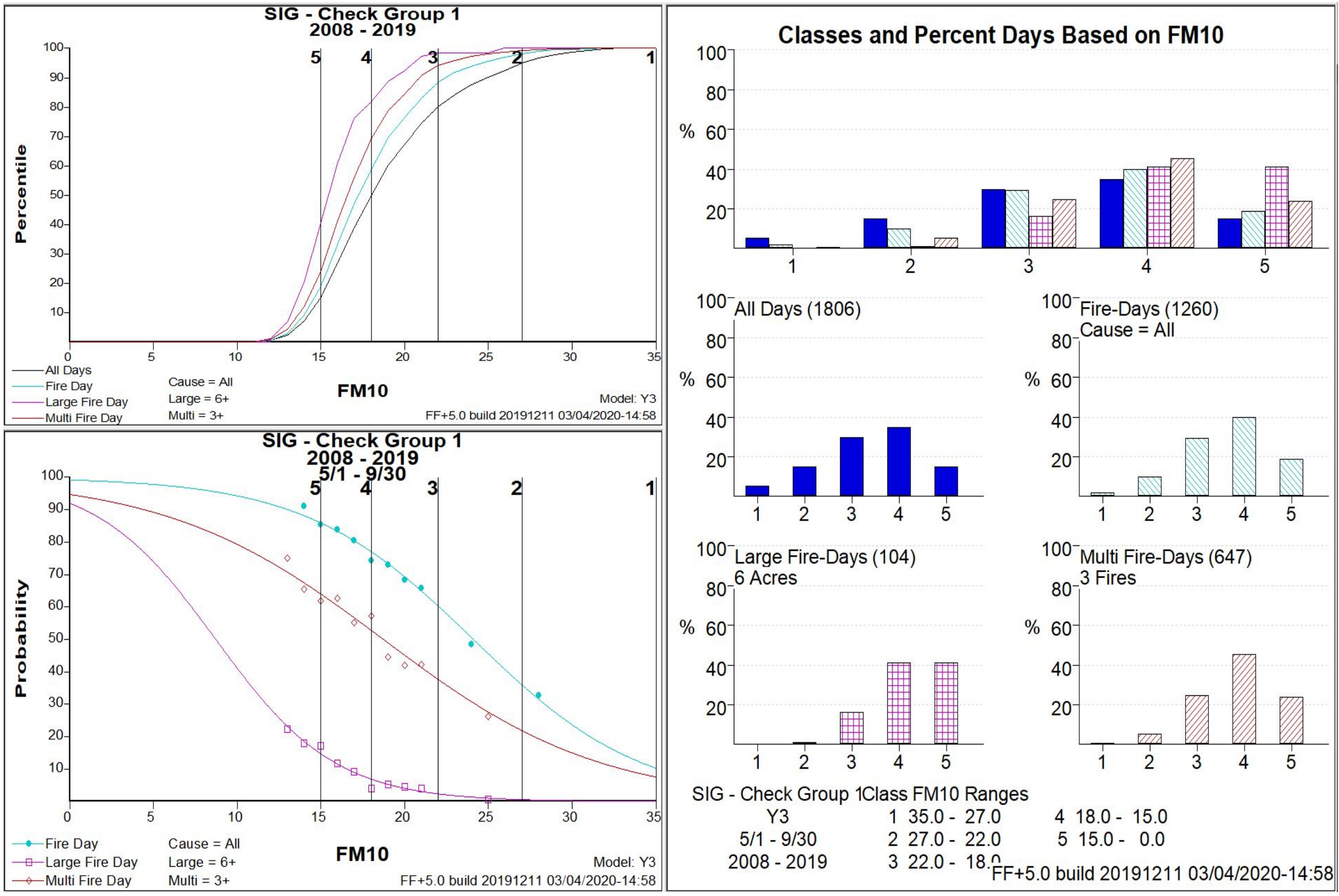


Figure B2.5: 10HR Breakpoints for Lowlands FDRA

TableB2.8: For each 10HR 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. Conditional probability analysis was used to determine these breakpoints.

Class	10HR 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	35-27	89	5	25	2	28	0	0	0	0	5	1	20	6
2	27-22	257	14	111	9	43	1	1	1	0	29	4	26	11
3	22-18	514	28	352	28	68	13	13	4	3	147	23	42	29
4	18-15	626	35	488	39	78	43	41	9	7	274	42	56	44
5	15-0	320	18	284	23	89	47	45	17	15	192	30	68	60

Table B2.9: Response level rating by 10HR range for Lowlands.

Response Level for Lowlands FDRA					
Lowlands 10HR	35-27	27-22	22-18	18-15	15-0
Response Level	1	2	3	4	5

B-3: Coast FDRA Analysis

Description
General Location: The Washington coast from the Columbia River to the Strait of Juan De Fuca and inland between 10 and 35 miles, including the coast range and plains.
Vegetation: Rainforest timber with intermixed coastal prairies encompassing the majority of the natural occurrence of Sitka Spruce in Washington.
Climate: The foothills in the Olympics are the wettest location in the continental US with annual rainfall amounts averaging 150 inches a year, and 70-100 inches per year through the coastal plains and range. Average July high temperatures are near 70 along the coast, and 75 in the foothills. Marine layer fog frequently carries inland during the summer months up to 15 miles. Offshore flow that prevents the marine layer from moving inland and prevents overnight humidity recoveries is the critical fire weather condition for this FDRA.
Topography: Sea level to roughly 3000ft in the Willapa Hills of Southwest Washington and the western foothills of the Olympic Mountains.

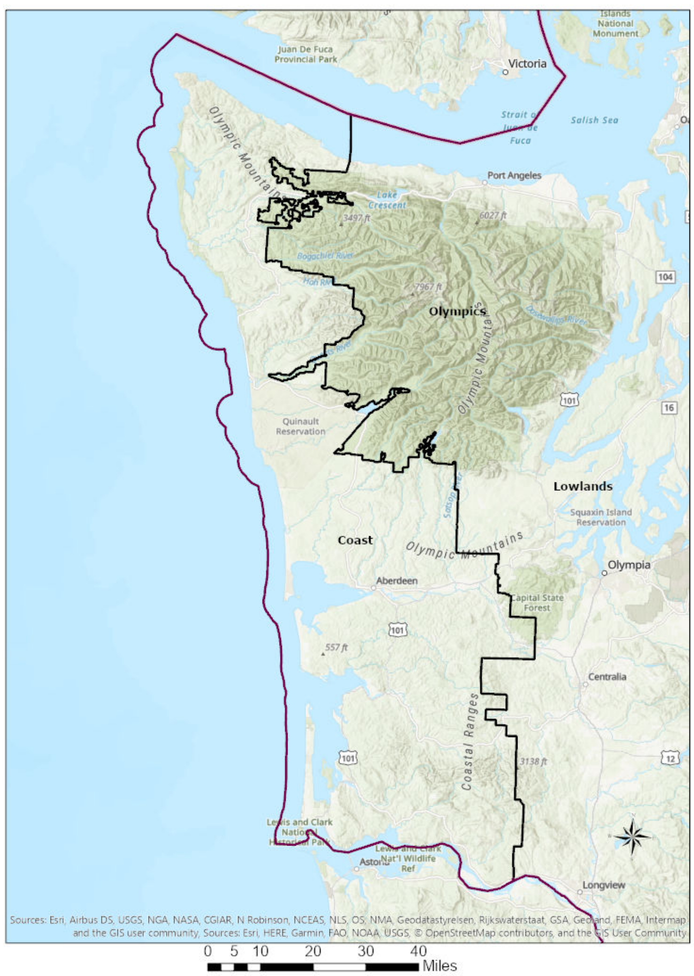


Figure B3.1: Overview map of Coast FDRA.

Fire Danger Problem Analysis

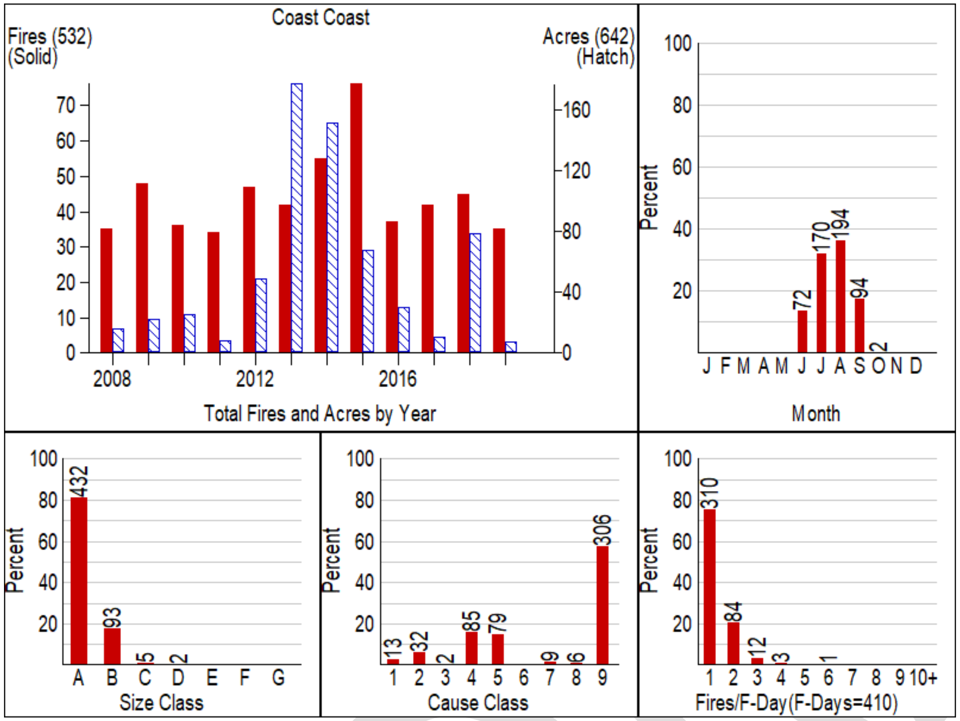


Figure B3.2: Fire Summary Graph for analysis months and years for Coast FDRA

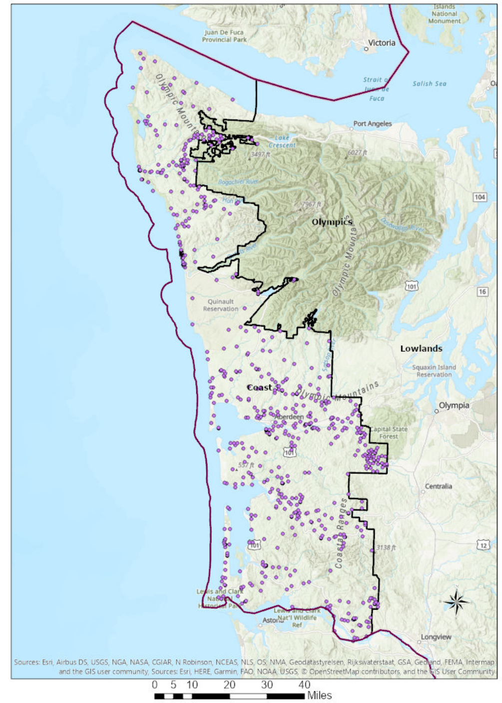


Figure B3.3: Map of fires used for Coast analysis

Table B3.1: Select fire summary graph data for Coast FDRA.

Fire Cause Classes		Fires By Month Lightning vs Human			Fire Size Percentiles	
1	Lightning	Month	Lightning	Human	Percentile	Acres
2	Equipment				100	127
3	Smoking				99	16.2
4	Campfire	June	1	71	98	6.4
5	Debris	July	0	170	97	4.8
6	Railroad	August	7	187	95	3.1
7	Arson	Sept	5	89	90	1
8	Children	Oct	0	2	80	0.3
9	Misc				70	0.1

Season and Size Determination

Table B3.2: Season, large fire size in acres, and multiple fire day used in analysis for Coast FDRA.

Season	Large Fire	Multiple Fire Day
June 1st – October 1st	5	3

Fire Danger Decision Analysis

Table B3.3: The season, large fire, and multiple fire day as defined in the fire problem analysis for Coast FDRA and the number of qualifying weather days, fire days, large fire days, and multiple fire days used in correlation analysis for Coast FDRA.

Season	**Large Fire**	**Multi Fire Day**	**Number of Weather Days**	**Number of Fire Days**	**Number of Large Fire Days**	**Number of Multi Fire Days**
June 1-Oct 1	5 acres	3 or more fires	1475	410	16	16

SIG Catalogue

Table B3.4: Final SIG station parameters as determined through correlation analysis for Coast FDRA.

Station ID	**Name**	**Analysis Years**	**Season**	**NFDRS Fuel Model**	**Slope Class**	**Average Precip**	**Max SC**	**Station Weight**
450130	Ellis MT	2008-2019	June 1 - Oct 1	Y	3	106.00	5	1
450306	Minot LO	2008-2019	June 1 - Oct 1	Y	2	100.00	5	1
450312	Humptulips	2008-2019	June 1 - Oct 1	Y	4	160.00	5	1
450407	Huckleberry Rdg	2008-2019	June 1 - Oct 1	Y	4	120.00	5	1

Correlation Analysis Table

Table B3.5: Correlation values for Coast FDRA. Conditional Probability analysis is shown, but was not used for the Staffing and Adjective rating breakpoints.

SIG/Station#	Variable	Model	Greenup	Freeze	FD Type	FD R^2	FD Chi^2	FD P-Val	FD P-Range	LFD	LFD R^2	LFD Chi^2	LFD P-Val	LFD P-Range	MFD	MFD R^2	MFD Chi^2	MFD P-Val	MFD P-Range
SIG - proposed	BI	Y3	1-Jun	31-Dec	All	0.94	6.27	0.6166	0.12 - 0.61	5 (C)	0.05	4.52	0.8072	0.03 - 0.05	3 (C)	0.23	14.46	0.0706	0.01 - 0.13
450130	BI	Y3P4	1-Jun	31-Dec	All	0.9	8.63	0.3745	0.16 - 0.67	5 (C)	0.23	7.33	0.501	0.02 - 0.09	3 (C)	0.44	5.1	0.7471	0.02 - 0.17
450306	BI	Y2P4	15-May	31-Dec	All	0.88	9.55	0.2979	0.15 - 0.59	5 (C)	0.01	6.67	0.4641	0.03 - 0.04	3 (C)	0.12	16.19	0.0398	0.02 - 0.12
450312	BI	Y4P4	17-Jun	31-Dec	All	0.92	7.62	0.4714	0.15 - 0.56	5 (C)	0.06	4.08	0.85	0.03 - 0.04	3 (C)	0.36	6.9	0.547	0.01 - 0.15
450407	BI	Y4P3	1-Jun	31-Dec	All	0.92	8.1	0.4236	0.14 - 0.55	5 (C)	0.01	11.04	0.1995	0.03 - 0.05	3 (C)	0.01	10.63	0.2238	0.05 - 0.07
SIG - proposed	ERC	Y3	1-Jun	31-Dec	All	0.88	14.56	0.0682	0.12 - 0.67	5 (C)	0	6.15	0.6308	0.03 - 0.04	3 (C)	0.38	9.99	0.2658	0.01 - 0.19
450130	ERC	Y3P4	1-Jun	31-Dec	All	0.92	8.13	0.4207	0.15 - 0.65	5 (C)	0	14.68	0.0658	0.03 - 0.05	3 (C)	0.53	5.27	0.7286	0.02 - 0.16
450306	ERC	Y2P4	15-May	31-Dec	All	0.91	7.78	0.4552	0.14 - 0.68	5 (C)	0.06	6.59	0.5819	0.03 - 0.05	3 (C)	0.43	7.27	0.5075	0.02 - 0.17
450312	ERC	Y4P4	17-Jun	31-Dec	All	0.94	6.37	0.6059	0.14 - 0.68	5 (C)	0.01	5.05	0.7519	0.03 - 0.04	3 (C)	0.44	9.14	0.3307	0.01 - 0.21
450407	ERC	Y4P3	1-Jun	31-Dec	All	0.91	7.73	0.4606	0.13 - 0.68	5 (C)	0	8.75	0.3635	0.04 - 0.04	3 (C)	0.32	4.98	0.7594	0.02 - 0.14
SIG - proposed	FM100	Y3	1-Jun	31-Dec	All	0.85	13.22	0.1044	0.06 - 0.58	5 (C)	0.03	10.8	0.2134	0.03 - 0.06	3 (C)	0.39	8.62	0.3752	0.00 - 0.16
450130	FM100	Y3P4	1-Jun	31-Dec	All	0.88	9.01	0.3416	0.08 - 0.54	5 (C)	0.06	3.83	0.872	0.03 - 0.05	3 (C)	0.52	5.87	0.6621	0.01 - 0.16
450306	FM100	Y2P4	15-May	31-Dec	All	0.93	4.95	0.763	0.07 - 0.60	5 (C)	0.03	12.67	0.0806	0.03 - 0.06	3 (C)	0.4	6.02	0.6452	0.01 - 0.15
450312	FM100	Y4P4	17-Jun	31-Dec	All	0.97	2.82	0.9451	0.08 - 0.57	5 (C)	0.01	8.53	0.2882	0.03 - 0.04	3 (C)	0.57	6.22	0.6227	0.00 - 0.19
450407	FM100	Y4P3	1-Jun	31-Dec	All	0.81	13.26	0.1033	0.08 - 0.57	5 (C)	0	3.27	0.9159	0.04 - 0.04	3 (C)	0.64	3.94	0.8622	0.01 - 0.16
SIG - proposed	FM1000	Y3	1-Jun	31-Dec	All	0.84	12.92	0.1148	0.08 - 0.53	5 (C)	0.04	7.42	0.3863	0.03 - 0.06	3 (C)	0.31	10.7	0.1522	0.00 - 0.13
450130	FM1000	Y3P4	1-Jun	31-Dec	All	0.85	10.2	0.251	0.09 - 0.53	5 (C)	0	6.09	0.5296	0.03 - 0.04	3 (C)	0.38	3.06	0.9306	0.02 - 0.11
450306	FM1000	Y2P4	15-May	31-Dec	All	0.91	5.68	0.6831	0.08 - 0.56	5 (C)	0.03	11.66	0.0699	0.03 - 0.06	3 (C)	0.51	3.21	0.8649	0.02 - 0.12
450312	FM1000	Y4P4	17-Jun	31-Dec	All	0.84	13.77	0.0879	0.08 - 0.57	5 (C)	0.04	12.31	0.0909	0.02 - 0.06	3 (C)	0.77	2.14	0.9517	0.01 - 0.16
450407	FM1000	Y4P3	1-Jun	31-Dec	All	0.87	7.33	0.5013	0.11 - 0.54	5 (C)	0.05	2.43	0.8767	0.03 - 0.05	3 (C)	0.55	3.42	0.8438	0.01 - 0.14

SIG - proposed	KBDI	Y3	1-Jun	31-Dec	All	0.71	18.13	0.0203	0.21 - 0.61	5 (C)	0.2	4.75	0.7841	0.03 - 0.09	3 (C)	0.37	5.97	0.6508	0.02 - 0.16
450130	KBDI	Y3P4	1-Jun	31-Dec	All	0.77	17.68	0.0237	0.21 - 0.62	5 (C)	0.37	5.76	0.6746	0.02 - 0.14	3 (C)	0.01	26.37	0.0009	0.05 - 0.08
450306	KBDI	Y2P4	15-May	31-Dec	All	0.35	41.13	0	0.25 - 0.52	5 (C)	0	6.61	0.4701	0.03 - 0.04	3 (C)	0.15	13.41	0.0985	0.04 - 0.14
450312	KBDI	Y4P4	17-Jun	31-Dec	All	0.37	39.94	0	0.25 - 0.57	5 (C)	0.08	9.05	0.3377	0.03 - 0.07	3 (C)	0.03	26.76	0.0008	0.05 - 0.10
450407	KBDI	Y4P3	1-Jun	31-Dec	All	0.33	40.58	0	0.25 - 0.47	5 (C)	0.18	8.69	0.3695	0.03 - 0.09	3 (C)	0.15	6.08	0.6387	0.04 - 0.10

Decision Points

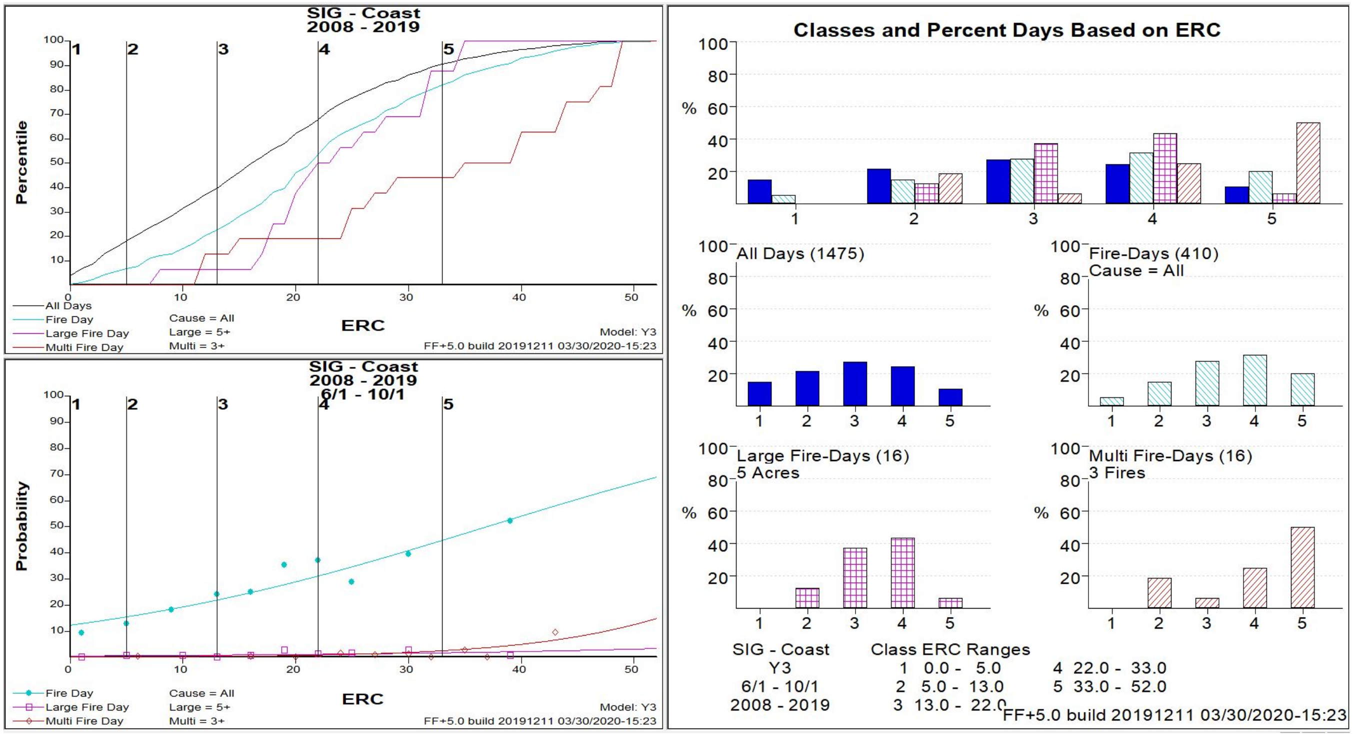


Figure B3.4: ERC-Y Breakpoints for Coast FDRA

Table B3.6: 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. Staffing and Adjective level breakpoints were done without conditional probability analysis.

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	0-4	221	15	23	6	10	0	0	0	0	0	0	0	0
2	5-12	323	22	61	15	19	2	13	3	1	3	19	5	1
3	13-21	406	28	115	28	28	6	38	5	1	1	6	1	0
4	22-32	364	25	129	31	35	7	44	5	2	4	25	3	1
5	33-51	161	11	82	20	51	1	6	1	1	8	50	10	5

Table B3.7: Staffing level and adjective rating by ERC-Y range for Coast.

Staffing Level and Adjective Rating for Coast FDRA					
Coast ERC-Y	0-4	5-12	13-21	22-32	33-51
Staffing Level	1	2	3	4	5
Adjective Rating	Low	Moderate	High	Very High	Extreme

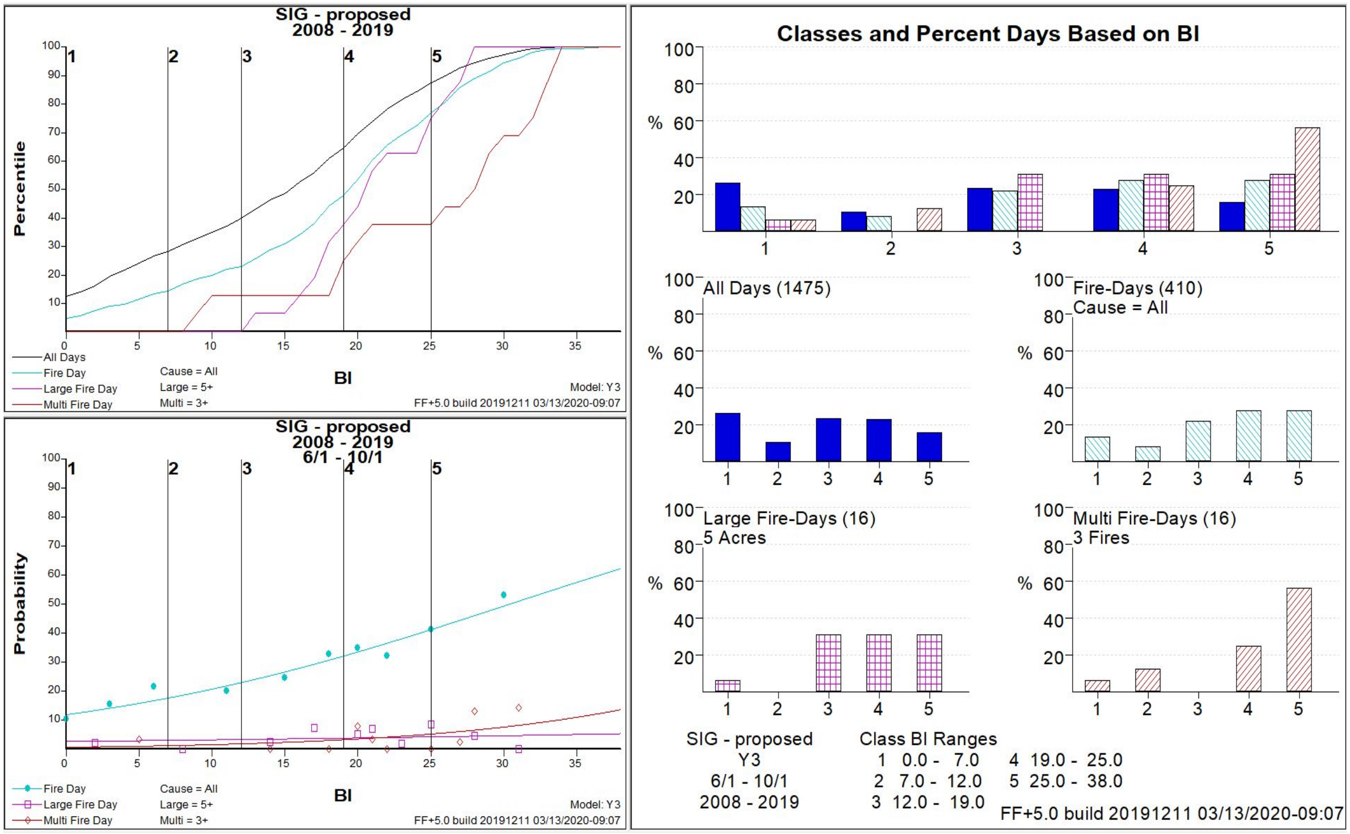


Figure B3.5: Burning Index Breakpoints for Coast FDRA

Table B3.8: For each BI 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. Response level breakpoints were created with a conditional probability analysis.

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	0-6	390	26	55	13	14	1	6	2	0	1	6	2	0
2	7-11	157	11	35	9	22	0	0	0	0	2	13	6	1
3	12-18	350	24	91	22	36	5	31	5	1	0	0	0	0
4	19-24	343	23	115	28	34	5	31	4	1	4	25	3	1
5	25-37	235	16	114	28	49	5	31	4	2	9	56	8	4

Table B3.9: Response level rating by BI range for Coast.

Response Level for Coast FDRA					
Coast BI	0-6	7-11	12-18	19-24	25-37
Response Level	1	2	3	4	5

Fire Danger Rating Area Analysis – Western Washington FDOP

B-4: Cascades FDRA Analysis

General Location: This area includes the western slope of the Cascade Range from approximately 150 feet in elevation to 14,000 feet, just north of the Columbia River to the Canadian Border.

Vegetation: Primarily Timber with understory.

Climate: Annual precipitation ranges from 40 in the shadow of some peaks to 240 inches. The direst months are typically July and August with some years receiving minimal precipitation during this period. Severe years can exhibit continued dry weather through September.

Topography: Terrain is extremely steep and rugged. Elevation varies from approximately 150 feet in the lower river valleys and foothills to 14000' at Mount Rainer. Burnable vegetation is generally confined to elevations less than 6000 feet.

Figure B4.1: Overview map of Cascade FDRA.

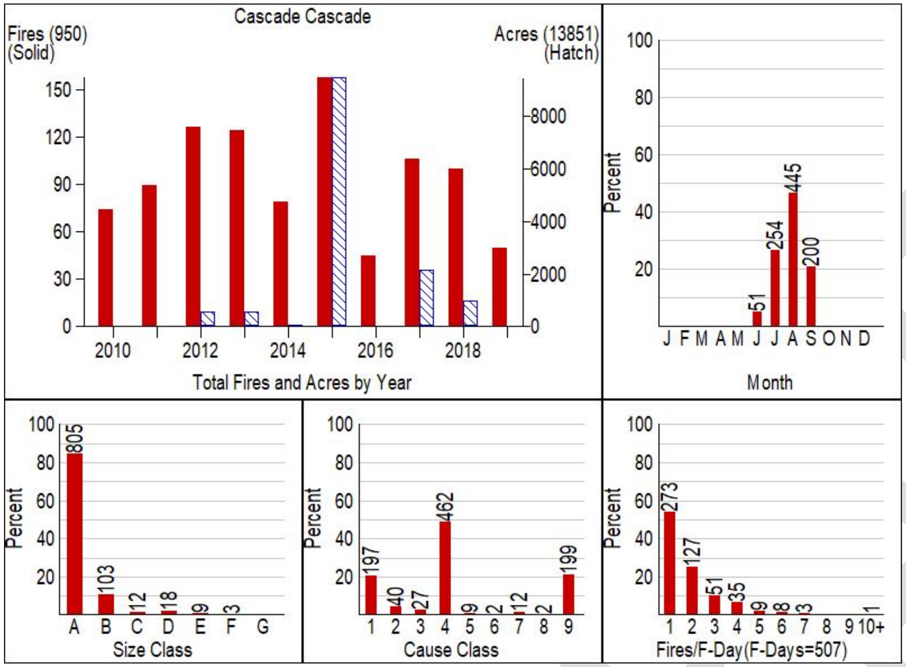


Figure B4.2: Fire Summary Graph for analysis months and years for Cascade FDRA

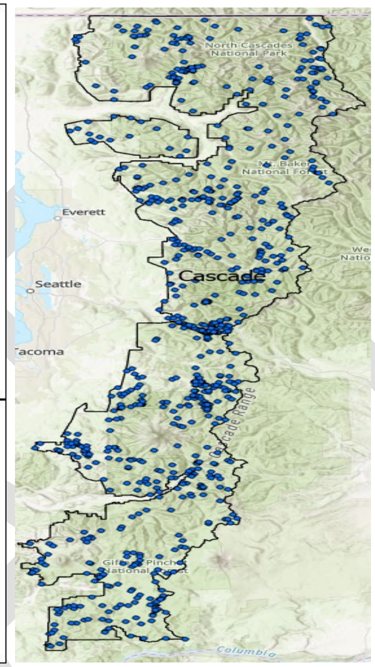


Figure B4.3: Map of fires used for Cascade analysis

Table B4.1: Select fire summary graph data for Cascade FDRA.

Fire Cause Classes		Fires By Month Lightning vs Human			Fire Size Percentiles	
1	Lightning	Month	Lightning	Human	Percentile	Acres
2	Equipment	June (15th)	7	44	100	2961
3	Smoking	July	46	208	99	397
4	Campfire	August	105	340	98	182
5	Debris	Sept	39	161	97	105
6	Railroad				96	15
7	Arson				95	5
8	Children				90	1
9	Misc				80	0.2

Season and Size determination

Table B4.2: Season, large fire size in acres, and multiple fire day used in analysis for Cascade FDRA.

Season	Large Fire	Multiple Fire Day
June 15th-Sept 30th	3 acres	3 fires

Fire Danger Decision Analysis

Table B4.3: The season, large fire, and multiple fire day as defined in the fire problem analysis for Cascade FDRA and the number of qualifying weather days, fire days, large fire days, and multiple fire days used in correlation analysis for Cascade FDRA.

Season	Large Fire	Multiple Fire Day	Number of fire Weather days	Number of Fire Days	Number of Large Fires	Number of Multiple Fire Days
June 15th-Sept 30th	3 acres	3 fires	1080	507	42	107

SIG Catalog

Table B4.4: Final SIG station parameters as determined through correlation analysis for Cascade FDRA.

Station ID	Name	Analysis Years	Analysis Time of Year	NFDRS Fuel Model	Slope Class	Avg Precip	Initial KBDI	Max SC	Herb Annual	Station Weight
451115	HAGER	2010-2019	June 15th-Sept 30th	Y	3	50	100	5	N	1
451509	FINNEY	2010-2019	June 15th-Sept 30th	Y	3	90	100	5	N	1
451718	GREENWATER	2010-2019	June 15th-Sept 30th	Y	4	140	100	5	N	1
451721	FIRE ACADEMY	2010-2019	June 15th-Sept 30th	Y	3	64	100	5	N	1

Correlation Analysis Table

Table B4.5: Correlation values for Cascade FDRA.

SIG/Station	Years	Annual Filter	Variable	Model	FD Type	FD R^2	FD Chi^2	FD P-Val	FD P-Range	LFD Acres	LFD R^2	LFD Chi^2	LFD P-Val	LFD P-Range	MFD Fires	MFD R^2	MFD Chi^2	MFD P-Val	MFD P-Range
451115	2010 - 2019	6/15 - 9/30	ERC	Y3P3	All	0.95	8.62	0.3751	0.10 - 0.94	3	0.85	7.24	0.511	0.00 - 0.51	3	0.78	14.58	0.0677	0.01 - 0.61
451415	2010 - 2019	6/15 - 9/30	ERC	Y4P3	All	0.94	11.01	0.201	0.17 - 0.90	3	0.81	8.7	0.368	0.00 - 0.32	3	0.9	7.93	0.4399	0.02 - 0.45
451504	2010 - 2019	6/15 - 9/30	ERC	Y5P3	All	0.95	7.01	0.5358	0.14 - 0.85	3	0.59	18.3	0.0191	0.00 - 0.25	3	0.72	16.37	0.0374	0.02 - 0.37
451509	2010 - 2019	6/15 - 9/30	ERC	Y3P3	All	0.95	9.3	0.3174	0.19 - 0.92	3	0.84	5.93	0.6549	0.00 - 0.33	3	0.86	7.35	0.4996	0.02 - 0.48
451611	2010 - 2019	6/15 - 9/30	ERC	Y3P3	All	0.89	20.21	0.0096	0.15 - 0.91	3	0.87	3.9	0.8661	0.00 - 0.33	3	0.87	6.08	0.6383	0.02 - 0.47
451613	2010 - 2019	6/15 - 9/30	ERC	Y3P3	All	0.93	13.5	0.0958	0.14 - 0.92	3	0.83	6.53	0.5882	0.00 - 0.35	3	0.89	5.68	0.6833	0.02 - 0.48
451705	2010 - 2019	6/15 - 9/30	ERC	Y3P3	All	0.96	7.82	0.4516	0.09 - 0.87	3	0.78	9.55	0.2977	0.00 - 0.26	3	0.92	4.16	0.8425	0.01 - 0.41
451718	2010 - 2019	6/15 - 9/30	ERC	Y4P3	All	0.97	5.03	0.7544	0.08 - 0.92	3	0.83	7.44	0.4904	0.00 - 0.33	3	0.85	10.75	0.2162	0.01 - 0.50
451721	2010 - 2019	6/15 - 9/30	ERC	Y3P3	All	0.94	11.58	0.1708	0.14 - 0.93	3	0.83	7.87	0.4464	0.00 - 0.35	3	0.8	13.44	0.0977	0.02 - 0.50
451917	2010 - 2019	6/15 - 9/30	ERC	Y1P3	All	0.96	8.71	0.3671	0.04 - 0.90	3	0.9	3.49	0.9001	0.00 - 0.35	3	0.88	8.53	0.3831	0.00 - 0.47
451919	2010 - 2019	6/15 - 9/30	ERC	Y3P3	All	0.89	19.4	0.0129	0.08 - 0.91	3	0.77	8.51	0.3849	0.00 - 0.39	3	0.87	8.22	0.4126	0.01 - 0.54
451921	2010 - 2019	6/15 - 9/30	ERC	Y3P3	All	0.95	8.13	0.4206	0.16 - 0.92	3	0.83	14.15	0.078	0.00 - 0.43	3	0.77	15.99	0.0426	0.02 - 0.49
451924	2010 - 2019	6/15 - 9/30	ERC	Y3P3	All	0.98	3.57	0.8937	0.08 - 0.93	3	0.93	3.53	0.8971	0.00 - 0.47	3	0.84	11.77	0.162	0.01 - 0.53
SIG - Cascade-Finney, Fire Acad, Green, Hager	2010 - 2019	6/15 - 9/30	ERC	Y4	All	0.97	6.24	0.6208	0.11 - 0.93	3	0.85	6.24	0.6204	0.00 - 0.36	3	0.83	11.66	0.167	0.01 - 0.52

SIG - Cascadev1- Dry, Fire Acad, Hager, Green, Gold	2010 - 2019	6/15 - 9/30	ERC	Y3	All	0.97	6.01	0.6466	0.09 - 0.94	3	0.84	6.87	0.5509	0.00 - 0.39	3	0.86	10.93	0.2055	0.01 - 0.53
SIG - Cascadev2- Finney, Fire Acad, Green	2010 - 2019	6/15 - 9/30	ERC	Y4	All	0.98	3.39	0.9074	0.10 - 0.92	3	0.89	4.64	0.7953	0.00 - 0.36	3	0.86	11.02	0.2004	0.01 - 0.50
SIG - Cascadev4- Dry, Finney, Fire Acad, Green, Sumas	2010 - 2019	6/15 - 9/30	ERC	Y3	All	0.96	7.25	0.5102	0.10 - 0.92	3	0.81	11.48	0.1758	0.00 - 0.34	3	0.82	14.8	0.0631	0.01 - 0.49
SIG - Cascadev5- Finney, Hager, Johnson, Lester, Sumas	2010 - 2019	6/15 - 9/30	ERC	Y3	All	0.95	9	0.3421	0.11 - 0.92	3	0.83	8.93	0.3483	0.00 - 0.35	3	0.83	12.43	0.1332	0.01 - 0.48

Decision Points

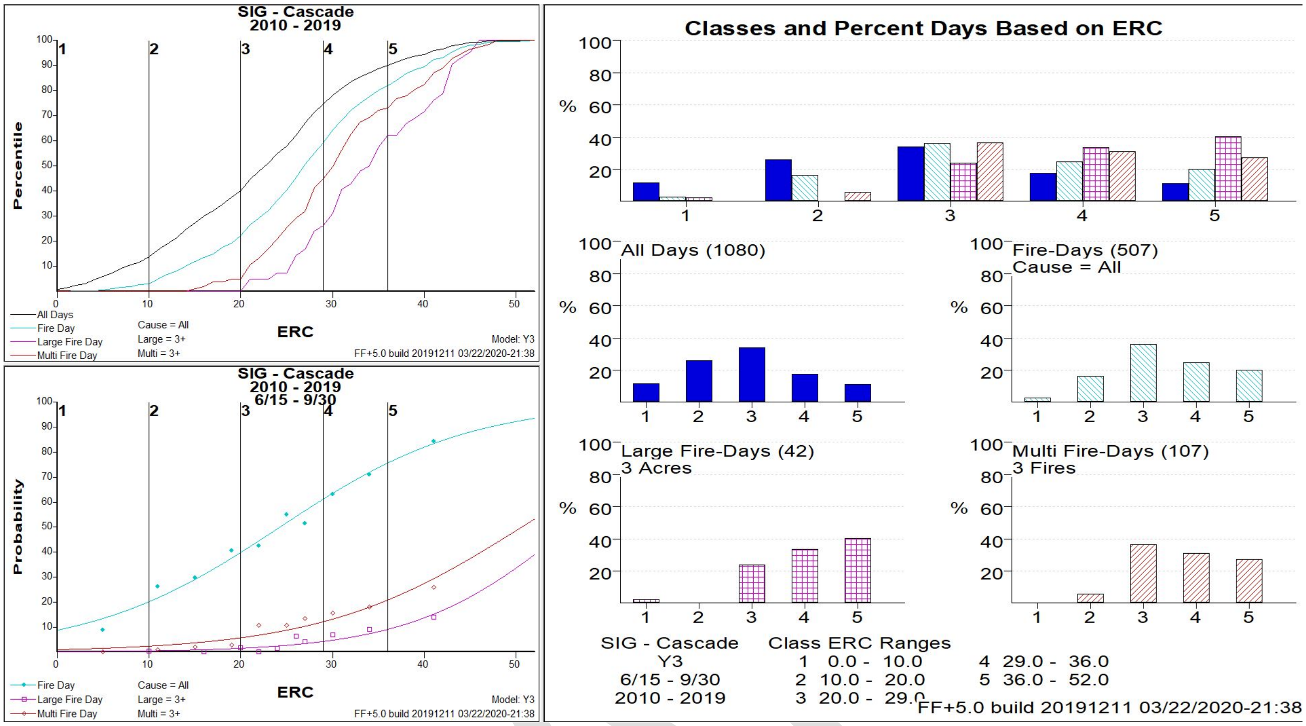


Figure B4.4: ERC-Y Breakpoints for Cascade FDRA

Table B4.6: 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	0-9	126	12	14	3	11	1	2	7	1	0	0	0	0
2	10-19	278	26	83	16	30	0	0	0	0	6	6	7	2
3	20- 28	365	34	183	36	50	10	24	5	3	39	36	21	11
4	29- 35	188	17	126	25	67	14	33	11	7	33	31	26	18
5	36- 51	123	11	101	20	82	17	40	17	14	29	27	29	24

Table B4.7: Staffing level and adjective rating by ERC-Y range for Coast.

Staffing Level and Adjective Rating for Cascade FDRA					
Cascade ERC-Y	0-9	10-19	20-28	29-35	36-51
Staffing Level	1	2	3	4	5
Adjective Rating	Low	Moderate	High	Very High	Extreme

Future and Continued Needs

Snow flags will continue to be needed with the transition to NFDRS 2016. The current status of snow flags is lacking with some stations reporting no snow flags for several years. At a minimum these need to be identified for each station for winter 2019 and maintained for all season into the future.

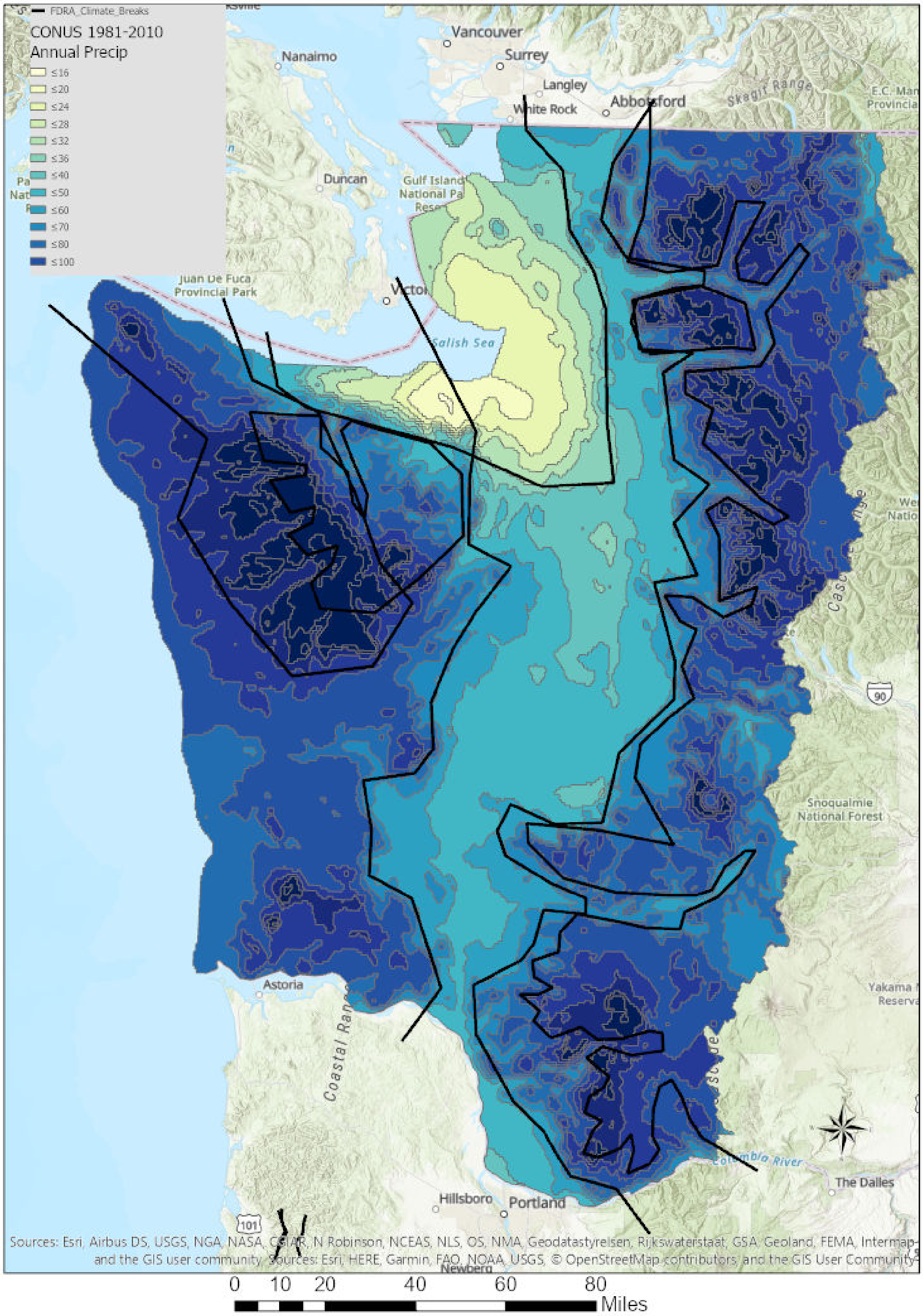
Station downtime is a critical factor in determining NFDRS outputs. NFDRS 2016 now uses all 24 hours of observations to calculate fuel moistures. With this, the ability to modify the daily 1300 weather observations to control NFDRS outputs is lost. Therefore, station downtime must be avoided to the fullest extent possible.

A fires analysis for this FDRA should be performed with large fires not broken into growth days and as needed a re-examination of the FDRA being split north/south.

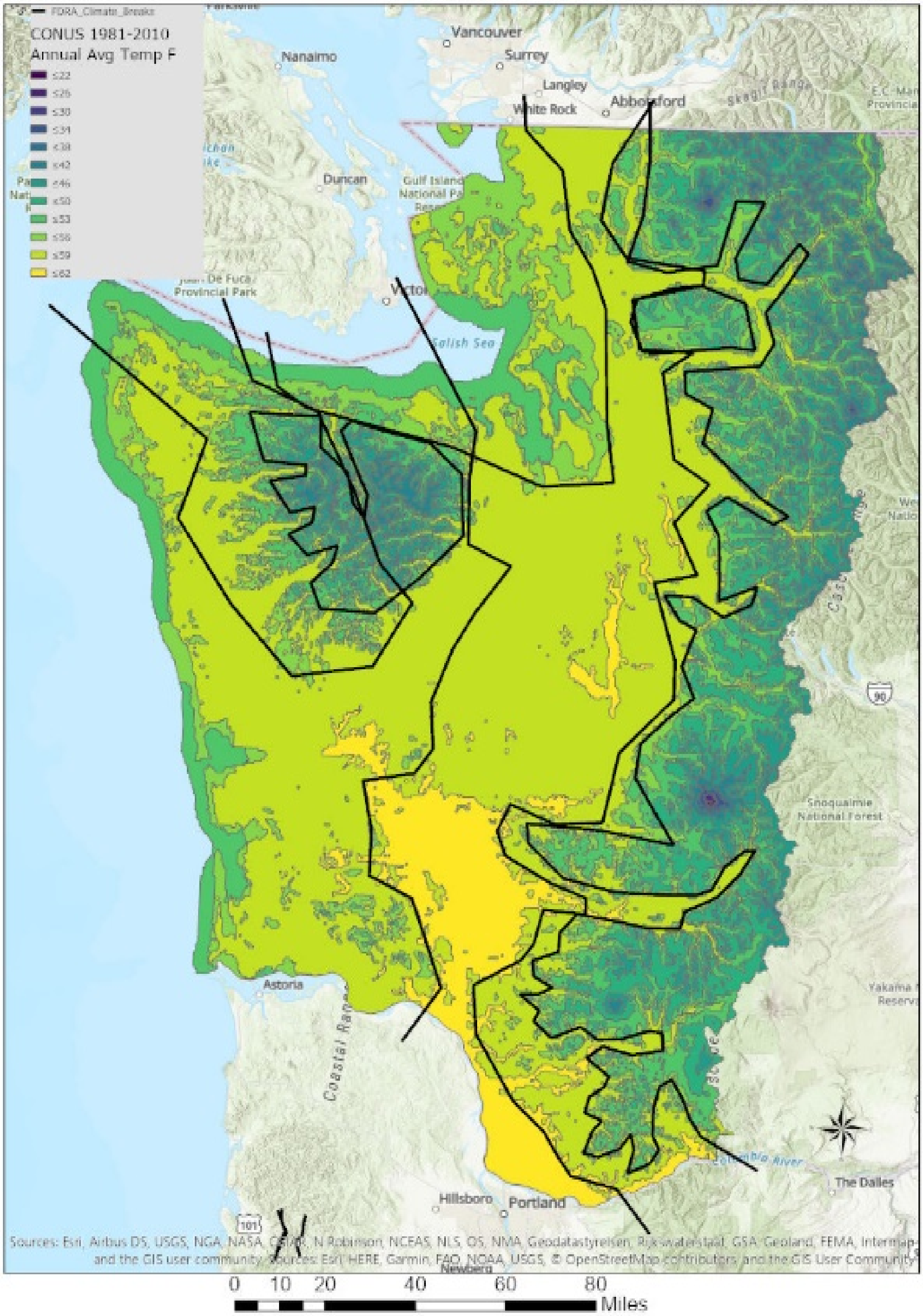
Some CEFA data for this FDRA has errors. Stations with previously unidentified errors needs to be forwarded to Tim Brown at DRI.

Appendix C: FDRA Delineations

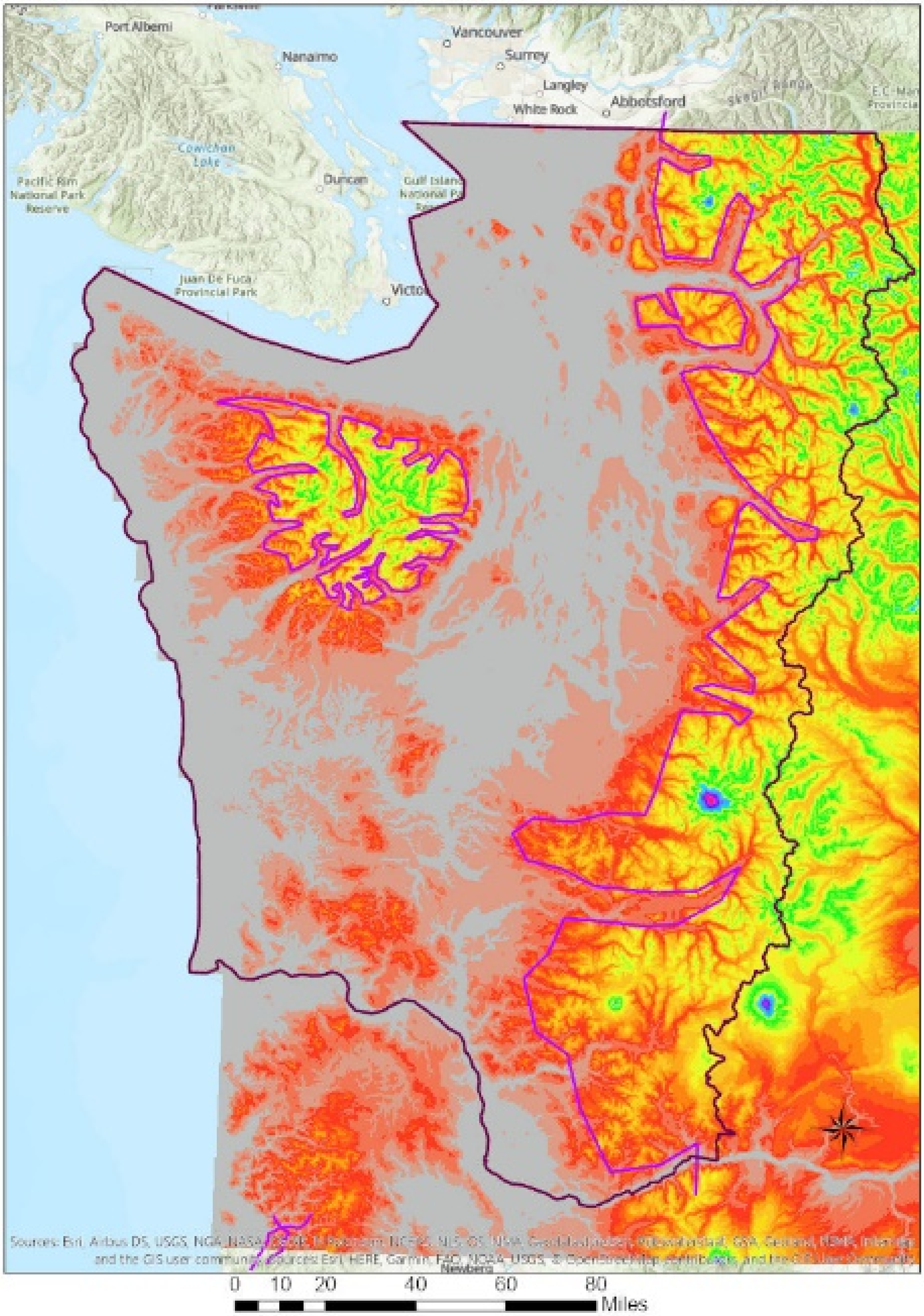
Climate delineations with annual precipitation PRISM 1981-2010.



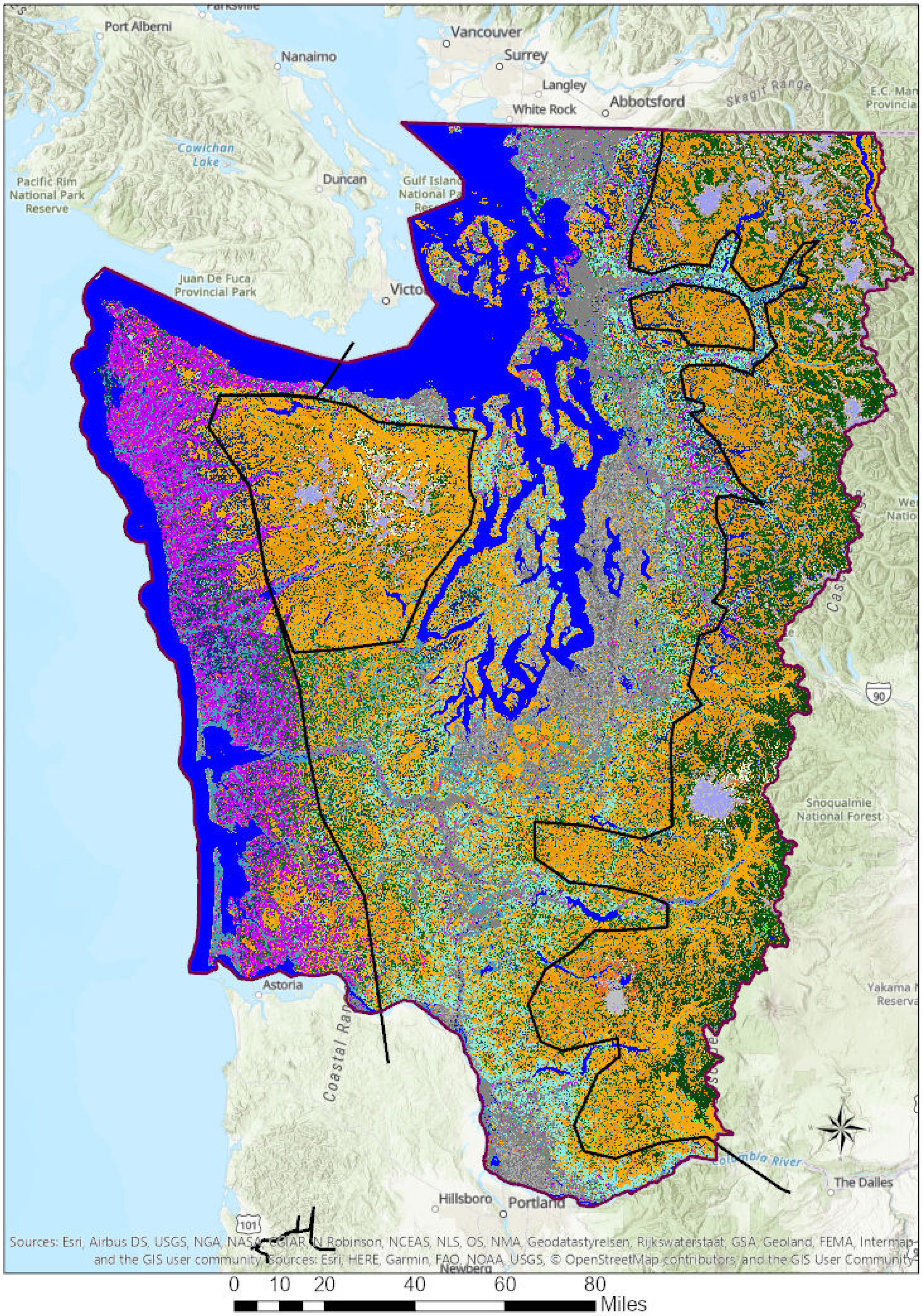
Climate delineations with Annual mean temperature PRISM 1981-2010.



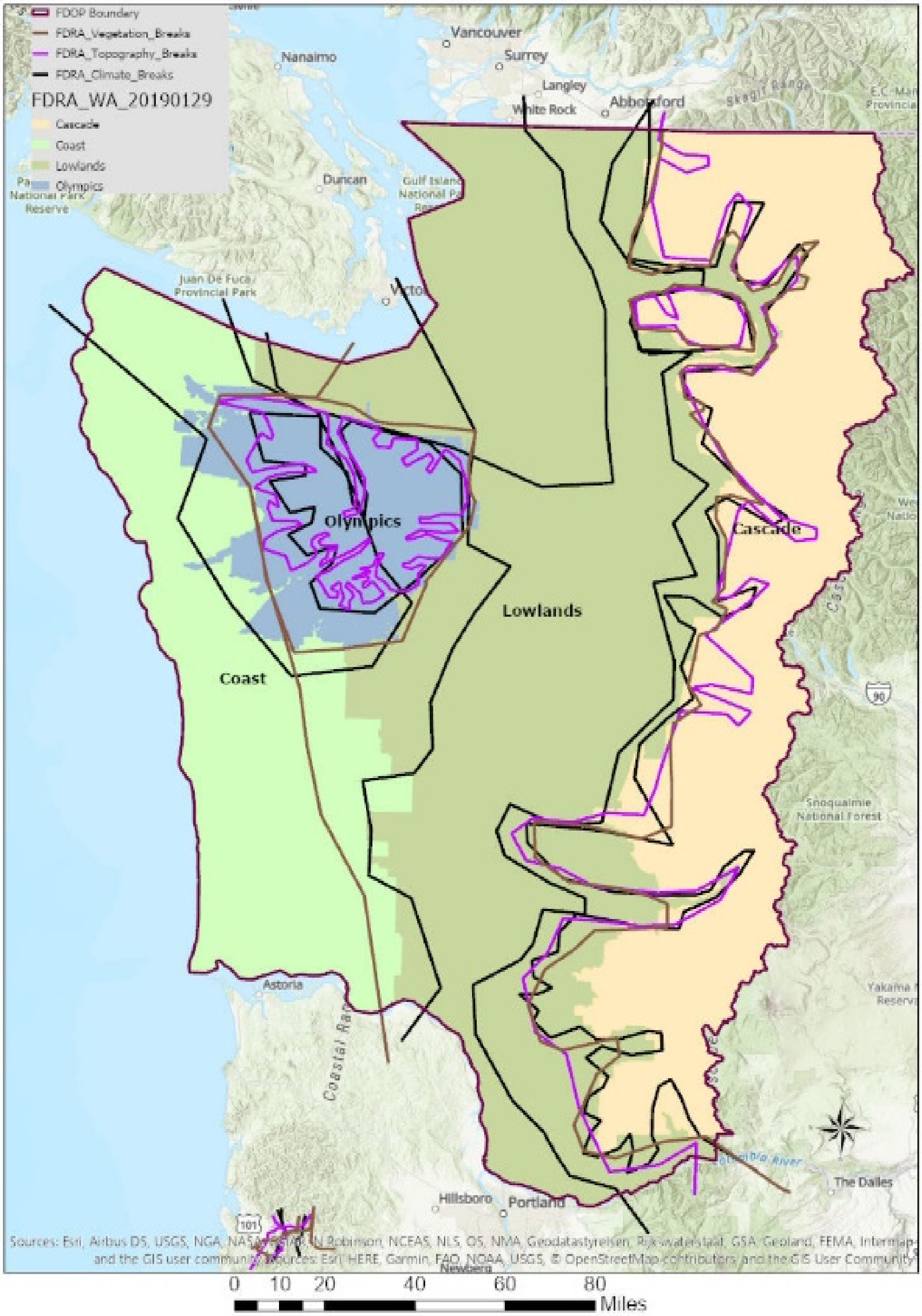
FDRA lines delineated by Elevation



FDRA lines delineated with Existing Vegetation Type. LANDFIRE EVT 2014.



Final FDRAs with Climate, Topographic and, and Vegetation lines overlayed.



**Note that several small boundary adjustments and a merge have been made since these appendices images were produced.*

Appendix D: Large Fire Growth Days

Table D1: Large fire growth days, determined through fire progression mapping. Not all fires were used if they fell outside the analysis timeframe.

FDRA	UnitID	Growth Date	TotalAcres	FireName
Olympics	OLF	7/26/2006	500	Bear Gulch 2
Olympics	OLF	8/4/2006	1600	Bear Gulch 2_1
Olympics	OLF	8/5/2018	1364	Maple
Olympics	OLF	8/16/2018	788	Maple_1
Olympics	OLF	8/25/2018	1120	Maple_2
Olympics	WA-OLP	8/6/2010	0.1	Hopper
Olympics	WA-OLP	8/13/2010	330	Hopper_1
Olympics	WA-OLP	7/29/2016	0.1	Ignar
Olympics	WA-OLP	8/26/2016	135	Ignar_1
Olympics	WA-OLP	6/23/2009	0.1	Ten Mile
Olympics	WA-OLP	7/30/2009	150	Ten Mile_1
Olympics	WA-OLP	8/25/2009	667	Ten Mile_2
Olympics	OLF	9/1/2011	0.1	Big Hump
Olympics	OLF	9/3/2011	1100	Big Hump_1
Olympics	WA-OLP	6/15/2015	368	Paradise
Olympics	WA-OLP	6/21/2015	883	Paradise_1
Olympics	WA-OLP	7/5/2015	541	Paradise_2
Olympics	WA-OLP	8/1/2015	653	Paradise_3
Olympics	WA-OLP	8/20/2015	376	Paradise_4
Olympics	WA-OLP	7/29/2009	299	Buckinghorse
Olympics	WA-OLP	7/11/2009	0.1	Constance
Olympics	WA-OLP	7/29/2009	430	Constance_1
Olympics	WA-OLP	7/29/2009	127	Knife
Olympics	WA-OLP	7/25/2016	20	Godkin
Olympics	WA-OLP	8/20/2016	805	Godkin_1
Olympics	WA-OLP	7/26/2019	0.1	Hayes 2
Olympics	WA-OLP	7/29/2016	175	Hayes 2_1
Olympics	WA-OLP	8/20/2016	2300	Hayes 2_3
Olympics	WA-OLP	7/23/2016	0.1	Cox Valley
Olympics	WA-OLP	8/18/2018	75	Cox Valley_1
Olympics	WA-OLP	9/12/2016	50	Cox Valley_2
Olympics	WA-OLP	9/7/2003	0.1	Griff
Olympics	WA-OLP	9/27/2003	820	Griff
Cascade	WA-NPC	8/5/2003	0.1	Tricouni
Cascade	WA-NPC	8/17/2003	52.7	Tricouni_1
Cascade	WA-NPC	8/19/2003	100.1	Tricouni_2

Cascade	WA-NPC	8/23/2003	51.1	Tricouni_final
Cascade	WA-NPC	5/30/2015	15	ThunderCreek
Cascade	WA-NPC	5/31/2015	47	ThunderCreek_1
Cascade	WA-NPC	6/4/2015	41	ThunderCreek_2
Cascade	WA-NPC	8/15/2015	0.1	Klawatti
Cascade	WA-NPC	9/7/2015	121.9	Klawatti_1
Cascade	WA-NPC	8/15/2015	1.5	Snowfield
Cascade	WA-NPC	8/26/2015	182.5	Snowfield_1
Cascade	WA-NPC	9/7/2015	122	Snowfield_2
Cascade	WA-NPC	8/1/2009	0.5	Elija
Cascade	WA-NPC	8/2/2009	72.6	Elija_1
Cascade	WA-NPC	8/6/2009	280.4	Elija_2
Cascade	WA-NPC	8/19/2009	46.3	Elija_3
Cascade	WA-NPC	8/12/2015	7	Goodell
Cascade	WA-NPC	8/18/2015	148	Goodell_1
Cascade	WA-NPC	8/19/2015	2961	Goodell_2
Cascade	WA-NPC	8/24/2015	452	Goodell_3
Cascade	WA-NPC	8/25/2015	979	Goodell_4
Cascade	WA-NPC	8/26/2015	926	Goodell_5
Cascade	WA-NPC	8/27/2015	1137	Goodell_6
Cascade	WA-NPC	8/28/2015	397	Goodell_7
Cascade	WA-NPC	6/28/2009	2	Panther
Cascade	WA-NPC	7/2/2009	58	Panther_1
Cascade	WA-NPC	7/3/2009	63.4	Panther_2
Cascade	WA-NPC	7/15/2009	87.6	Panther_3
Cascade	WA-NPC	8/15/2015	0.1	CatIsland
Cascade	WA-NPC	8/27/2015	147.9	CatIsland_1
Cascade	WA-NPC	8/17/2003	10.4	BigBeaver
Cascade	WA-NPC	8/30/2003	81.5	BigBeaver_1
Cascade	WA-NPC	8/31/2003	358.1	BigBeaver_2
Cascade	WA-NPC	9/1/2003	187.1	BigBeaver_3
Cascade	WA-NPC	9/3/2003	380.9	BigBeaver_4
Cascade	WA-NPC	9/4/2003	136	BigBeaver_5
Cascade	WA-NPC	9/5/2003	274	BigBeaver_6
Cascade	WA-NPC	9/6/2003	281	BigBeaver_7
Cascade	WA-NPC	9/7/2003	263.7	BigBeaver_8
Cascade	WA-NPC	9/9/2003	97.6	BigBeaver_9
Cascade	WA-NPC	9/14/2003	97	BigBeaver_10
Cascade	WA-NPC	10/2/2003	133.4	BigBeaver_11
Cascade	WA-NPC	8/10/2015	0.5	ThursdayCreek
Cascade	WA-NPC	8/16/2015	272.5	ThursdayCreek_1
Cascade	WA-NPC	8/22/2015	208	ThursdayCreek_2

Cascade	WA-NPC	8/26/2015	85	ThursdayCreek_3
Cascade	WA-NPC	9/3/2003	20	NoName
Cascade	WA-NPC	9/6/2003	135.7	NoName_1
Cascade	WA-NPC	9/7/2003	357.5	NoName_2
Cascade	WA-NPC	9/9/2003	91.9	NoName_3
Cascade	WA-NPC	9/14/2003	113.4	NoName_4
Cascade	WA-NPC	10/2/2003	296.6	NoName_5
Cascade	WA-NPC	8/11/2015	0.1	NoName15
Cascade	WA-NPC	8/24/2015	412.9	NoName15_1
Cascade	WA-NPC	8/26/2015	143	NoName15_2
Cascade	WA-NPC	8/2/2009	3	BrushCreek
Cascade	WA-NPC	8/30/2009	155.6	BrushCreek_1
Cascade	WA-NPC	9/3/2009	60.8	BrushCreek_2
Cascade	WA-NPC	9/8/2009	45	BrushCreek_3
Cascade	WA-NPC	7/17/2013	5	ArcticDan
Cascade	WA-NPC	8/1/2013	239	ArcticDan_1
Cascade	WA-NPC	8/8/2008	2	Arctic
Cascade	WA-NPC	8/16/2008	79.1	Arctic_1
Cascade	WA-NPC	9/10/2008	62.5	Arctic_final
Cascade	WA-NPC	8/12/2015	10	RockyBeaver
Cascade	WA-NPC	8/16/2015	113	RockyBeaver_1