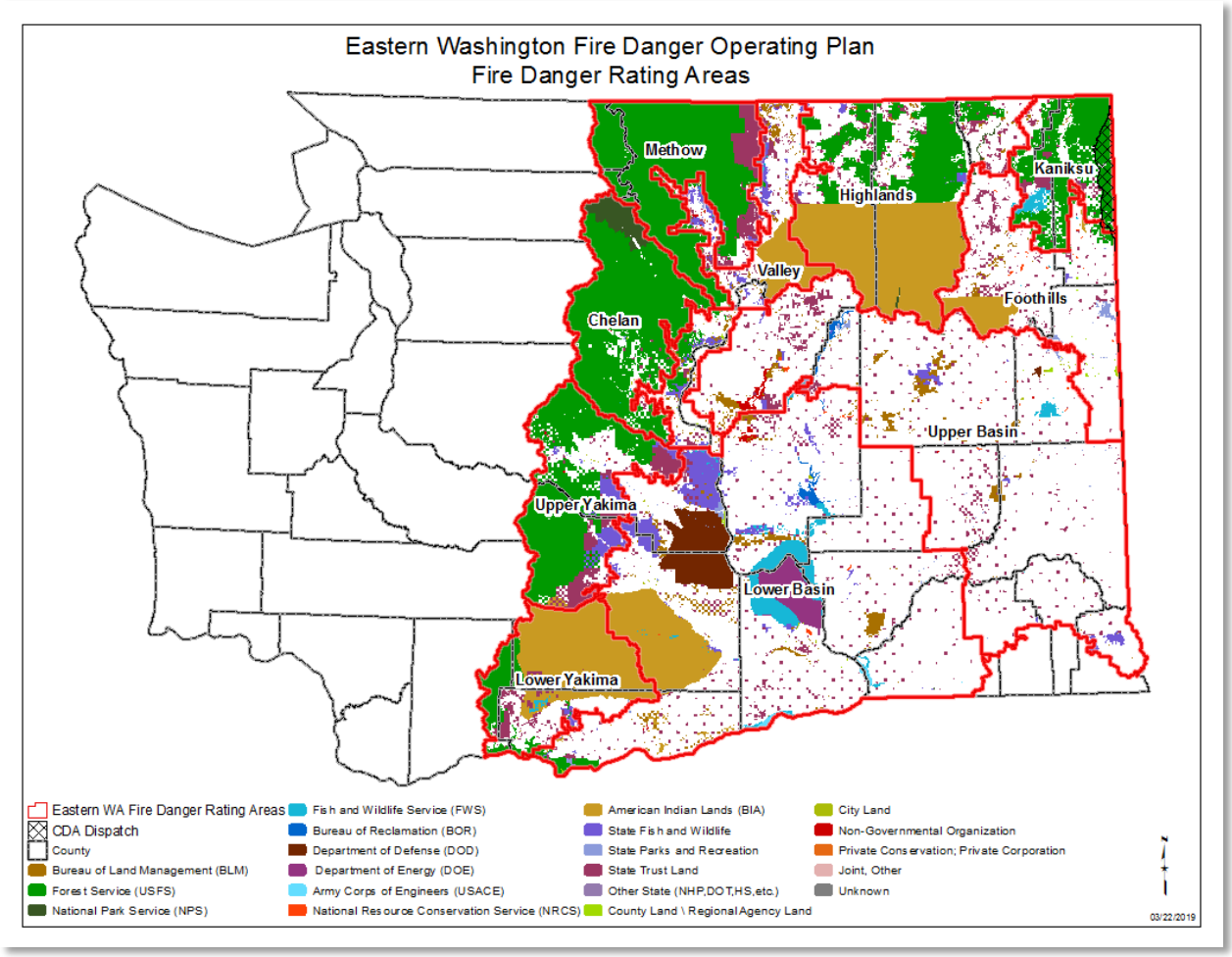
Central and Northeast Washington

Interagency Fire Danger Operating Plan



Version: 5/1/2019 (Edited 1/31 to make several corrections, no operational changes result)

This plan is compatible with NFDR16, expires 5/1/2022.

Central and Northeast Washington

Interagency Fire Danger Operating Plan

Approved by:

Signatories to this plan include the following agencies.

- Bureau of Land Management, Spokane District
- Chelan County
- National Park Service, Lake Roosevelt National Recreation Area
- National Park Service, North Cascades National Park
- US Fish and Wildlife Service, Columbia National Wildlife Refuge Complex
- US Fish and Wildlife Service, Inland Northwest National Wildlife Refuge Complex
- US Forest Service, Colville National Forest
- US Forest Service, Okanogan Wenatchee National Forest
- Washington State Department of Natural Resources, Northeast Region
- Washington State Department of Natural Resources, Southeast Region

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

Agency Administrator Printed Name:

Agency Administrator Signature:

Contents

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 a science-based tool for incorporating a measure of risk associated with 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.

1.1.1 Fire Danger Operating Plan

Interagency policy and guidance requires 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 others, as depicted below.

This FDOP guides the application of information from NFDRS at the local level 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.

1.1.1.1 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, one burning period, Fourth of July 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.

1.1.1.2 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 in with the individual agency-unit.

1.1.1.3 Prevention Plan

Prevention plans document the wildland fire problems identified by a prevention analysis. 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 in the Central and Northeast Washington are documented in this FDOP; the associated decisions and planned actions are located in with the individual agency-unit.

1.1.1.4 Restriction Plan

A restriction plan is an interagency document that outlines interagency 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 to an unplanned ignition within a defined geographic area based on fire danger, fire management objectives, and resource availability. Response levels are identified and documented in this FDOP. The number and type of suppression resources dispatched to a reported fire is documented in the associated initial response plan (contained within the Local Mobilization Plan for WACWC and WANEC).

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 WACWC and WANEC websites.

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. Department of Agriculture Forest Service - Manual 5120
- U.S. Department of the Interior, Bureau of Land Management - Manual 9211-1
- U.S. Department of the Interior, National Park Service - Manual 18, Chapter 5
- Fish and Wildlife Service - Fire Management Handbook, Chapter 10
- 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 fire business decisions.
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. Determine appropriate preparedness breakpoints and thresholds using an integrated database of historical fire weather and fire occurrence data.
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. Determine the most effective 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 seasonal risk analysis criteria and establish general fire severity thresholds.
9. Identify the development and distribution of fire danger pocket cards to all personnel involved with fire suppression within the fire danger planning area.
10. Identify program needs and suggest improvements for implementation of the Fire Danger Operating Plan.

2.0 Fire Danger Planning Area Inventory and Analysis

2.1 Administrative Units

This document supports consistent application of fire danger decisions applied across multiple jurisdictional boundaries. Wildland fire management and suppression responsibilities are shared among Federal, State, and local cooperators. Administrative units participating in this plan can be found on the signature page.

2.2 Weather Stations

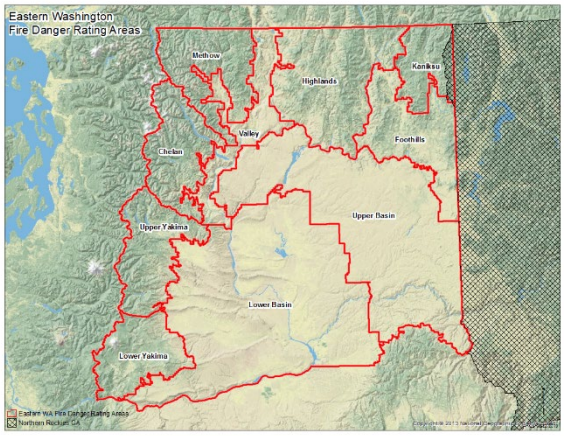
All RAWS used in this plan to produce NFDR outputs comply with the National Wildfire Coordinating Group (NWCG) weather station standards and guidelines (PMS 426-3). Each RAWS receives, at a minimum, one annual on-site maintenance visit by either the local user or contracted personnel to ensure sensors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

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 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 or 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 as advised by WACWC and WANEC. It is important that response areas utilized, in this case local fire district boundaries, are 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.



2.3.1 FDRA Descriptions

The following broad regional descriptions were mostly lifted from the Western Region Climate Center state climate narratives.

2.3.1.1 East Slope Cascades (Chelan, Methow, Lower and Upper Yakima FDRAs)

General Location: This area extends from the summit of the Cascades eastward for distances varying from 25 to 75 miles and from the Canadian Border to the Columbia River. The area was further broken from north to south after the initial analysis along major hydrological divides and the Yakama response boundary to; reduce total FDRA size, account for changes in slope, fire business, and fire response. Currently the Yakama Nation are not participants in this plan.

Vegetation: Timber.

Climate: One of the outstanding features of the climate is the decrease in precipitation along the eastern slope of the mountains as the distance from the summit increases and the elevation decreases. For example, within a distance of 20 miles, the average annual precipitation decreases from 92 inches at Stampede pass (elevation 3,958 ft.) to 22 inches at Cle Elum (elevation 1,920 ft.*).*

Topography: In an easterly direction elevation decreases from the summit of the Cascade Mountain Range to approximately 2,000 feet above sea level.

2.3.1.2 Valley FDRA

General Location: This area includes fruit producing valleys along the Okanogan, Methow and Columbia Rivers, grazing land along the southern Okanogan highlands, the Waterville Plateau and part of the channeled scablands.

Vegetation: Grass and Brush.

Climate: The annual precipitation increases from 11 inches in the valley to 16 inches over some of the Plateau. Winter season snowfall varies from 30 to 70 inches. Both rainfall and snowfall increase in the higher elevations.

Topography: Elevation varies from approximately 1,000 feet in the lower river valleys to 3,000 feet over the Waterville Plateau and Okanogan highlands. North-south ranges of mountains extending into southern British Columbia reach elevations of 4,000 to 5,000 feet within a few miles of the Okanogan River.

2.3.1.3 Columbia Basin (Lower and Upper Basin FDRAs)

General Location: The [Columbia] Basin includes the Ellensburg valley, the central plains area in the Columbia basin south from the Waterville Plateau to the Oregon border and east to near the Palouse River. The southeastern most boundary was snapped to the existing Blue Mountains FDOP and is within the BMICC area of response.

Vegetation: Grass and Brush.

Climate: This is the lowest and driest section in eastern Washington. Annual precipitation ranges from seven inches in the drier localities along the southern slopes of the Saddle Mountains, Frenchman Hills and east of Rattlesnake Mountains, to 15 inches in the vicinity of the Blue Mountains. Summer precipitation is usually associated with thunderstorms. During July and August, it is not unusual for four to six weeks to pass without measurable rainfall.

Topography: Elevation increases from approximately 400 feet at the confluence of the Snake and Columbia Rivers to 1,300 feet near the Waterville Plateau and 1,800 feet along the eastern edge of the area.

2.3.1.4 Northeastern (Foothills, Highlands, Kaniksu FDRAs)

General Location: The northeastern and higher elevations of the Okanogan highlands, the Selkirk Mountains, and the lower elevations southward to the vicinity of the Spokane River are included in the northeastern area.

Vegetation: Timber.

Climate: The average annual precipitation increases in a northeasterly direction from 17 inches in the Spokane area to 28 inches in the northeastern corner of the State.

Topography: Ranges of mountains in this section of the State are separated by narrow north-south valleys. The elevation increases from 2,000 feet in the valleys to 6,000 feet along the higher ridges.

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 2006 to 2015) 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 the Appendix B.

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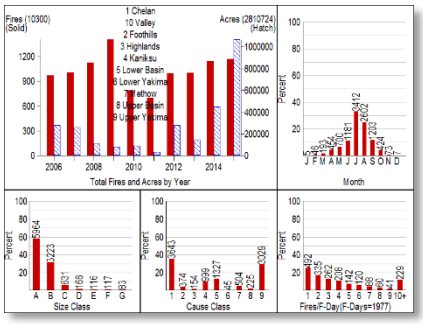


Fire Season: April through October (97% of fires)
Top 3 Fire Causes: Lightning, Debris Burning, and Campfires
Percent Human Caused: 61%
Fire Size (ac.) Percentiles 90/95/97: 11/79/300

3.2 Identification/Definition of the Fire Problem(s)

The ability to regulate, educate, or control 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).

The following table broadly identifies and defines the fire problem in Central and Northeast 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	WACWC/WANEC communicates fire weather (LAL) and fire danger (SL and PL)	Fires which exceed the units capability to manage due growth on the discovery day
Agency	Agency suppression resources and fire managers	1 - Lightning	Abundant Lightning	High	WACWC/WANEC communicates fire weather (LAL) and fire danger (SL and PL)	Fires which exceed the units capability to manage because they cannot be staffed on discovery and 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 operating on public lands	2 - Equipment	Any ignition associated with the target group from chainsaws to yarding	Moderate	WACWC/WANEC communicates IFPL for agency personnel, state posts on internet for public	Ignitions which become large fires resulting from industrial forest operations (equipment and smoking)
Public	Private Landowners	5 - Debris Burning	Escaped debris burns	Low	WACWC/WANEC PIO 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.

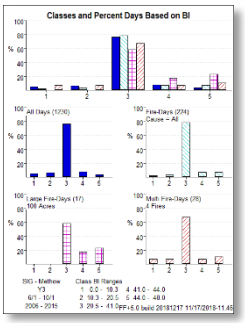
4.1 Climatological Breakpoints

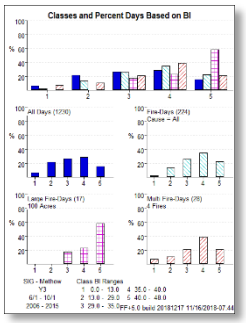
Climatological breakpoints are points on the cumulative distribution curve of a fire danger indices computed from climatology (weather). For example the value at the 90th percentile ERC is the climatological breakpoint at which only 10 percent of the ERC values are greater in value. Climatological percentiles 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; the current exception is the Lower Yakima rating area. Note the fire business charts below, 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 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 D 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.

Note that several stations were removed from the special interest groups until station conversion to NFDR 2016. These include the following BIA stations; Mill Creek, Gold, Kramer, and Wellpinit. Future consideration should be given to these stations, as well as Entiat ('new' location) which is a few years short a decade worth of data.

4.2.1 NFDR Stations and Special Interest Groups (SIGS)

CENTER	FDRA	STATION ID	STATION NAME	OWNER	PRISM ANN PRECIP
WACWC	Methow	452006	First Butte	FS-WAOWF	25
		452035	Douglas Ingram	FS-WAOWF	21
	Chelan	452134	Dry Creek	FS-WAOWF	34
		452132	Camp 4	FS-WAOWF	16
	Upper Yakima	452219	Swauk	FS-WAOWF	28
		452306	Sedge Ridge	FS-WAOWF	35
	Lower Yakima	452404	Grayback	WADNR	25
	Valley	452030	NCSB	FS-WAOWF	15
	Upper Basin	453002	Spring Canyon	NPS-LARO	9
		453601	Escure	BLM	15
	Lower Basin	453102	Columbia NWR	USFWS	8
		453201	Juniper Dunes	BLM	10
		452701	Saddle	USFWS	7
WANEC	Highlands	452029	Lost Lake	FS-WAOWF	18
		452511	Lane Creek	FS-WACOF	27
	Foothills	452916	Kettle Falls	NPS-LARO	17
	Kaniksu	453413	Tacoma Creek	FS-WACOF	32

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.

At this time a separate analysis was not considered for lighting versus human ignitions, due in part to the lack of hourly weather data needed to run NFDR 2016 and number of problem fires necessary to use the statistics for this regression model (n > 20). As more quality data becomes available over time or through research separate analysis may conducted.

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 annuals are not curing during the fire season under current vapor pressure deficit settings. Fuel model Y contains no

live fuels and more often than not had better statistical results than others, perhaps in part to the aforementioned GSI issue. Statistical results of chosen combinations are included in the Appendices E.

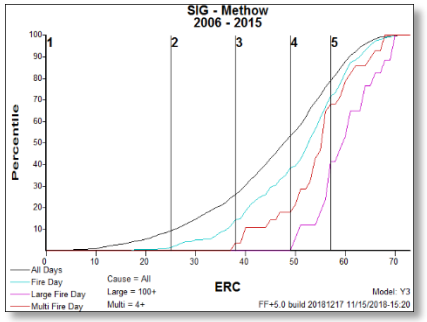
4.4 Parameters Used to Calculate Fire Danger

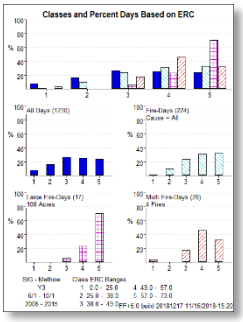
Slope Class was determined using GIS slope analysis. Large fires, multiple fire days, and herb type were determined through analysis and participant input. KBDI and precipitation are both required to run NFDR 2016. KBDI, used to adjust for drought fuels, was left at the default of 100. Annual precipitation 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.

FDRA	SLOPE CLASS	HERB TYPE	KBDI START	LARGE FIRE AC	MULTI FIRE DAY N	NFDR FUEL MODEL
Methow	3	P	100	100	4	Y
Chelan	4	P	100	100	4	Y
Upper Yakima	2	P	100	100	4	Y
Lower Yakima	2	P	100	20	4	Y
Valley	2	P	100	300	4	Y
Upper Basin	1	A	100	300	4	Y
Lower Basin	1	A	100	300	4	Y
Highlands	2	P	100	20	5	Y
Kaniksu	2	P	100	20	5	Y
Foothills	2	P	100	20	5	Y

4.5 Decision Points

Using Fire Family Plus software (5.0, build 9/17/2018), 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 E. Energy release component and burning index were carried forward from the analysis for use in this plan as the basis for setting fire danger levels.





Burning index and energy release component breakpoints used in this plan.

FDRA	STAFFING (BI)		PREPAREDNESS (ERC)		FDRA	STAFFING (BI)		PREPAREDNESS (ERC)	
Methow	1	0	1	0	Upper Basin	1	0	1	0
	2	13	2	25		2	14	2	27
	3	29	3	38		3	21	3	38
	4	35	4	49		4	28	4	52
	5	40	5	57		5	35	5	62
Chelan	1	0	1	0	Lower Basin	1	0	1	0
	2	20	2	21		2	9	2	24
	3	35	3	32		3	25	3	33
	4	41	4	45		4	30	4	47
	5	47	5	55		5	35	5	58
Upper Yakima	1	0	1	0	Highlands	1	0	1	0
	2	12	2	22		2	8	2	16
	3	25	3	35		3	15	3	29
	4	30	4	43		4	25	4	45
	5	35	5	50		5	28	5	55
Lower Yakima	1	0	1	0	Foothills	1	0	1	0
	2	8	2	12		2	9	2	18
	3	17	3	24		3	17	3	31
	4	33	4	47		4	23	4	41
	5	38	5	55		5	26	5	50
Valley	1	0	1	0	Kaniksu	1	0	1	0
	2	11	2	10		2	6	2	13
	3	19	3	26		3	12	3	25
	4	26	4	38		4	25	4	47
	5	30	5	47		5	31	5	55

4.6 Fire Business Decision Summary Table

TARGET GROUP	DECISION POINTS	INDEX	FUEL MODEL	PLAN INTENDED TO MODIFY TARGET GROUP BEHAVIOR
Agency	5	Burning Index	Y	Staffing Plan
Agency	3	Burning Index	Y	Response Plan
Agency	5	Energy Release Component	Y	Preparedness Plan
Public	5	Energy Release Component	Y	Prevention Plan (Adjective Rating)
Public	TBD by Unit	Energy Release Component	Y	Prevention Plan or Public Use Restriction Plan
Industry	4	IFPL	TBD	WAC 332-24-301

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.

- **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

Calculated and published twice daily by the communications centers, not broadcast.

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.

BI DECISION POINTS (STAFFING)	RESPONSE LEVEL
1	1
2	
3	
4	2
5	3

5.2 Staffing Level

Calculated, published and broadcast twice daily by the communications 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; WACWC and WANEC will calculate staffing level based on decision points defined in this plan and incorporate a measure of ignition risk using the worksheet below.

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 burning index decision points defined in this plan. The secondary input is the occurrence of a red flag warning or fire weather watch within the respective dispatch area.

5.3 Preparedness Level

Input value calculated, published and broadcast twice daily by the communications centers. Actual value calculated by unit weekly or biweekly.

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.

PREPAREDNESS INPUT VALUE	1 □	2 □		3 □		4 □		5 □	
US DROUGHT MONITOR LEVEL D3-D4?	↓	No □	Yes □	No □	Yes □	No □	Yes □	No □	Yes □
PREPAREDNESS OUTPUT VALUE	I	II		III		IV		V	

The preparedness input value should be an average, or weighted average, of the forecast preparedness level and trend pertinent to the unit. For example, Spokane BLM may choose to use the average of the Upper, Lower, and Valley fire danger rating area current/forecast trend value as the input since this covers the majority of their response area of concern. Drought status can be found via the US Drought Monitor in this example Spokane BLM may choose to use the Middle Columbia time series product found here.

5.4 Adjective Fire Danger Rating Level

Informed by preparedness input value calculated, published and broadcast twice daily by the communications centers. Actual value set weekly during fire season based on discussion with cooperators.

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. Ignition component was removed as an input variable to reduce the output sensitivity (reduce frequency of rating changes). If daily, as opposed to weekly or bi-weekly, adjective ratings are desired in the future it should be reincorporated.

ERC DECISION POINTS (PREPAREDNESS)	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

NFDR 2016 IFPL calculation TBD.

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.

Current and prior IFPL are based on the precaution value, a function of indices calculated by the 1978 model. Discussions are ongoing regarding how IFPL will be calculated using NFDR 2016 as the analysis used for developing the IFPL calculation is no longer applicable (different fuel model, live and dead fuel moisture models, etc.).

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. The following are specific individuals which have participated in plan development or review to date.

- Bureau of Land Management; Jeff Dimke (Spokane District BLM)
- National Park Service; Scott Ebel (North Cascades and Lake Roosevelt)
- US Fish and Wildlife Service; Ken Meinhart, Joshua Tellesen (Inland Northwest National Wildlife Refuge Complex)
- US Forest Service; Ben Curtis (Colville), Brian Maier (Okanogan Wenatchee)
- Washington State Department of Natural Resources; Steve Harris (NE), Liz Smith (SE)

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 communication 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 communication center will monitor RAWS daily for unusual readings that may suggest an issue which needs attention and contact the station owners to arrange resolution and notify agency fire program managers (FMO).

The communication center will give WIMS the proper seasonal care and feeding required to run NFDR 2016, including setting snow flags and starting KBDI.

6.1.6 Duty Officers

Duty officer, from each agency, will be identified to the WACWC and WANEC 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, Spokane office. 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

Efforts will be made to continue to provide web NFDR products to WACWC and WANEC 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.

Morning broadcasts will use the days forecast indices and will be effective until the afternoon broadcast. Afternoon broadcasts will use the days observed indices and be effective until the morning broadcast.

WACWC and WANEC morning and afternoon broadcast should include; observed BI and ERC, predicted BI and ERC when available, and predicted Staffing Level and ERC when available.

6.3 Critical Fire Danger

Critical fire danger events such as post thermal trough, marine push, and dry cold front winds will be typically captured by National Weather Service meteorologists in red flag warnings or fire weather watches. For more information see the publication Critical Weather Patterns of the United States which can be found on the NWCC website here.

Other critical fire danger elements contributing to explosive fire growth aside from wind, high daytime temperatures and low relative humidity, include; abnormally low seasonal snowpack/streamflow, drought, and periods of poor overnight humidity recoveries.

Sustained maximum recoveries below approximately 40-45 percent combined with preparedness level input values of 5 (ERC generally above the 90th percentile) should be considered a watch out in the timber fuel types, especially when combined with any of the above frontal patterns. Effects of prolonged periods of poor humidity recovery on heavy fuels can last a day or two after frontal passage and humidity recovery.

Information on the current state of drought can be obtained from the US Drought Monitor here. Information on the current state of streamflow can be obtained from USGS here. 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) can be found on the communication center websites.

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

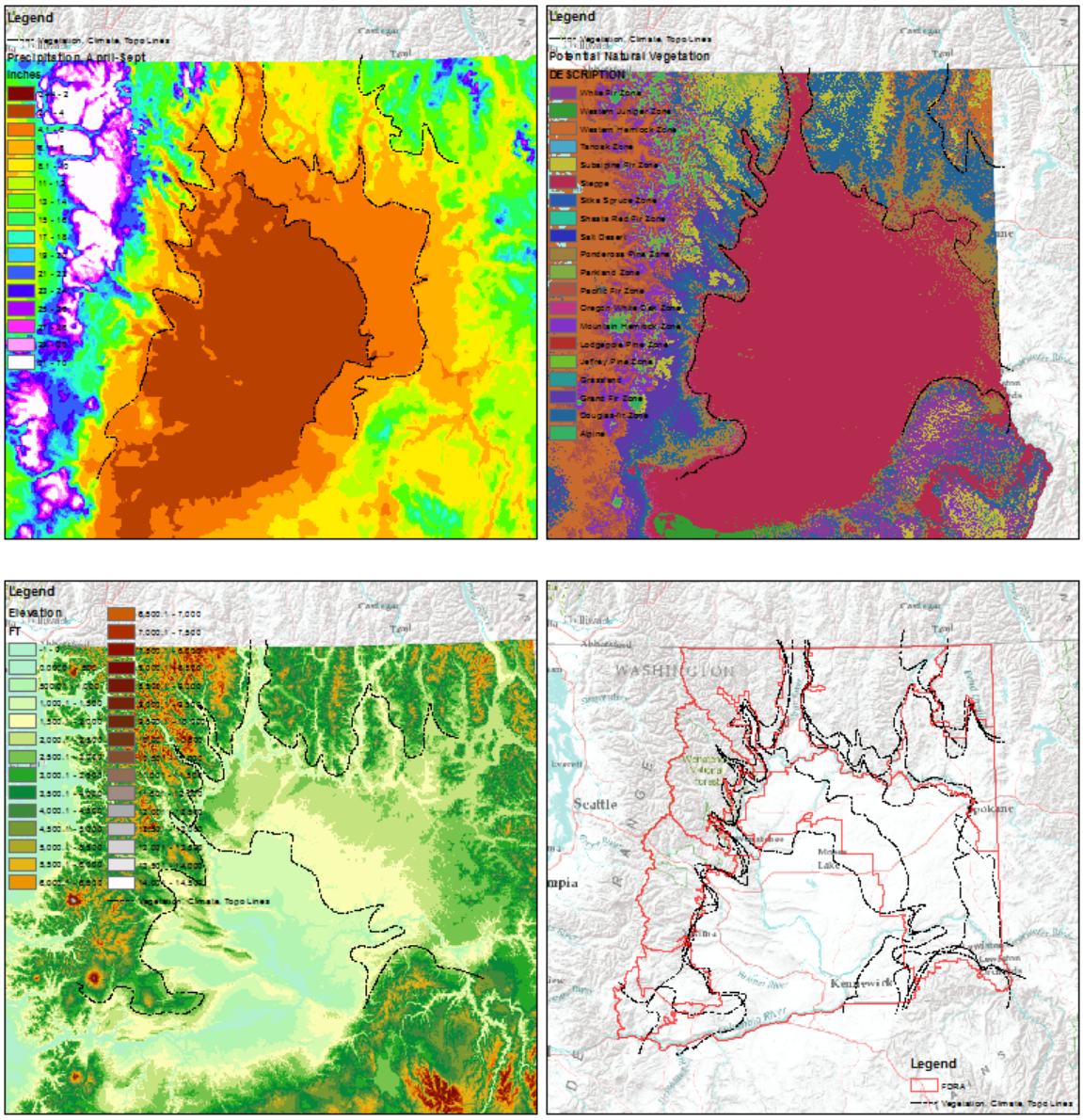
Appendix A: Primary Distribution List

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

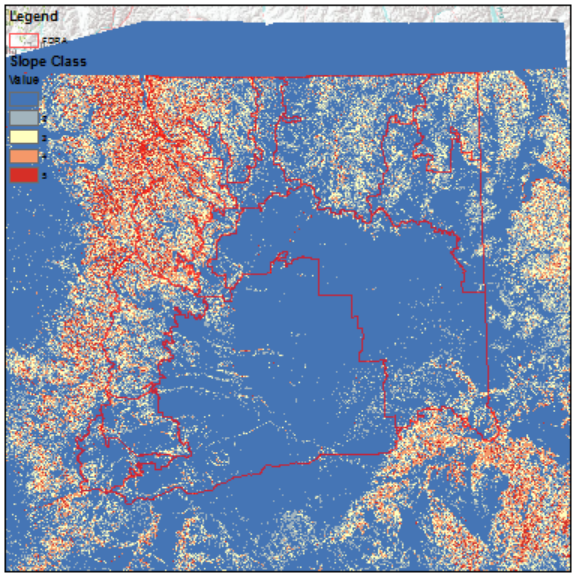
- Bureau of Land Management
    - Spokane Resource Area Fire Management Officer
- Communications Centers
    - Central Washington Interagency Communication Center Manager
    - Northeast Washington Interagency Communication Center Manger
- Forest Service
    - Colville National Forest Fire Management Officer
    - Okanogan Wenatchee National Forest Fire Management Officer
- National Park Service
    - North Cascades and Lake Roosevelt Fire Management Officer
- US Fish and Wildlife Service
    - Inland Northwest National Wildlife Refuge Complex Fire Management Officer
    - Mid-Columbia River National Wildlife Refuge Complex Fire Management Officer
- Washington State Department of Natural Resources
    - Northeast Region Manager
    - Southeast Region Manager

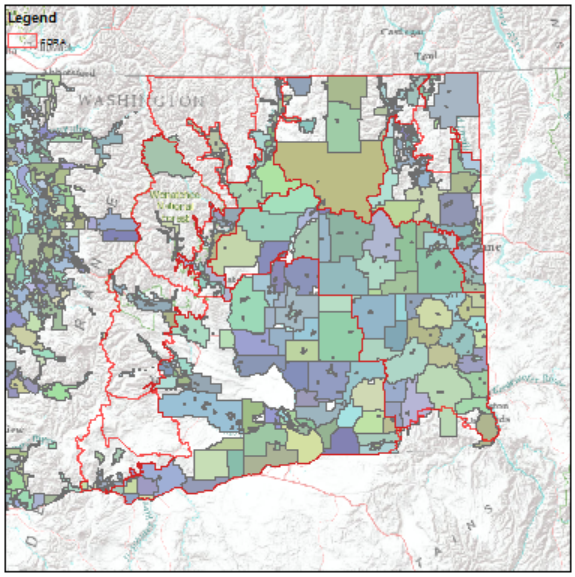
Appendix B: Fire Danger Rating Areas

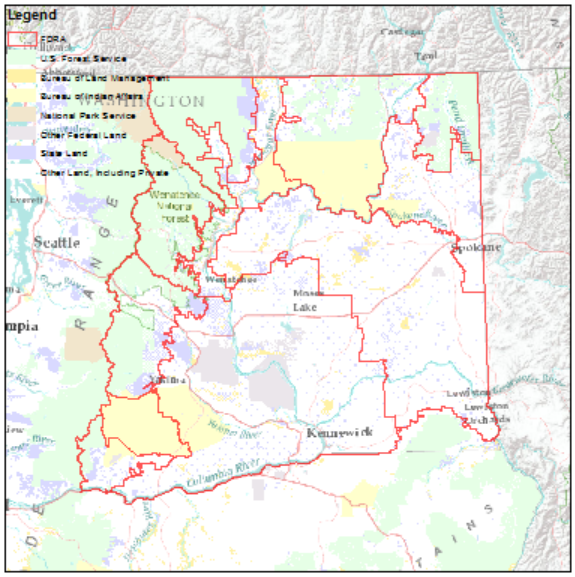
Delineation of fire danger rating areas select figures. Counter clockwise from the top right; LANDFIRE Potential Natural Vegetation, PRISM April-September Precipitation 1981-2000, DEM Elevation, Delineations and Final FDRAs.



Counter clockwise from top right, final FDRAs and; Fire Protection Districts, NFDR Slope Class, BLM LLI Ownership.







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

Appendix C: Fire History

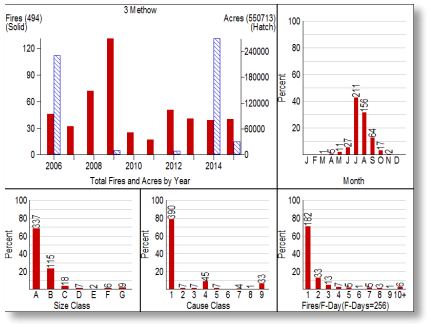
Fire Family Plus fire history charts and information for each fire danger rating area.

```
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
```

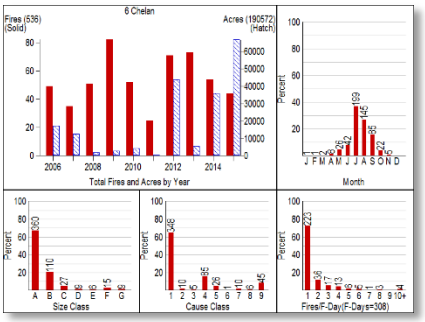
C.1 East Slope Cascades (Chelan, Methow, Lower and Upper Yakima FDRAs)

Methow FDRA:



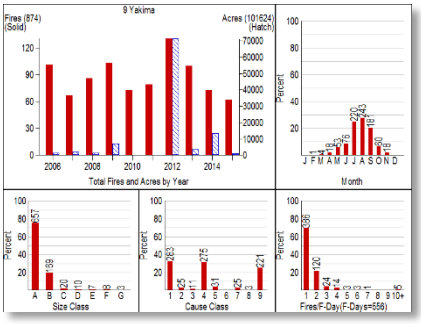
Fires: 494
Acres: 550,713
Primary Fire Cause: Lightning
Secondary Fire Cause: Campfire
Human Caused: 21%
Fire Size (ac.) Percentiles 90/95/97: 6/85/333
Multi Fire Day Event (n >= 10/5): 3/10+ (Fires per Day)
First 100 ac./300 ac. Fire: 4-20 (Chopaka), 7-2 (Newby)

Chelan FDRA:



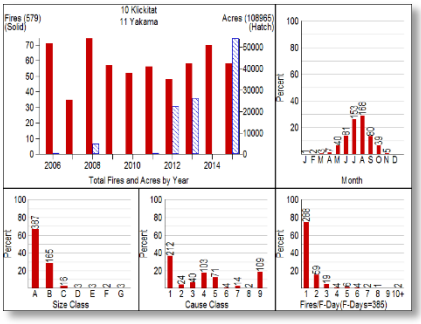
Fires: 536
Acres: 190,572
Primary Fire Cause: Lightning
Secondary Fire Cause: Campfire
Human Caused: 35%
Fire Size (ac.) Percentiles 90/95/97: 25/525/1502
Multi Fire Day Event (n >= 10/5): 4/6 (Fires per Day)
First 100 ac./300 ac. Fire: 6-25 (Hay), 6-29 (Wolverine)

Upper Yakima FDRA:



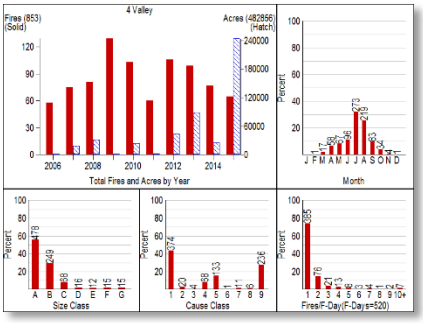
Fires: 874
Acres: 101,624
Primary Fire Cause: Lightning
Secondary Fire Cause: Campfire
Human Caused: 68%
Fire Size (ac.) Percentiles 90/95/97: 2/12/100
Multi Fire Day Event (n >= 10/5): 4/10+ (Fires per Day)
First 100 ac./300 ac. Fire: 6-27 (Trout), 7-22 (Stuhlmiller)

Lower Yakima FDRA:



Fires: 579
Acres: 108,965
Primary Fire Cause: Lightning
Secondary Fire Cause: Campfire
Human Caused: 63%
Fire Size (ac.) Percentiles 90/95/97: 4/8/40
Multi Fire Day Event (n >= 10/5): 3/5 (Fires per Day)
First 100 ac./300 ac. Fire: 5-17 (Vessy Y), 7-3 (Horseshoe)

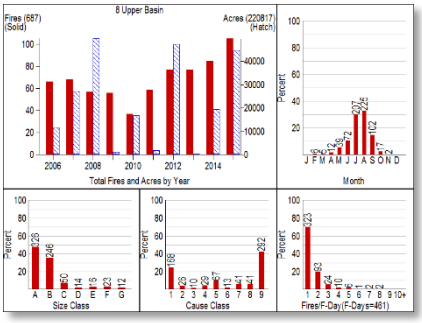
C.2 Valley



Fires: 853
Acres: 482,856
Primary Fire Cause: Lightning
Secondary Fire Cause: Debris Burning
Human Caused: 56%
Fire Size (ac.) Percentiles 90/95/97: 25/294/1277
Multi Fire Day Event (n >= 10/5): 4/10+ (Fires per Day)
First 300 ac. Fire: 5-28 (Malaga)

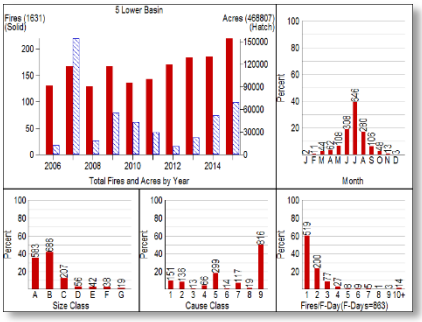
C.3 Columbia Basin (Lower and Upper Basin FDRAs)

Upper Basin FDRA



Fires: 687
Acres: 220,817
Primary Fire Cause: Lightning
Secondary Fire Cause: Debris Burning
Human Caused: 76%
Fire Size (ac.) Percentiles 90/95/97: 72/812/2172
Multi Fire Day Event (n >= 10/5): 4/5 (Fires per Day)
First 300 ac. Fire: 5-17 (Maggie Shoups)

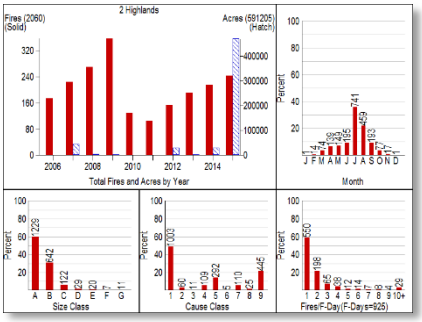
Lower Basin FDRA



Fires: 1,631
Acres: 468,807
Primary Fire Cause: Debris Burning
Secondary Fire Cause: Lightning
Human Caused: 91%
Fire Size (ac.) Percentiles 90/95/97: 80/486/1450
Multi Fire Day Event (n >= 10/5): 10+/10+ (Fires per Day)
First 300 ac. Fire: 6-1 (15 Road)

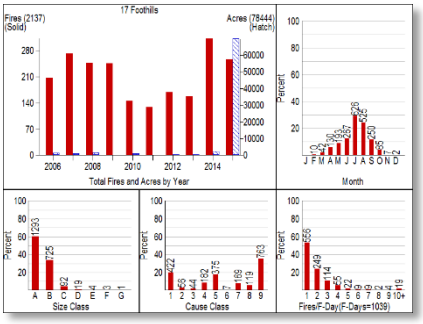
C.4 Northeastern (Foothills, Highlands, Kaniksu FDRAs)

Highlands FDRA



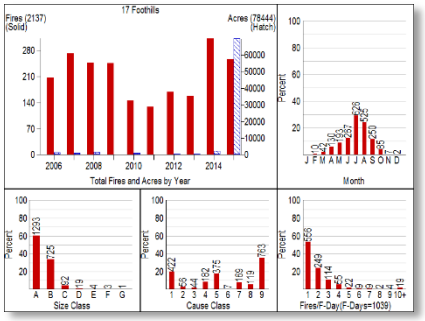
Fires: 2,060
Acres: 591,205
Primary Fire Cause: Lightning
Secondary Fire Cause: Debris Burning
Human Caused: 51%
Fire Size (ac.) Percentiles 90/95/97: 8/38/109
Multi Fire Day Event (n >= 10/5): 10+/10+ (Fires per Day)
First 100 ac./300 ac. Fire: 3-6 (Mollenberg), 4-11 (Meteor)

Foothills FDRA



Fires: 2,137
Acres: 78,444
Primary Fire Cause: Lightning
Secondary Fire Cause: Debris Burning
Human Caused: 80%
Fire Size (ac.) Percentiles 90/95/97: 4/11/25
Multi Fire Day Event (n >= 10/5): 10+/10+ (Fires per Day)
First 100 ac./300 ac. Fire: 3-1 (Serengeti), 7-3 (Williams)

Kaniksu FDRA

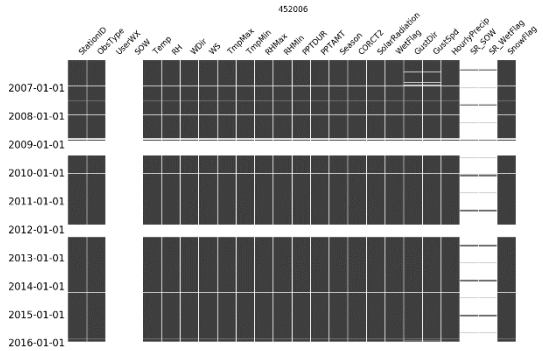


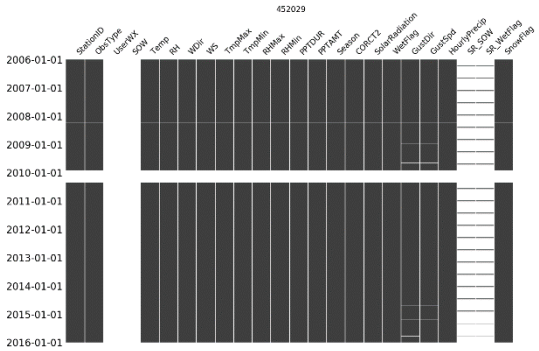
Fires: 449
Acres: 16,720
Primary Fire Cause: Lightning
Secondary Fire Cause: Campfires
Human Caused: 35%
Fire Size (ac.) Percentiles 90/95/97: 2/7/27
Multi Fire Day Event (n >= 10/5): 3/4 (Fires per Day)
First 100 ac./300 ac. Fire: 7-13 (Windy Ridge)

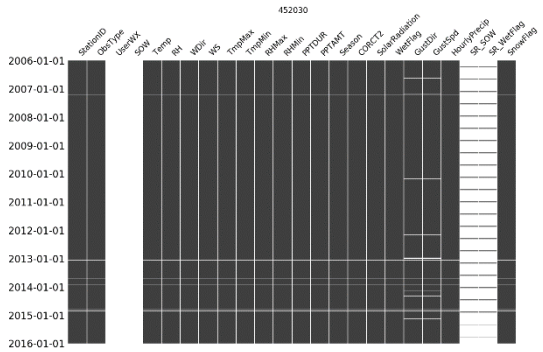
Appendix D: Weather Stations

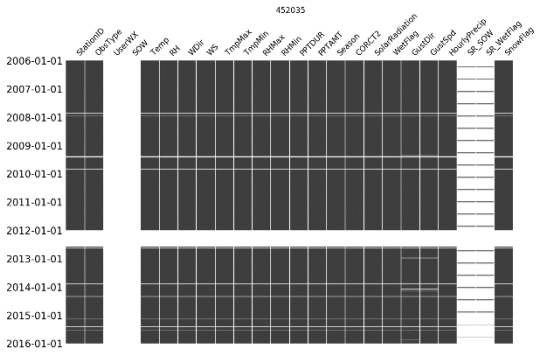
D.1 Study Area Weather Station Hourly Data Completeness

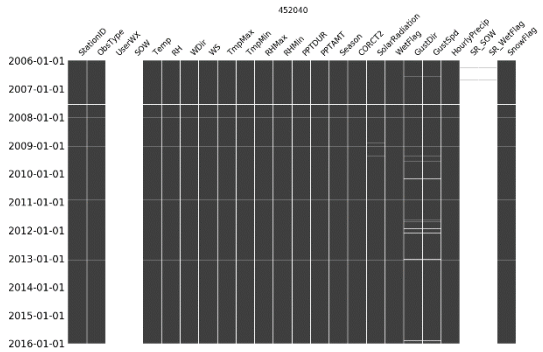
NFDR 2016 requires hourly data to run properly. Gaps of 7 days or greater cause a reset in some intermediate calculations. The following are plots generated using Python and the missingno library to assess station viability.

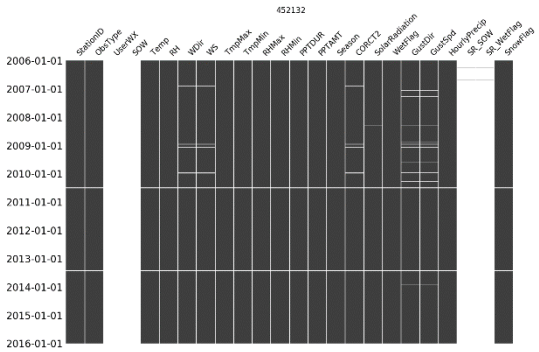


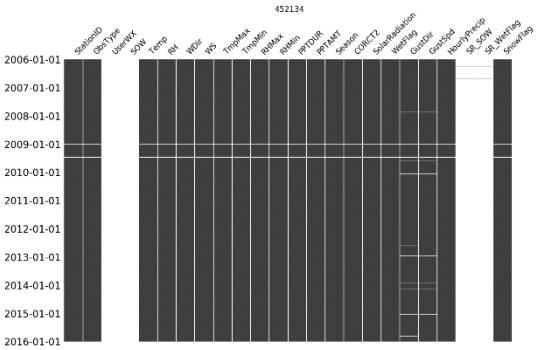











452134
StationID ObsType UserWX SOW Temp RH WDir WS TmpMax TmpMin RHMax RHMin PPTDUR PPTAMT Season CORCT2 SolarRadiation WetFlag GustDir GustSpd HourlyPrecip SR_SOW SR_WetFlag SnowFlag
2006-01-01
2007-01-01
2008-01-01
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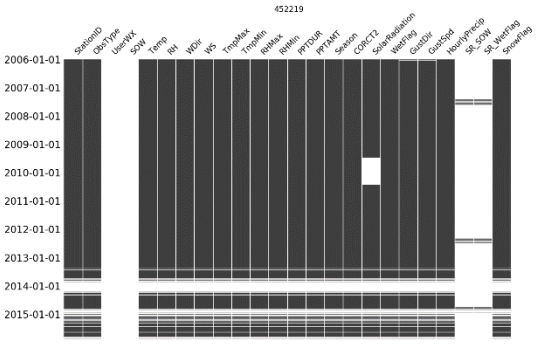
2015-01-01
2016-01-01


452219
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2006-01-01
2007-01-01
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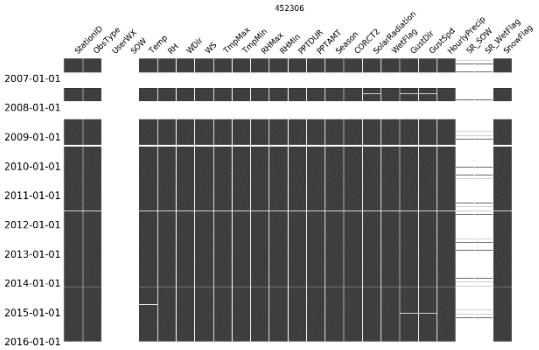
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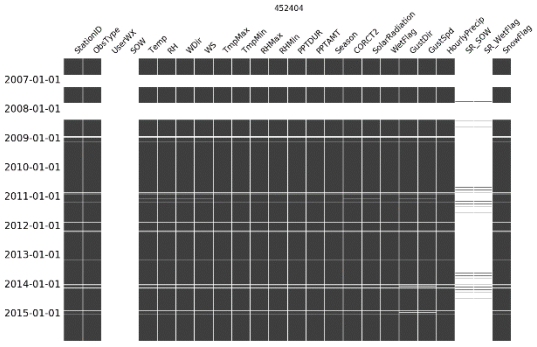
2014-01-01
2015-01-01
2016-01-01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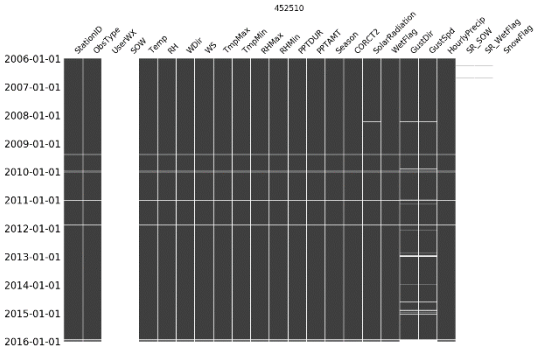
2007-01-01
2008-01-01
2009-01-01
2010-01-01
2011-01-01
2012-01-01
2013-01-01
2014-01-01
2015-01-01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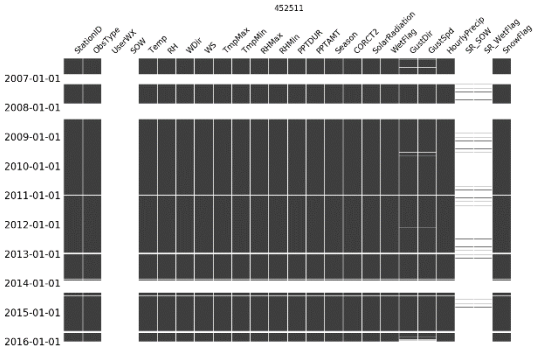
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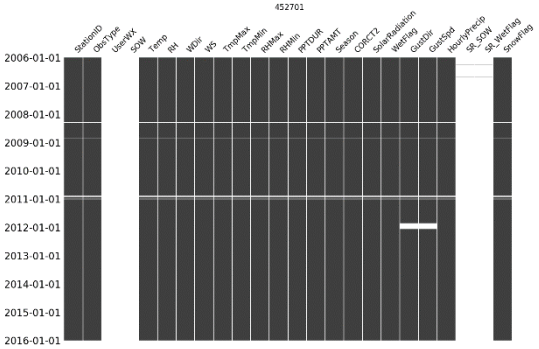
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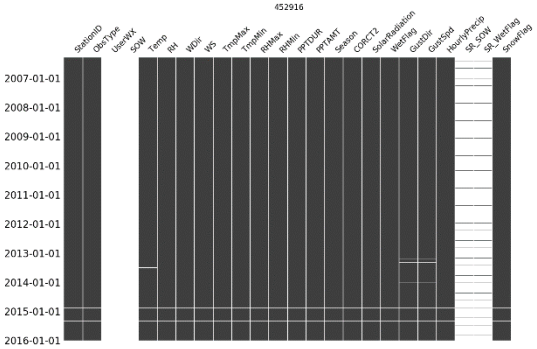
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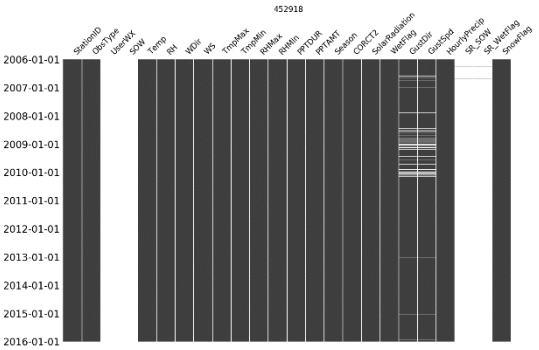
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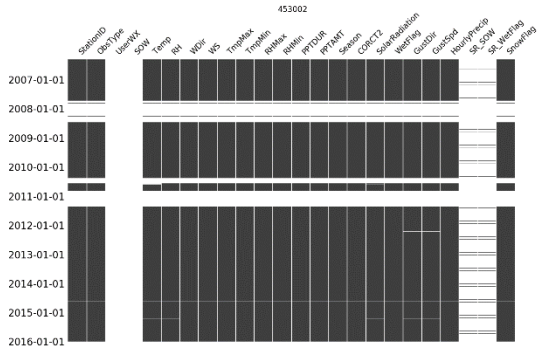
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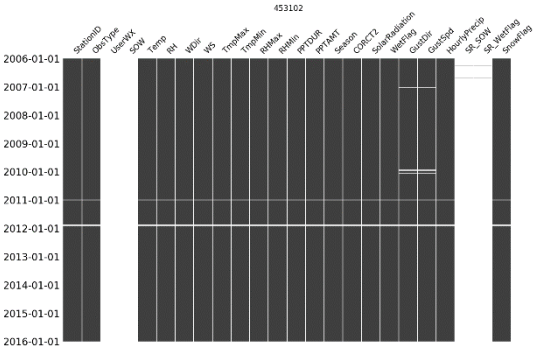
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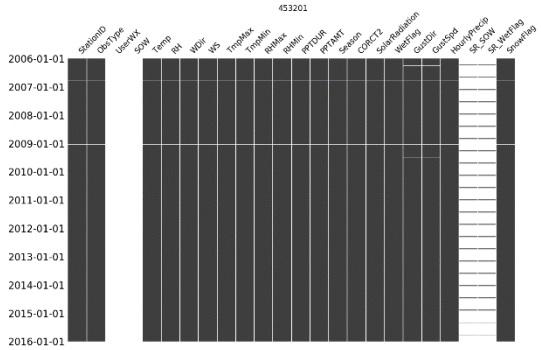
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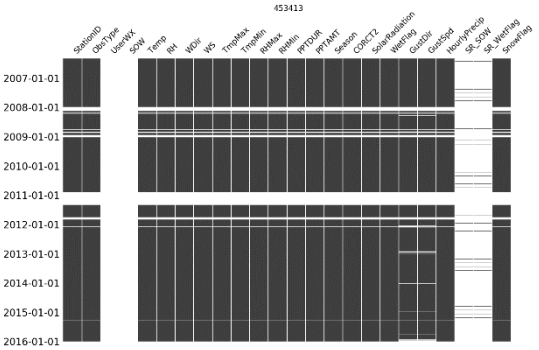
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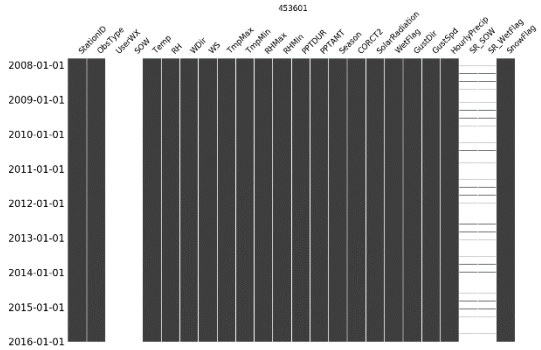
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2010-01-01
2011-01-01
2012-01-01
2013-01-01
2014-01-01
2015-01-01
2016-01-01

D.2 Study Area Weather Station Summary

RAWS NAME	NESDIS ID	NWS ID	OWNER	ELEV.	2006-2015 QUALITY	COMMENTS
BUCK CREEK	3261A52A	451917	FS-WAGPF	2690	POOR	BAD DATA
AENEAS	30074760	452001	WADNR-NE	5161	POOR	BAD DATA
FIRST BUTTE	3249A062	452006	FS-WAOWF	5509	GOOD	METHOW FDRA
LEECHER	326284C8	452020	FS-WAOWF	4991	GOOD	METHOW FDRA
NESPELEM	52119772	452028				NOT NFDR
LOST LAKE	3249D6F2	452029	FS-WAOWF	3876	GOOD	HIGHLANDS FDRA
NCSB	3249C584	452030	FS-WAOWF	1697	EXCELLENT	VALLEY FDRA
DOUGLAS INGRAM	3246936A	452035	FS-WAOWF	3566	GOOD	METHOW FDRA
PEONY	3260813C	452038	FS-WAOWF	3804	EXCELLENT	HIGHLANDS FDRA
OROVILLE	3243F14C	452039	BLM	1360	EXCELLENT	VALLEY FDRA
KRAMER	5210650C	452040	FS-WACOF	2720	EXCELLENT	VALLEY FDRA
STEHEKIN-AIRSTRIP	FA411054	452121	NPS-NOCA	1230	GOOD	CHELAN FDRA
VIEWPOINT	323807CC	452128	FS-WAOWF	3760	POOR	BAD DATA
CAMP 4	3245A1FE	452132	FS-WAOWF	3156	EXCELLENT	CHELAN FDRA
DRY CREEK	323814BA	452134	FS-WAOWF	3661	EXCELLENT	CHELAN FDRA
ENTIAT	3335C016	452138	FS-WAOWF	2825		ONLY 3 YEARS DATA
PEOH POINT	3000804A	452206	WADNR-SE	4020	GOOD	YAKIMA FDRA
SWAUK	3245B288	452219	FS-WAOWF	3480	GOOD	YAKIMA FDRA
SAWMILL FLATS	3245C418	452221	FS-WAOWF	3000	GOOD	YAKIMA FDRA
MILL CREEK	32640212	452304	BIA-YAKAMA	2928	EXCELLENT	YAKAMA FDRA
SEDGE RIDGE	300070CE	452306	WADNR-SE	4533	GOOD	YAKIMA FDRA
SIGNAL PEAK	3263F0A2	452307	BIA-YAKAMA	5052	GOOD	YAKAMA FDRA
TEPEE CREEK	52105096	452317	BIA-YAKAMA	2980	GOOD	YAKAMA FDRA
HIGHBRIDGE	52125562	452318	BIA-YAKAMA	2106	GOOD	YAKAMA FDRA
GRAYBACK	3000A6A6	452404	WADNR-SE	3766	GOOD	KITTITAS FDRA
GOLDENDALE EAST	300731F0	452408	WADNR-SE	2481		NO DATA AFTER 2009
GOLD MOUNTAIN	52118404	452510	FS-WACOF	4636	EXCELLENT	HIGHLANDS FDRA
LANE CREEK	32458712	452511	FS-WACOF	4430	GOOD	HIGHLANDS FDRA
IRON MOUNTAIN	333390A4	452512	FS-WACOF	4350	GOOD	HIGHLANDS FDRA
OWL MOUNTAIN	3262C7C2	452513	FS-WACOF	3560	POOR	BAD DATA
BROWN MTN. ORCH	326297BE	452514				NOT NFDR
DOUGLAS	32649770	452601	BLM	2530	POOR	BAD DATA
SADDLE MOUNTAIN	8374F59C	452701	USFWS	650	EXCELLENT	LOWER FDRA
PAL MOORE ORCHA	32459464	452915	FS-WACOF	3120	POOR	BAD DATA
KETTLE FALLS	FA501530	452916	NPS-LARO	1310	EXCELLENT	FOOTHILLS FDRA
CEDAR CREEK ORCH	32318784	452917				NOT NFDR
WELLPINIT	83756204	452918	BIA-SPOKANE	2240	EXCELLENT	FOOTHILLS FDRA
SPRING CANYON	FA500646	453002	NPS-LARO	1340	GOOD	UPPER FDRA
COLUMBIA NWR (O	83743082	453102	USFWS	890	EXCELLENT	LOWER FDRA
FLOWERY TRAIL	323194F2	453145				NOT NFDR
JUNIPER DUNES	3264A2EA	453201	BLM	950	EXCELLENT	LOWER FDRA
DEER MOUNTAIN	32457796	453412	FS-WACOF	3330	POOR	BAD DATA
TACOMA CREEK	3262A224	453413	FS-WACOF	3240	GOOD	KANIKSU FDRA
TEEPEE SEED ORCHA	3231D7F8	453414				NOT NFDR
LITTLE PEND OREILL	83745564	453416	USFWS	2020	EXCELLENT	KANIKSU FDRA
CHENEY	837460FE	453506				NOT NFDR
DOUGLAS (ESCURE)	3244756C	453601	BLM	1725	GOOD	UPPER FDRA
FAIRCHILD 36 RQF	AA1094C8	NO WIMS ID				NOT NFDR
BIG BLUE	32A18970	NO WIMS ID	WADNR-SE			INSTALLED 2018

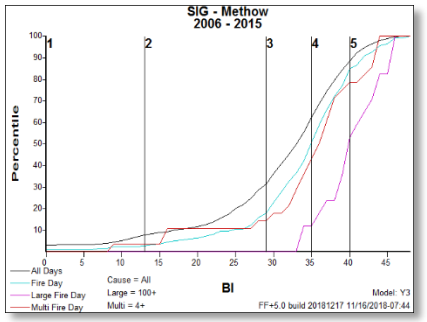
Appendix E: Fire Business Analysis

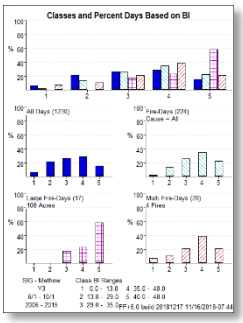
E.1 Decision Points

E.1.1 East Slope Cascades (Chelan, Methow, Lower and Upper Yakima FDRAs)

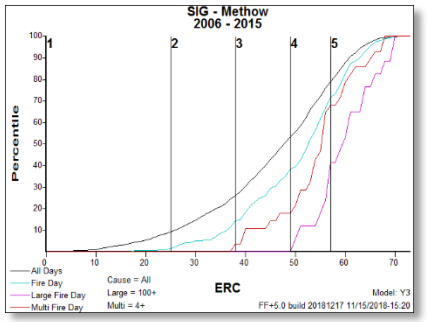
Methow FDRA

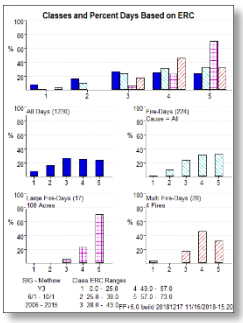
Burning Index





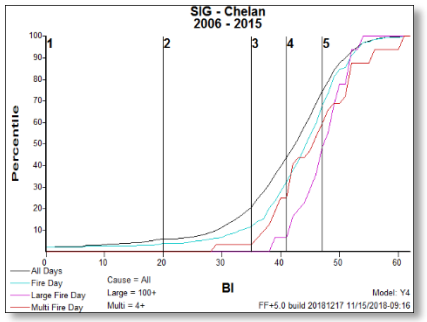
Energy Release Component

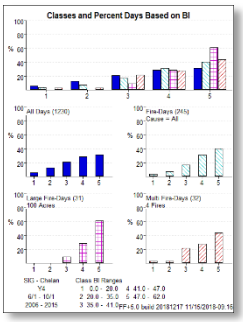




Chelan FDRA

Burning Index





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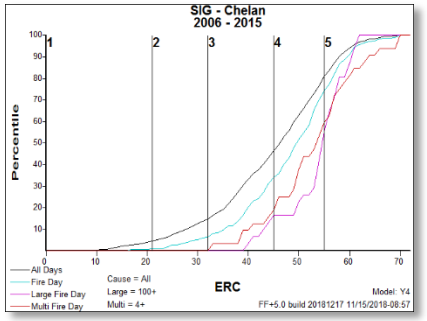
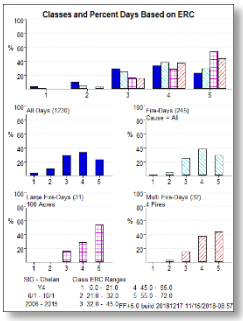
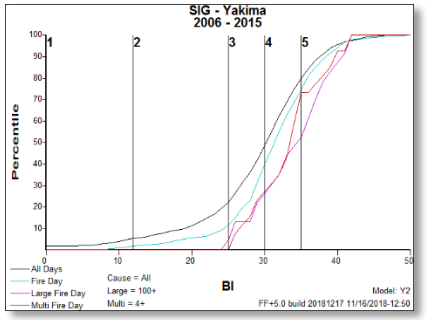
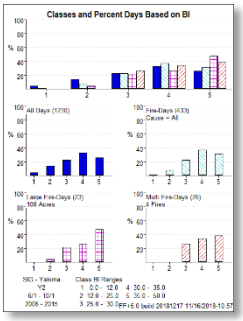




Upper Yakima FDRA

Burning Index





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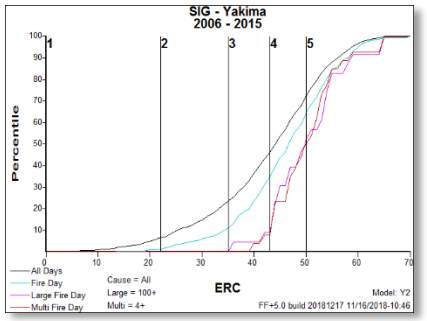
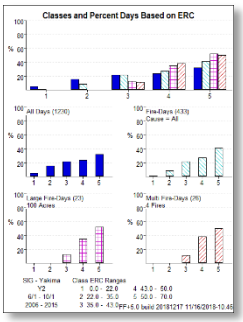
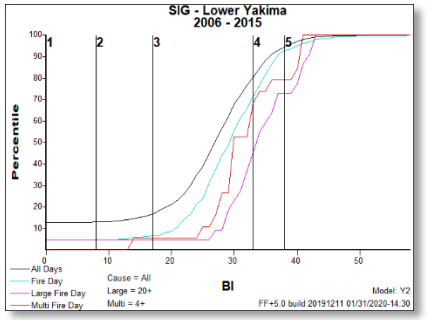


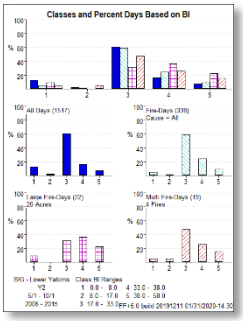


Lower Yakima FDRA

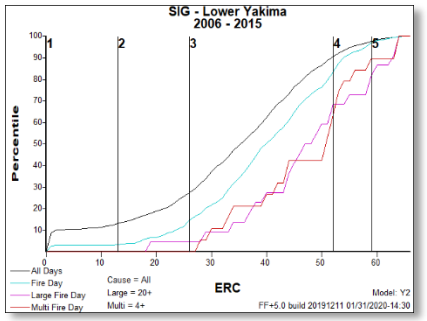
**Note that decision points for this rating area are based on annual climatology (90/97); primarily due to a lack of large fire occurrence relative to other rating areas (using fire business would create disparity at the dispatch center – operating plan level, additionally if Yakama fires are removed from consideration there are not enough large fires, even at 20 acres, to conduct a valid statistical analysis, currently Yakama does not participate directly in the plan).*

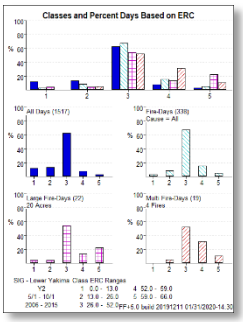
Burning Index





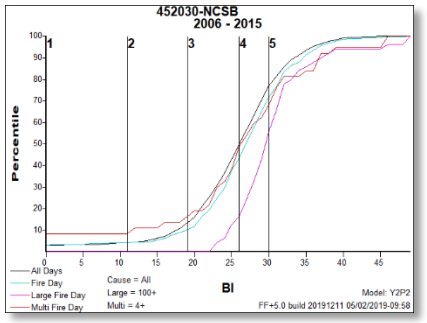
Energy Release Component

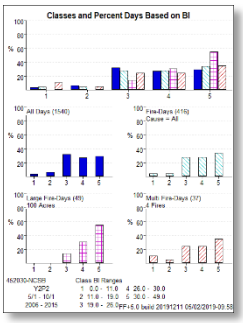




E.1.2 Valley

Burning Index





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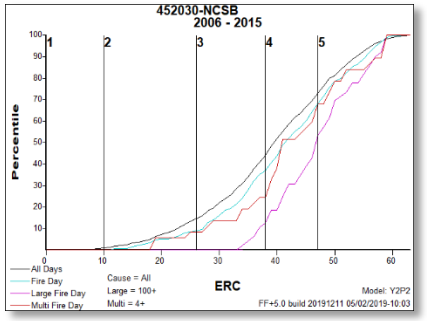
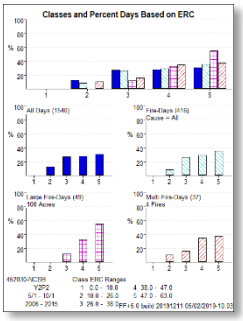
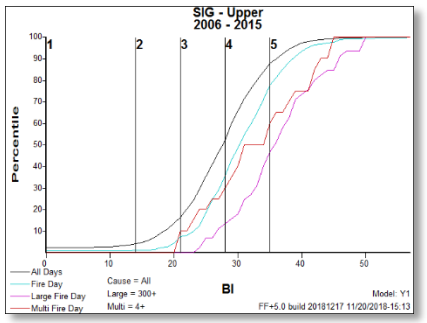


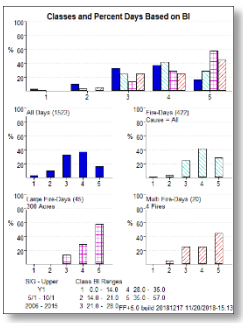


E.1.3 Columbia Basin (Lower and Upper Basin FDRAs)

<u>Upper Basin FDRA</u>

Burning Index





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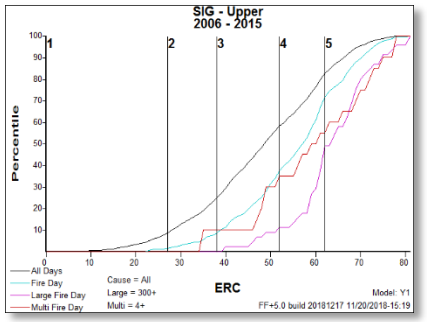
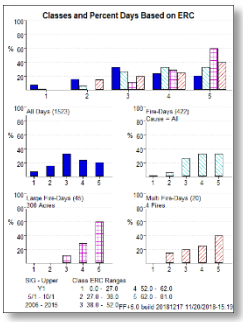
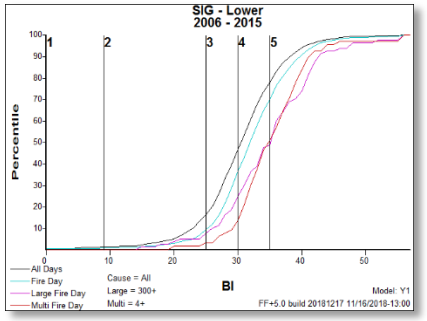
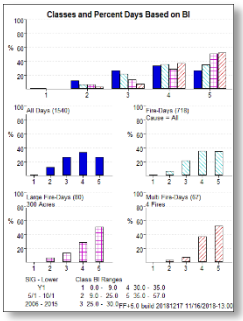




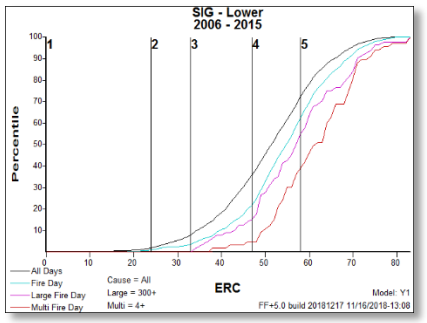
Lower Basin FDRA

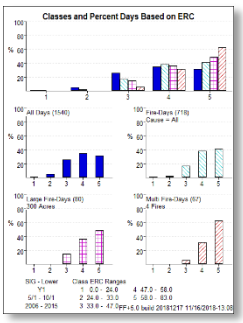
Burning Index





Energy Release Component

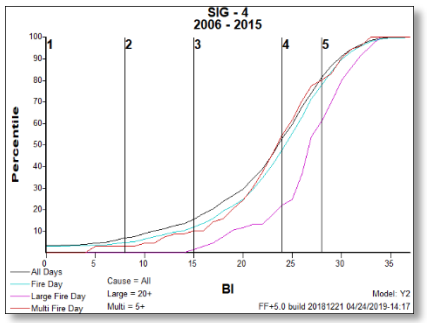


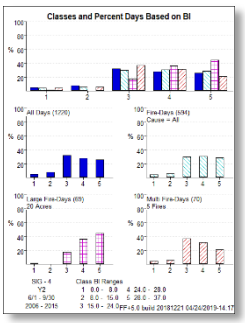


E.1.4 Northeastern (Foothills, Highlands, Kaniksu FDRAs)

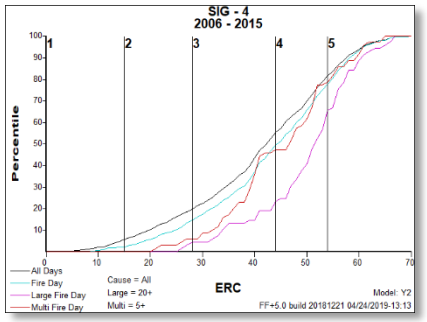
Highlands FDRA

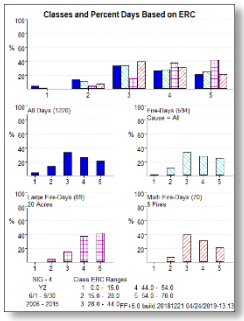
Burning Index





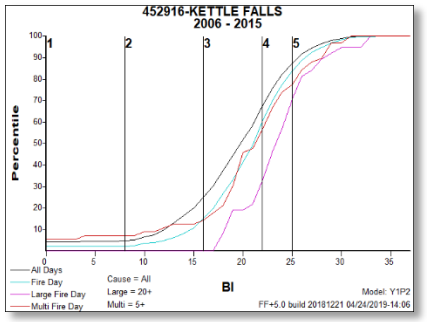
Energy Release Component

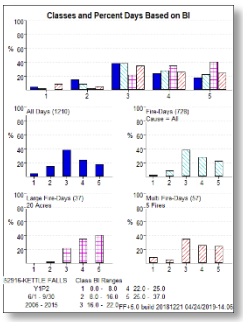




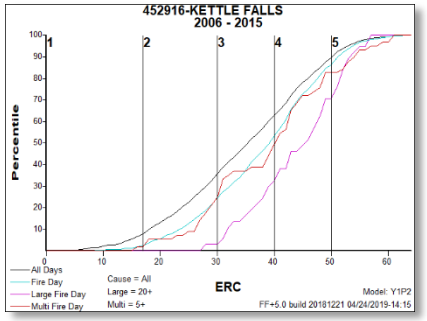
Foothills FDRA

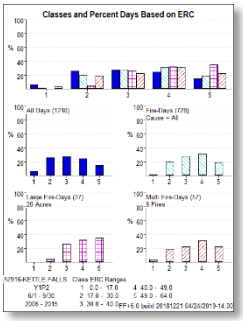
Burning Index





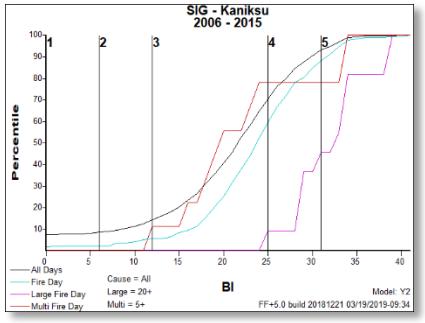
Energy Release Component

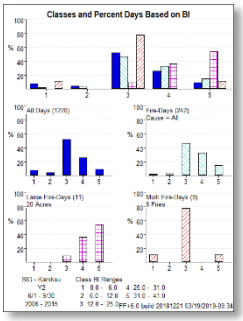




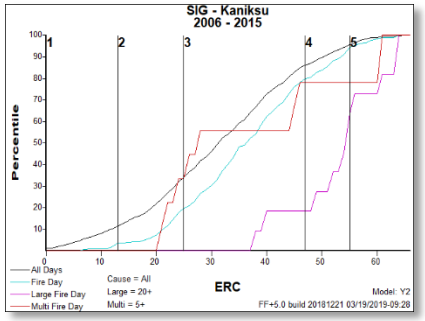
Kaniksu FDRA

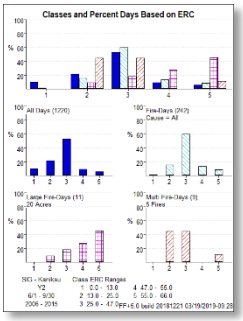
Burning Index





Energy Release Component





E.2 Statistical Results

**Lower Yakima rating area is currently based on climatological breakpoints (90/97).*

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
SIG - Chelan	2006 - 2015	4/1 - 10/31	BI	Y4	All	0.92	10.57	0.2275	0.03 - 0.37	100 (C)	0.7	6.01	0.6466	0.00 - 0.42	4 (C)	0.29	11.87	0.1573	0.02 - 0.22
SIG - Chelan	2006 - 2015	4/1 - 10/31	ERC	Y4	All	0.94	8.8	0.3596	0.02 - 0.43	100 (C)	0.61	11.38	0.181	0.00 - 0.41	4 (C)	0.66	5.58	0.6944	0.01 - 0.32
SIG - Lower Basin	2006 - 2015	4/1 - 10/31	BI	Y1	All	0.91	21.93	0.0051	0.03 - 0.90	300 (C)	0.8	4.81	0.7779	0.01 - 0.40	4 (C)	0.34	14.87	0.0617	0.01 - 0.17
SIG - Lower Basin	2006 - 2015	4/1 - 10/31	ERC	Y1	All	0.97	11.2	0.1908	0.03 - 0.86	300 (C)	0.7	3.81	0.8737	0.03 - 0.21	5 (C)	0.6	8.77	0.3619	0.00 - 0.18
SIG - Methow	2006 - 2015	4/1 - 10/31	BI	Y3	All	0.93	8.96	0.3458	0.02 - 0.37	100 (C)	0.59	7.83	0.4502	0.00 - 0.29	4 (C)	0.1	7.9	0.443	0.05 - 0.15
SIG - Methow	2006 - 2015	4/1 - 10/31	ERC	Y3	All	0.91	15.98	0.0427	0.02 - 0.40	100 (C)	0.49	8.9	0.3505	0.00 - 0.26	4 (C)	0.62	4.28	0.8315	0.01 - 0.26
SIG - Upper Basin	2007 - 2015	4/1 - 10/31	BI	Y1	All	0.92	16.97	0.0304	0.01 - 0.90	300 (C)	0.82	5.18	0.7386	0.00 - 0.77	4 (C)	0.14	17.24	0.0277	0.01 - 0.19
SIG - Upper Basin	2007 - 2015	4/1 - 10/31	ERC	Y1	All	0.96	13.13	0.1074	0.01 - 0.73	300 (C)	0.82	3.95	0.8617	0.01 - 0.37	4 (C)	0.04	16.92	0.031	0.02 - 0.07
SIG - Upper Yakima	2006 - 2015	4/1 - 10/31	BI	Y3	All	0.93	17.03	0.0298	0.05 - 0.63	100 (C)	0.65	4.13	0.845	0.00 - 0.15	4 (C)	0.42	9.36	0.3128	0.00 - 0.16
SIG - Upper Yakima	2006 - 2015	4/1 - 10/31	ERC	Y3	All	0.95	12.79	0.1193	0.05 - 0.66	100 (C)	0.64	3.65	0.8871	0.00 - 0.15	4 (C)	0.49	7.87	0.4461	0.00 - 0.16
SIG - Valley	2006 - 2015	4/1 - 10/31	BI	Y2	All	0.74	14.04	0.0806	0.11 - 0.44	100 (C)	0.75	6.54	0.5872	0.01 - 0.44	4 (C)	0	5.06	0.7514	0.07 - 0.07
SIG - Valley	2006 - 2015	4/1 - 10/31	ERC	Y2	All	0.9	5.51	0.7017	0.11 - 0.38	100 (C)	0.68	8.3	0.4043	0.01 - 0.27	4 (C)	0.31	5.6	0.6924	0.03 - 0.12
SIG - Foothills	2006 - 2015	6/1 - 9/30	BI	Y1	All	0.92	13.05	0.11	0.08 - 0.90	20 (C)	0.78	5.64	0.6872	0.00 - 0.28	5 (C)	0.01	11.08	0.1973	0.07 - 0.10
SIG - Foothills	2006 - 2015	6/1 - 9/30	ERC	Y1	All	0.88	19.98	0.0104	0.13 - 0.89	20 (C)	0.44	17.71	0.0235	0.01 - 0.16	5 (C)	0.03	12.63	0.1254	0.06 - 0.10
SIG - Highlands	2006 - 2015	6/1 - 9/30	BI	Y2	All	0.74	6.79	0.5594	0.30 - 0.62	20 (C)	0.78	8.16	0.4178	0.01 - 0.38	5 (C)	0.02	5.4	0.7143	0.12 - 0.12
SIG - Highlands	2006 - 2015	6/1 - 9/30	ERC	Y2	All	0.73	11.89	0.1563	0.28 - 0.65	20 (C)	0.69	9.69	0.2872	0.01 - 0.29	5 (C)	0.06	16.33	0.0379	0.08 - 0.15
SIG - Kaniksu	2006 - 2015	6/1 - 9/30	BI	Y2	All	0.91	4.02	0.8552	0.06 - 0.44	20 (C)	0.68	7.7	0.2612	0.00 - 0.51	5 (C)	0.47	4.6	0.5961	0.01 - 0.21
SIG - Kaniksu	2006 - 2015	6/1 - 9/30	ERC	Y2	All	0.74	13.65	0.0914	0.08 - 0.42	20 (C)	0.78	3.2	0.7832	0.00 - 0.33	5 (C)	0.22	6.23	0.3983	0.01 - 0.09

Appendix F: Large Fire Growth Days

Large fire growth days, determined through use of historic MODIS and VIIRS spatial data, and select values from Fire Family Plus. Percentiles are annual and for the period 2008-2017.

FDRA	Fire	Miles	Event Start	BI	ERC	MaxT	MnRH	MxRH	Wind	Note
Chelan	Chiwaukum	3+	7/17/2014	53 (99th%)	59 (98th%)	93	14	46	9	MxRH 42 on 7/16
Chelan	Duncan	4+	7/30/2014	53 (99th%)	56 (93rd%)	94	12	35	3	
Chelan	Wolverine	10+	8/1/2015	58 (99th%)	64 (99th%)	96	8	24	4	
Chelan	Cougar Creek	3+	8/10/2018	55 (99th%)	66 (99th%)	96	18	36	5	
Klickitat	Cascade Creek	1+	9/13/2012	29 (84th%)	44 (89th%)	73	18	27	4	
Klickitat	Cougar Creek	1+	8/26/2015	40 (99th%)	60 (99th%)	82	12	26	8	
Lower Basin	Snag Canyon	2+	8/5/2014	37 (96th%)	69 (99th%)	102	11	43	6	
Lower Basin	Silver Dollar	5+	7/3/2017	32 (84th%)	55 (85th%)	95	15	66	8	
Lower Basin	Boylston	5+	7/20/2018	32 (84th%)	64 (95th%)	93	13	65	6	
Methow	30-Mile	-	7/10/2001	45 (99th%)	56 (92nd%)	89	11	30	8	
Methow	Carlton	10+	7/17/2014	41 (98th%)	65 (99th%)	93	11	32	3	
Methow	Upper Falls	2+	8/6/2014	40 (97th%)	61 (97th%)	90	10	39	3	
Methow	Twisp	4+	8/19/2015	40 (97th%)	61 (97th%)	82	20	42	3	
Methow	Diamond	2+	8/11/2017	48 (100th%)	74 (100th%)	92	10	24	3	
Methow	Diamond	5+	8/30/2017	45 (99th%)	68 (99th%)	86	13	31	4	
Methow	Crescent	3+	8/23/2018	40 (97th%)	65 (99th%)	78	21	36	3	
Upper Basin	Nisqually John	1+	7/5/2018	33 (92nd%)	49 (80th%)	90	22	55	10	
Upper Basin	Angel Springs	1+	8/2/2018	45 (99th%)	73 (99th%)	96	11	47	11	
Upper Basin	Grass Valley	2+	8/11/2018	51 (99th%)	72 (99th%)	104	14	48	15	
Valley	Swakane	2+	7/10/2010	32 (94th%)	48 (90th%)	96	13	46	4	
Valley	Mills	2+	7/9/2014	41 (99th%)	55 (97th%)	97	11	44	9	
Valley	Reach	5+	8/14/2015	46 (100th%)	59 (99th%)	100	13	48	15	
Yakima	Table	2+	9/19/2012	44 (99th%)	63 (99th%)	85	10	21	9	
Yakima	Meeks	1+	9/13/2015	37 (96th%)	47 (88th%)	88	10	57	12	MxRH 39 on 9/12
Yakima	Jolly	2+	8/30/2017	38 (97th%)	64 (99th%)	89	9	37	7	
Yakima	Norse	5+	9/5/2017	36 (95th%)	61 (99th%)	84	21	37	6	