

# Northern Rockies Southwest Zone

## *Interagency Fire Danger Operating Plan*



2021-2023

United States Forest Service, Lolo & Bitterroot National Forests;  
Montana Department of Natural Resources, Missoula & Clearwater Units; Bureau  
of Indian Affairs; Confederated Salish & Kootenai Tribes, U.S. Fish & Wildlife  
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# Northern Rockies Southwest Zone

## Interagency Fire Danger Operating Plan

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# Northern Rockies Southwest Zone

## Interagency Fire Danger Operating Plan

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# Northern Rockies Southwest Zone

## Interagency Fire Danger Operating Plan

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## I. INTRODUCTION

### A. PURPOSE

The Northern Rockies Southwest Zone Interagency Fire Danger Operating Plan (FDOP) is intended to document a decision making process for agency administrators, fire program managers, fire operation specialists, dispatchers, agency cooperators, and firefighters by establishing interagency planning and response levels using the best available scientific methods and historical weather/fire data. 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.

An appropriate level of preparedness to meet wildland fire management objectives is 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 interagency fire managers to incorporate a measure of risk associated with decisions which have the potential to significantly compromise safety and control of wildland fires.

#### 1. Preparedness:

Interagency policy and guidance require numerous unit plans and guides to meet preparedness objectives. Some of these plans and guides are inter-related; some plans and guides 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 the Fire Management Reference System (FMRS); 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



Figure 1: Preparedness Plan Relationship

management decisions. The actual implementation of the fire business thresholds is described in the following supplemental action plans.

The decision thresholds are identified and documented in the appendices of Southwest Zone Fire Danger Operating Plan.

**a. Preparedness Plan**

Preparedness plans provide management direction given identified levels of burning conditions, fire activity, and resource commitment, and are required at national, state/regional, and local levels. Preparedness Levels (1-5) are determined by incremental measures of burning conditions, fire activity, and resource commitment. Fire danger rating is a critical measure of burning conditions. The Preparedness Levels are identified and documented in the Northern Rockies Southwest Zone Fire Danger Operating Plan; the associated decisions and planned actions are in the Preparedness Plan, located in Appendix A.

**b. Staffing Plan**

The Staffing Plan describes escalating responses that are usually noted in the FMRS. 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 thresholds are identified and documented in the Northern Rockies Southwest Zone Fire Danger Operating Plan. The recommended staffing actions for the Lolo and Bitterroot National Forests, Montana DNRC, and CSKT (pending) are located in Appendix B.

**c. Fire 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 objective of the prevention program is the reduction of public exposure and fire fighter risk, fire suppression expenditures, and damages from human-caused fires. The prevention team aims to foster leadership and integrate fire prevention activities and education through public outreach programs that coordinate fire prevention and education activities across the Southwest Zone.



The CSKT Prevention Plan is available upon request; please contact Ronan Fire Dispatch Center Manager, Confederated Salish and Kootenai Tribes.

The Montana DNRC Prevention Plan is available upon request; please contact the Southwestern Land Officer Fire Program Manager.

The Lolo and Bitterroot National Forest Prevention Plans are available upon request; please contact the Lolo or Bitterroot National Forest Prevention Education Coordinators. Links to these plans can also be found in Appendix C.

**d. Fire Restrictions and Closures 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.

The Restrictions and Closures Plan for the Missoula Area is written in cooperation with all interagency partners. This plan provides standardized wording, criteria, and process for implementing and rescinding fire restrictions and small-scale closures. It also provides clear direction and responsibility for the coordination and implementation of fire restrictions and area closures within the Missoula Area. The Missoula Area Restrictions and Closure Plan includes lands owned by the Lolo and Bitterroot National Forests, Montana DNRC, BLM, US Fish and Wildlife, and CSKT. A link to this plan is located in Appendix D.

The Bitterroot NF also has lands covered under the Dillon Area Restrictions and Closure Plan for the Anaconda-Pintler Wilderness and the Idaho Fire Restrictions Plan for the portion of Idaho lands on the Bitterroot NF.

**2. Wildfire Response**

**a. 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. Dispatch response levels are identified and documented in the Northern Rockies Southwest Zone Fire Danger Operating Plan and Response Plan. The number and type of suppression resources dispatched to a reported fire will be documented in the associated Response Plans. These Response Plans, run cards, can be found in Appendix

E and are currently in the development phase with projected use in 2021/2022.

The CSKT Dispatching Response Plan is available upon request; please contact Ronan Fire Dispatch Center Manager.

**b. Local Mobilization Plan**

The Northern Rockies Interagency Mobilization Guide 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 link to the Northern Rockies Interagency Mobilization Guide is in Appendix F.

**B. 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](#)
- Montana DNRC – [Fire and Aviation Manual](#)
- Bureau of Indian Affairs – [Wildland Fire and Aviation Program Management Operations Guide](#)
- U.S. Fish and Wildlife Service – [Fire Management Handbook, Chapter 10 - Preparedness](#)
- Bureau of Land Management– [Manual 9211-1-Fire Planning Handbook](#)

**C. 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) within the fire danger planning area with similar climate, vegetation, and topography.
3. Document the interagency fire weather-monitoring network consisting of Remote Automated Weather Stations (RAWS) which comply with the NWCG Interagency Wildland Fire Weather Station Standards and Guidelines (PMS 426-3).
4. Determine climatological and fire business thresholds using the Weather Information Management System (WIMS), National Fire Danger Rating System



(NFDERS), and FireFamilyPlus software to analyse and summarize 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 current and expected 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. Develop and distribute fire danger pocket cards to all personnel involved with fire management within the fire danger planning area.
10. Identify program needs and suggest improvements for implementation of the Fire Danger Operating Plan.

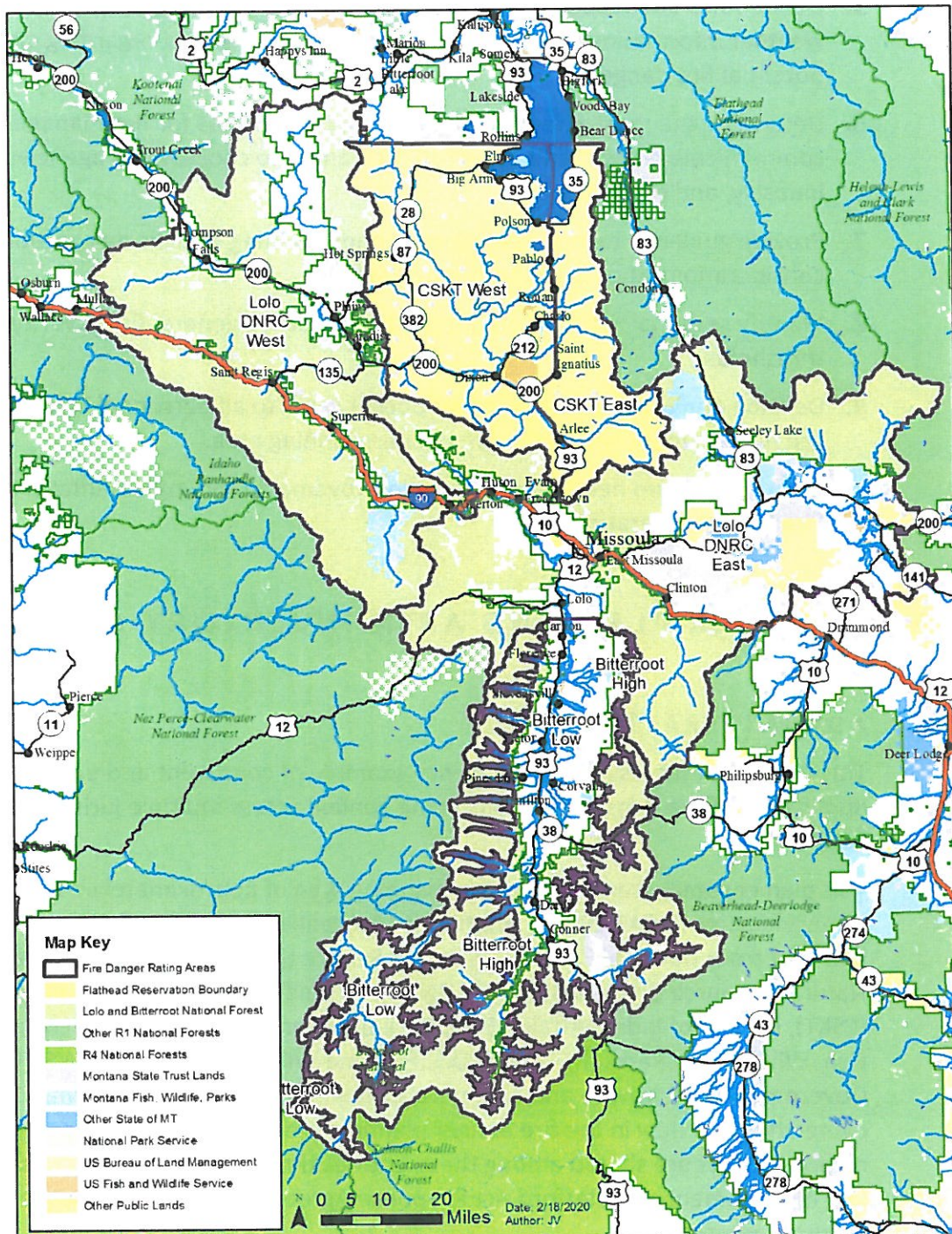
## **II. FIRE DANGER PLANNING AREA INVENTORY AND ANALYSIS**

### **A. ADMINISTRATIVE UNITS**

This document serves as an *interagency* example of consistent and effective application of fire danger decisions being applied across multiple jurisdictional boundaries.

This plan encompasses a fire danger planning area of approximately 7 million, 41 thousand acres (7,041,180) in southwest Montana including land owned by the Lolo and Bitterroot National Forests, US Forest Service (USFS); Montana Department of Natural Resource Conservation (MT DNRC); Confederated Salish and Kootenai Tribes (CSKT), Bureau of Indian Affairs (BIA); Bureau of Land Management (BLM); Montana, Fish, Wildlife and Parks (MT FWP); U.S. Fish and Wildlife Service (USFWS); local Government; and private and commercially owned lands. Reference Map 1 for ownership overview in the fire danger planning area. Wildland fire management responsibilities are shared among these entities through the Montana Cooperative Fire Management and Stafford Act Response Agreement (locally known as the six-party agreement).

## 1. Overview Map



Map 1: Fire Danger Planning Area Overview

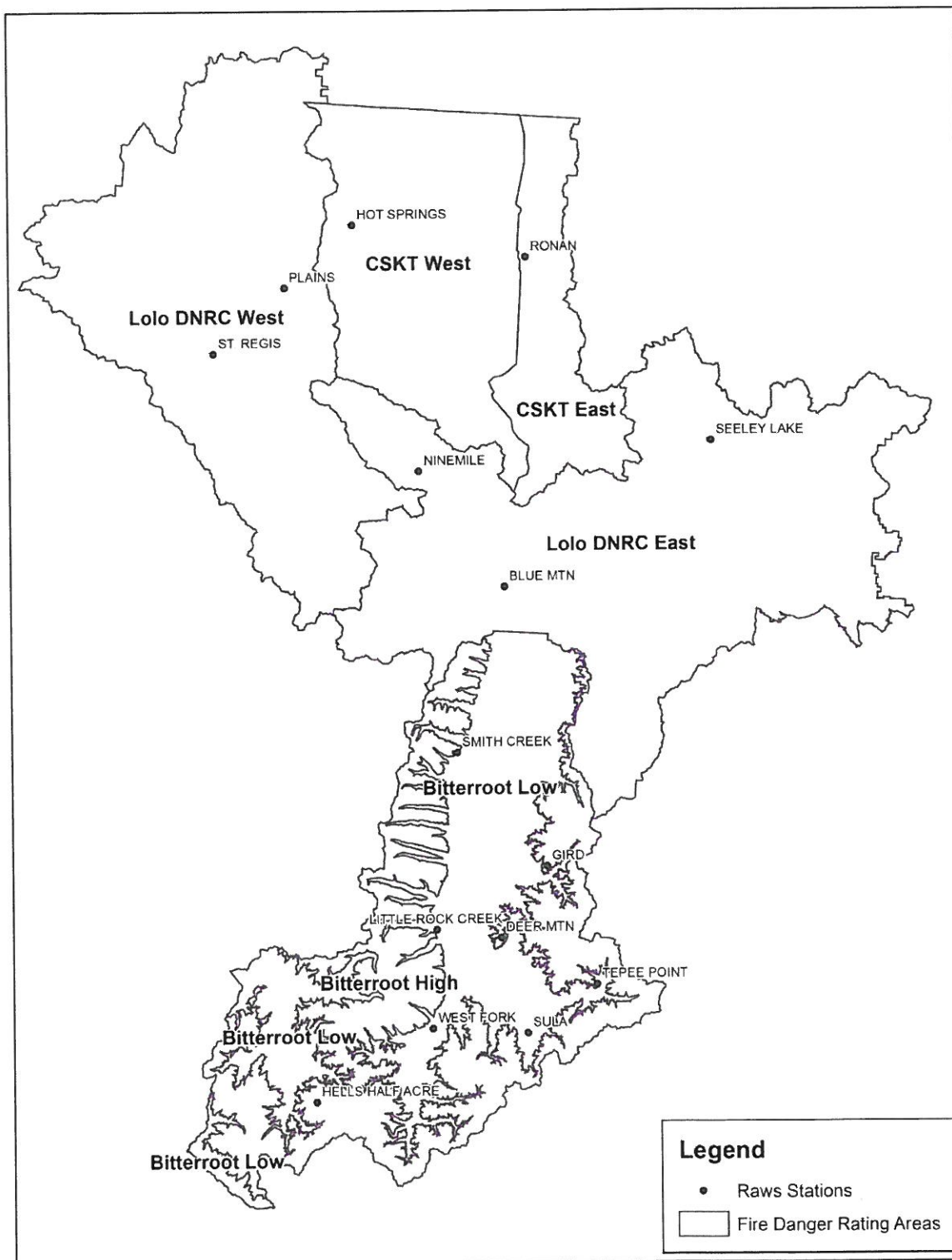


## B. FIRE DANGER RATING AREAS

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. Fire Danger Rating Areas were delineated based upon an analysis of these three factors: climate, vegetation, and topography. After these environmental factors were considered, the FDRAs were or will be *edge-matched* to existing administrative boundaries using Response Areas. It is important that existing Response Areas are not split by FDRAs and to avoid additional workload and confusion for operational personnel, a Response Area must not have two FDRAs.

The Northern Rockies Southwest Zone Fire Danger Operating Plan has been delineated into six FDRAs: Lolo DNRC East, Lolo DNRC West, CSKT East, CSKT West, Bitterroot Low, and Bitterroot High. Map 2 displays the final FDRA delineation and RAWS locations included in this analysis. Table 1 displays acres and percentage of the area each FDRA covers.

## 1. Northern Rockies Southwest Zone FDRA's and RAWS Map



Map 2: FDRAs and RAWS Locations

## 2. Northern Rockies Southwest Zone FDRA Table

Fire Danger Rating Area	Acreage	% of Total Area
Lolo DNRC East (LDE)	2,071,510	29%
Lolo DNRC West (LDW)	1,622,589	23%
CSKT East (CE)	397,937	6%
CSKT West (CW)	917,928	13%
Bitterroot Low (BRL)	1,004,594	14%
Bitterroot High (BRH)	1,026,622	15%

Table 1: Fire Danger Rating Areas (FDRAs)

### C. WEATHER STATIONS

All Remote Automated Weather Stations (RAWS) comply with the National Wildfire Coordinating Group (NWCG) weather station standards.

<http://www.nwcg.gov/pms/pubs/PMS426-3.pdf>.

There are many options available for managers to consider when selecting permanent RAWS for use in this analysis. Fifteen RAWS were used across the fire danger rating areas which can be referenced in Appendix L. The longevity of their data and the diverse bio physical settings where the RAWS are located, including the lowest elevations possible which dry out the soonest, alerting fire managers of the threat, and representing the areas where human populations are located, were all criteria for selecting the RAWS used.

Two of the FDRA's have one RAWS each. The CSKT East FDRA will use the Ronan RAWS and the CSKT West will use the Hot Springs RAWS. This is due to the reality that these RAWS are the only ones that have collected data in each area for the analysis period.

#### 1. Special Interest Groups (SIGs)

Special Interest Groups are when RAWS are grouped and their data compiled to run together in a single analysis. There are four SIGs within this Fire Danger Operating Plan: Lolo DNRC East (LDE), Lolo DNRC West (LDW), Bitterroot Low (BRL), and Bitterroot High (BRH). See the listing of SIGs and their associated RAWS in Table 7 and Appendix L.



### III. FIRE DANGER WORKLOAD ANALYSIS

To apply fire danger rating as a viable decision support tool, fire managers must be able to associate fire suppression workload with specific target groups. An understanding of the specific target groups from which the suppression workload originates will help determine the appropriate communication methods and deterrence measures which may effectively change the behavior of the respective target groups.

#### A. IDENTIFICATION/FRAMING OF THE FIRE OCCURRENCE WORKLOAD

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:

1. **Affected Target Group:** The group of people commonly associated with the problem (Agency, Industry, or Public).
  - a. **Agency:** Employees of the federal, state, and local governments involved in the cooperative fire management efforts with wildland fires. This includes Federal, State, and County land management employees, along with volunteer fire departments who share a similar protection mission regarding wildland fires.
  - b. **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.
  - c. **Public:** Individuals who use public lands for non-commercial purposes such as off-highway vehicle (OHV) 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 (WUI).
2. **Workload Description:** This is the fire unit's suppression workload. Human-caused fires are usually described in terms of an ignition cause related to public and industrial target groups. Natural-caused (or lightning) fire workload is usually described as the Agency's workload.

## **B. FIRE WORKLOAD ANALYSIS**

Fire history data was downloaded from the Fire Program Analysis Fire Occurrence Database (FPA FOD) for an analysis time frame that complements available weather data. An analysis period of 2003 through 2017 was used for the Lolo DNRC East, Lolo DNRC West, Bitterroot Low, Bitterroot High, and CSKT West FDRA's. CSKT East FDRA used an analysis period of 2004-2017. These analysis time periods varied based upon available data.

A yearly summary of historical fire data for all agency fires within each FDRA was created using FireFamilyPlus. These yearly summary reports indicate the majority of fires within the FDRA's occur during the months of April through October. Therefore, the analysis parameters included April through October as the fire season filter setting. This decision was made so indices created represent the time of year with the greatest probability of fire occurrence. Yearly and April through October fire occurrence analysis can be referenced in Appendix K.

During April through October across all FDRA's, an average of 418 fires occurred per year and an average of 74,815 acres burned per year. Acreage numbers are skewed due to large acreage burned during the years 2003, 2005, 2007, 2012, 2013, 2016, and 2017. The analysed fire activity is seasonal with fires occurring in the spring through fall months and few to no fires occurring in the winter months. April and October account for 97% of all ignitions and the remaining 3% is accounted for in November through March. Approximately 69% of the fires are less than ¼ acre in size (size class A). Lightning is the ignition source for approximately 53% of the fires with the remaining 47% of the fires being human caused.

Lightning, campfires, debris burning, equipment, railroad, arson, and miscellaneous human caused fires combine for the total fires for each FDRA. Table 2 displays the statistical cause data for each FDRA during their analysis period.

FDRA	Total # of Fires	Lightning	Campfire	Debris Burning	Equipment	Railroad	Arson	Misc. Human	Acres Burned
Lolo DNRC East	2,303	1,083	326	279	69	16	38	492	433,351
Lolo DNRC West	1,526	840	146	104	53	82	22	279	280,145
CSKT East	416	100	193	35	16	2	33	37	78,077
CSKT West	734	268	233	41	82	8	37	65	43,198
Bitterroot Low	645	394	107	48	8	0	11	77	74,967
Bitterroot High	653	621	24	0	0	0	0	8	212,495
Totals	6,277	3,306	1,029	507	228	108	141	958	1,122,233

Table 2: FDRA Fire Statistics and Causes within each FDRA.

Lolo DNRC East: April 1-October 31; 2003-2017.

Lolo DNRC West: April 1-October 31; 2003-2017.

CSKT West: April 1-October 31; 2003-2017.

CSKT East: April 1-October 31; 2004-2017.

Bitterroot Low: April 1-October 31; 2003-2017.

Bitterroot High: April 1-October 31; 2003-2017.

#### IV. FIRE DANGER DECISION ANALYSIS

Decision thresholds can be based upon either:

- Climatological Thresholds, or
- Fire Business Thresholds.

This Fire Danger Operating Plan will be used to support preparedness, staffing and response decisions which are made at specific decision thresholds. A “decision threshold” is a threshold along the range of possible output values where a decision shifts from one



choice to another. When the combination of events and conditions signal it is time to do something different, a “decision threshold” has been identified for each Fire Danger Rating Level within each Fire Danger Rating Area.

## A. CLIMATOLOGICAL ANALYSIS

Climatological thresholds are ranges on the cumulative distribution curve of one fire weather/danger index computed from climatology (weather) without regard for associated fire occurrence/business. For example, the value at the 90<sup>th</sup> percentile ERC is the climatological threshold at which only 10 percent of the ERC values are greater in value.

Table 3 displays the calculated decision thresholds for ERC across all FDRA's.

ERC thresholds are based upon percentile settings in FireFamilyPlus using the 40<sup>th</sup>, 80<sup>th</sup>, 90<sup>th</sup>, and 97<sup>th</sup> percentile breaks. PL1 and PL2 are typically during times when there are generally minimal fires occurring. PL3 uses the 80<sup>th</sup> percentile to represent the threshold at which we begin to see more fires occurring. This is represented well in the class percentage charts in Appendix M for each FDRA. The 90<sup>th</sup> percentile represents the fire danger value where only 10% of the fire weather days historically have been higher than that value and the 97<sup>th</sup> percentile represents the top 3% of fire weather days.

Decision Threshold Ranges	Lolo DNRC East	Lolo DNRC West	CSKT East	CSKT West	Bitterroot Low	Bitterroot High
<b>Low-PL 1</b> <b>0% - &lt;40%</b>	0-21.9	0-23.9	0-20.9	0-31.9	0-23.9	0-16.9
<b>Moderate-PL 2</b> <b>&gt;40% - &lt;80%</b>	22-39.9	24-41.9	21-32.9	32-49.9	24-42.9	17-39.9
<b>High-PL 3</b> <b>&gt;80% - &lt;90%</b>	40-45.9	42-47.9	33-37.9	50-56.9	43-47.9	40-45.9
<b>Very High-PL 4</b> <b>&gt;90% - &lt;97%</b>	46-51.9	48-54.9	38-43.9	57-64.9	48-52.9	46-50.9
<b>Extreme-PL 5</b> <b>&gt;97%</b>	52+	55+	44+	65+	53+	51+

Table 3: Preparedness Levels and ERC Decision Threshold Ranges in all FDRA's.

Table 4 displays the decision threshold ranges for BI across all FDRA's. The first BI threshold (Low/Moderate) is based upon the relationships between BI and fire activity observed by the Moderate Resolution Imaging Spectroradiometer (MODIS) instrument. The second BI threshold (Moderate/High) is selected solely based on the climatology of each FDRA and is set to the 97<sup>th</sup> percentile. A description of the methods and results of this analysis are presented in Appendix M.

Decision Threshold Ranges	Lolo DNRC East	Lolo DNRC West	CSKT East	CSKT West	Bitterroot Low	Bitterroot High
Low	0-21.9	0-25.9	0-24.9	0-20.9	0-36.9	0-32.9
Moderate	22-37.9	26-45.9	25-33.9	21-39.9	37-46.9	33-41.9
High >97%	38+	46+	34+	40+	47+	42+

Table 4: BI Decision Threshold Ranges in all FDRA's.

The decision matrix, in Table 5, uses the combination of ERC (hot and dry weekly trend) and BI (windy daily trend) levels to determine the overall Dispatch Response Level. This table provides a connection between the preparedness plan and response plan while incorporating staffing plan needs. This Dispatch Response Level will be calculated daily to assist fire managers with resource staffing and response decisions.

+ days represent the 3% days when the ERC and BI are above the 97<sup>th</sup> percentile. Historically, most firefighter entrapments, shelter deployments, and fatalities have occurred under these conditions.

		Dispatch Response Level				
BI Class	H	Low	Low	Mod	High	High +
	M	Low	Low	Mod	Mod	High
	L	Low	Low	Low	Mod	Mod
		1	2	3	4	5
		ERC Class				

Table 5: Dispatch Response Level Matrix



## B. FIRE BUSINESS ANALYSIS

The primary target groups are agency, public, and industry. The main fire issues are lightning, campfires, debris burning, equipment, railroad, arson, and miscellaneous human caused fires.

Lightning caused fires require Agencies to prepare themselves for predicted storms. Agency personnel become the target group where fire preparedness and appropriate staffing levels are essential. Lightning has the potential for multiple starts in challenging terrain. The majority of our multiple fire days are the result of lightning.

Campfire, debris burning, equipment, railroad, smoking, arson, children, and other miscellaneous human caused fires require interactions with the public and industry, as they are the target groups. All non-lightning fires can be addressed through fire prevention programs, which includes restriction and closures, across agencies. Table 6, Fire Decision Summary Table, identifies the target group and the appropriate plan for addressing the fire cause.

The indices analysed for each FDRA were Energy Release Component (ERC) and Burning Index (BI). ERC and BI are commonly chosen in this forested, mountainous region as fire season indicators depending on climate, predictability, fuel type/condition, and fire occurrence association. ERC is a good predictor of seasonal trends in areas of heavy fuels whereas BI, with a wind component, is a good indice for response functions.

Target Group	FDRA	Statistical Cause	Workload Definition	Climatological or Fire Business Thresholds	Number of Decision Points	Index/ Comp	Fuel Model	Preparedness Plan to Modify Target Group Behaviour
Agency	All FDRA's	1 - Lightning	Lightning caused ignitions which can quickly exceed the capability of the local units initial attack resources.	Fire Business Thresholds	5	ERC, BI, Fire Danger Rating Level	Y	Staffing Plan
Public	All FDRA's	4 - Campfire	Increased reports of escaped campfires.	Fire Business Thresholds	5	ERC, BI, Fire Danger Rating Level	Y	Prevention Plan

Public	All FDRA's	9 - Miscellaneous	Increased fire starts from smoking, children, and unknown ignition sources.	Fire Business Thresholds	5	ERC, BI, Fire Danger Rating Level	Y	Prevention Plan
Public	All FDRA's	5 – Debris Burning	Increase in escaped fires resulting from debris burning activities.	Fire Business Thresholds	5	ERC, BI, Fire Danger Rating Level	Y	Restrictions/ Closure plan
Industry	All FDRA's	2- Equipment	Fires along roadways or right of ways resulting from machinery and/or mechanical activities.	Fire Business Thresholds	5	ERC, BI, Fire Danger Rating Level	Y	Restrictions/ Closure Plan
Public	All FDRA's	7 - Arson	Increase in fire starts from arson activities.	Fire Business Thresholds	5	ERC, BI, Fire Danger Rating Level	Y	Prevention Plan
Industry	CSKT East CSKT West Lolo DNRC East Lolo DNRC West	6 - Railroad	Fires along railroad corridors resulting from railway maintenance or train passage.	Fire Business Thresholds	5	ERC, BI, Fire Danger Rating Level	Y	Prevention Plan

Table 6: Fire Decision Summary Table.

### C. PARAMETERS USED TO CALCULATE FIRE DANGER

Parameters for each FDRA analysis are listed below in Table 7.

Fire Danger Rating Area	SIG	Station ID	Name	Slope Class	Analysis Period	Large Fire Size	Multiple Fire Day
Lolo DNRC East	LDE	241507	Ninemile	3	1	9	3
		241508	Seeley Lake	3			
		241513	Blue Mtn	3			
Lolo DNRC West	LDW	241302	St. Regis	4	1	10	3
		241507	Ninemile	3			
		241206	Plains	4			
CSKT West	CW	241211	Hot Springs	1	1	40	3
CSKT East	CE	241403	Ronan	3	1	15	3
Bitterroot Low	BRL	242912	Smith Creek	4	1	10	5
		242905	Sula	4			
		242907	West Fork	4			
		242914	Little Rock Creek	4			
Bitterroot High	BRH	242911	Gird	3	1	10	5
		242910	Teepee Point	3			
		242902	Deer Point	4			
		101019	Hells Half	4			

Table 7: FDRA Analysis Parameters.

### D. CORRELATION WITH FIRE OCCURRENCE

The analysis using the above parameters provided an adequate correlation with fire occurrence. Fire business decisions can be made with confidence utilizing the identified decision thresholds for associated plans.

Indices for each FDRA were evaluated to determine the most representative index and fuel model to use as the primary fire danger indicator.



## E. DECISION SUMMARY NARRATIVE

In summary, the FDOP will utilize ERC and BI as both correlate well with fire occurrence. However, ERC stands out as a better overall fire danger indicator for Preparedness Levels, Staffing Levels, and Adjective Fire Danger Ratings because it tracks well with fire season and has very few fire occurrences at low ERC values. BI works well for setting Daily Dispatch Response Levels to capture daily variations in wind and fuel moistures.

Fuel model Y was selected for analysis with each of the indices because it best represents the fuels found within the Southwest Zone. Fuel model Y includes both open timber/grass and closed, short-needle conifer, and heavy dead fuels. It represents fine dead fuels, which respond quickly to changes in weather and tend to have a lower energy output than heavier fuels. Fuel Model Y also contains a large load of heavy dead fuels. Because heavy fuels react very slowly to changes in weather, fuel model Y reflects longer term weather trends.

An overview of the analysis results are as follows. These fuel model/indice pairs will be used to determine the climatological thresholds.

Fire Danger Rating Area	Index (Fuel Model)	Climatological Thresholds Used For:
All FDRA's	ERC(Y)	- Adjective Fire Danger Rating - Staffing Levels - Preparedness Levels - Pocket Cards - Severity Requests
	BI(Y) & ERC(Y)	- Dispatch Response Levels

Table 8: Climatological Thresholds for all FDRA's.

## V. FIRE DANGER RATING LEVELS

The NFDRS utilizes the WIMS processor to manipulate weather data and forecasted data stored in the National Interagency Fire Management Integrated Database (NIFMID) to produce fire danger ratings for corresponding weather stations. NFDRS outputs from the WIMS processor can be used to determine various levels of fire danger rating. The system is designed to model worst-case fire danger scenario. 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.



## **A. RESPONSE (OR DISPATCH) PLAN**

Response (or Dispatch) Levels (low, moderate, and high) 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.

Local-level initial pre-planned Response Plans, also referred to as “Run Cards” or “Dispatch Strategy”, specify the fire management response (e.g., number and type of suppression resources to dispatch) within a defined geographic area to an unplanned ignition, based on weather, fuel conditions, fire management objectives, and resource availability.

The Response Plans will outline actions to be taken for each initial attack response. These actions are to be considered guidelines and Duty Officer coordination is encouraged to inform initial response actions based on risk assessments and local factors. At the time of this document, the Missoula and Bitterroot Dispatch Centers are currently developing run cards with projected use in 2021/2022.

The CSKT Dispatching Response Plan is available upon request; please contact Ronan Fire Dispatch Center Manager.

Reference Appendix E for the Response Plans.

## **B. STAFFING LEVEL**

Staffing Levels will be used to make daily internal fire preparedness and operational decisions. At the protection unit level, the staffing level can form a basis for decisions regarding the “degree of readiness” for initial attack resources and support resources. Specific preparedness actions are defined at each staffing level. Although Staffing Level can be a direct output in WIMS, the WIMS output is only based upon weather observations and climatological percentiles. The use of climatological percentiles for daily staffing decisions is optional. The preferred method to delineate Staffing Level thresholds is based on statistical correlation of weather and fire occurrence.

The CSKT Staffing Levels are available upon request; please contact Ronan Fire Dispatch Center Manager, Confederated Salish and Kootenai Tribes.

The Montana DNRC Staffing Levels are defined in the Southwestern Fire Mobilization Guide; please contact the Southwestern Land Officer Fire Program Manager.

Staffing Levels for personnel and initial attack resources will vary throughout the year by the Fire Danger Rating Area. When fire danger rating is low, typically during pre/post and early season, no or limited initial attack capability is required.

Reference Appendix B for Staffing Level Tables for the Lolo and Bitterroot National Forests, Montana DNRC, and CSKT (available upon request).

### C. FIRE DANGER ADJECTIVE RATING

In 1974, the Forest Service, Bureau of Land Management and State Forestry organizations established five standard Adjective Fire Danger Rating Levels descriptions for public information and signing. Table 9 describes the Fire Danger Adjective Rating Levels.

Fire Danger Rating Adjective	Description
Low (L)	Fuels do not ignite readily from small firebrands although a more intense heat source, such as lightning, may start fires in duff or punky wood. Fires in open cured grasslands may burn freely a few hours after rain, but woods fires spread slowly by creeping or smoldering, and burn in irregular fingers. There is little danger of spotting.
Moderate (M)	Fires can start from most accidental causes, but with the exception of lightning fires in some areas, the number of starts is generally low. Fires in open cured grasslands will burn briskly and spread rapidly on windy days. Timber fires spread slowly to moderately fast. The average fire is of moderate intensity, although heavy concentrations of fuel, especially draped fuel, may burn hot.
High (H)	All fine dead fuels ignite readily and fires start easily from most causes. Unattended brush and campfires are likely to escape. Fires spread rapidly and short distance spotting is common. High intensity burning may develop on slopes or in concentrations of fine fuels. Fires may become serious and their control difficult unless they are attacked successfully while small.
Very High (VH)	Fires start easily from all causes and, immediately after ignition, spread rapidly, and increase quickly in intensity. Spot fires are a constant danger. Fires burning in light fuels may quickly develop high intensity characteristics such as long distance spotting and fire whirlwinds when they burn into heavier fuels.
Extreme (E)	Fires start quickly, spread furiously, and burn intensely. All fires are potentially serious. Development into high intensity burning will usually be faster and occur from smaller fires than in the very high fire danger class. Direct attack is rarely possible and may be dangerous except immediately after ignition. Fires that develop headway in heavy slash or in conifer stands may be unmanageable while the extreme burning condition lasts. Under these conditions the only effective and safe control action is on the flanks until the weather changes or the fuel supply lessens.

Table 9: Fire Danger Adjective Rating Levels

### D. PREPAREDNESS LEVEL

The Preparedness Level is a five-tier (1-5) fire danger rating decision tool based on NFDRS output(s) and other indicators of fire business (such as projected levels of resource commitment). Preparedness Levels will track seasonal trends and assist fire managers with more long-term (seasonal) decisions with respect to fire danger.

Reference Appendix A for the Southwest Zone Preparedness Plan.



## **Severity**

Fire severity funding is the authorized use of suppression operations funds for extraordinary preparedness activities required due to:

- FMP, FDOP, or Annual Operating Plan criteria that indicate the need for additional preparedness/suppression resources. The plan(s) should identify thresholds for severity needs;
- Anticipated fire activity will exceed the capabilities of local resources;
- Fire season that either starts earlier or lasts longer than identified in a FDOP;
- An abnormal increase in fire potential or danger not planned for in existing preparedness plans.

Forest Service established decision thresholds will be used to determine severity funding needs. Severity Requests are partially based on the 90<sup>th</sup> and 97<sup>th</sup> percentiles derived from year-round climate data; however, the need for severity funding can be evaluated once seasonal averages are exceeded.

CSKT severity needs are determined on a seasonal basis, for more information contact Jack Currie, Ronan Fire Dispatch Center Manager, Confederated Salish and Kootenai Tribes.

Montana DNRC will enter into discussion upon reaching Preparedness Level 3 and their severity information can be referenced through the Southwestern Land Office Fire Mobilization Guide. Contact Southwestern Land Office Fire Program Manager.

Reference Appendix B for Severity Staffing Levels in the Northern Rockies Southwest Zone Staffing Plan.

## **VI. FIRE DANGER OPERATING PROCEDURES**

### **A. ROLES AND RESPONSIBILITIES**

#### **1. Agency Administrators**

Agency Administrators will ensure this Fire Danger Operating Plan is a guide used by Fire Management Officers to make informed fire related decision.

#### **2. Fire Management Officers**

Forest, District, Tribal, and Montana DNRC Fire Management Officers are responsible for implementing, ensuring decisions are made consistent with the intent of the plan, and providing input for updating this plan. They are ultimately responsible for ensuring this plan is maintained, utilized, and communicated.



Fire Management Officers will also provide support for their Local RAWS Technicians and necessary training to assist the Missoula, Bitterroot, and Ronan Dispatch Centers for any local needs that may occur.

### **3. Duty Officers**

Coordinate with appropriate staff and Duty Officers across the zone to evaluate daily fire danger, ensure staffing levels are appropriate and adjust accordingly.

Share resources across the zone as feasible.

Provide input regarding preparedness, staffing, and response plans. Manage staffing appropriately based on established preparedness levels.

Assure that all local fire resources and other unit staff are aware of the fire danger and preparedness levels.

### **4. Local RAWS Technicians-Fire Danger Technical Group**

An individual from each Lolo NF Ranger District, Bitterroot NF Ranger District, Missoula Dispatch Center, Bitterroot Dispatch Center, and the Confederated Salish and Kootenai Tribes has been identified as members of the Fire Danger Technical Group. A Montana DNRC individual has not been identified because they do not manage any of the RAWS used in this analysis.

Lolo NF members of the Fire Danger Technical Group are responsible for coordinating with the Lolo NF RAWS Coordinators for annual maintenance and replacement of RAWS equipment and parts.

Bitterroot NF members of the Fire Danger Technical Group are responsible for coordinating with the Bitterroot NF RAWS Coordinator for annual maintenance and replacement of RAWS equipment and parts.

The Confederated Salish and Kootenai RAWS maintenance is contracted to Forest Technology Systems (FTS).

Appropriate training and team support will be provided to members of this technical working group.

Table 10 lists the specific personnel who may be RAWS technicians or constitute the Fire Danger Technical Group:

Location	Contact	Station	Station ID	Agency
Supervisors Office, LNF	Jeffrey Hayes	N/A	N/A	FS
Missoula Ranger District, LNF	Andrew Bidwell	Blue Mtn	241513	FS
Ninemile Ranger District, LNF	Erin O'Loughlin	Ninemile	241507	FS
Plains/Thompson Falls Ranger District, LNF	Trevor Unsworth	Plains	241206	FS
Seeley Lake Ranger District, LNF	Phil Shelmerdine	Seeley Lake	241508	FS
Superior Ranger District, LNF	Bobby Henderson	St. Regis	241302	FS
Missoula Dispatch Center: LNF RAWS Coordinators	DJ Johnson (primary)	N/A	N/A	FS
	Missoula Dispatch Center Manager (secondary)	N/A	N/A	FS
Ronan Dispatch Center, CSKT CSKT RAWS Coordinator	Jack Currie	Hot Springs Ronan	241211 241403	CSKT CSKT
Stevensville Ranger District, BRF	Jon Devino	Smith Creek	242912	FS
Darby/Sula Ranger District, BRF	Jonah Vaughan	Gird Point	242911	FS
		Deer Mt	242902	FS
		Little Rock Creek	242914	FS
		Sula	242905	FS
		Tepee Point	242910	FS
West Fork Ranger District, BRF BRF RAWS Coordinator	Bret Lewis	West Fork	242907	FS
		Hells Half	101019	FS
Bitterroot Dispatch Center	Kelly McKee	N/A	N/A	FS

Table 10: RAWS Technicians and/or Fire Danger Technical Group Representatives.

LNF-Lolo National Forest; BRF-Bitterroot National Forest, CSKT-Confederated Salish & Kootenai Tribes

## 5. Dispatch/Communication Center

The NFDRS2016 model does not require daily collection of State of the Weather (SOW) as was the practice in NFDRS78 formally used in this area. During fire season, each day the previous evenings indices will be broadcast with the morning weather forecast and the actual indices will be broadcast with the afternoon weather forecast. Indices will be posted on the Missoula Dispatch Center web page by 1600 daily. The Bitterroot Dispatch Center will post indices and a local Situation Report by 1800 daily.

## 6. Fire Weather Station Owners

All Lolo NF RAWS will be managed by the LNF RAWS Coordinator, DJ Johnson (primary)/Missoula Dispatch Center Manager (secondary). All Bitterroot NF RAWS will be managed by the BRF RAWS Coordinator, Bret Lewis. They are the contact for all issues regarding data and station maintenance. These coordinators will assure identified problems with hardware or data are either corrected or assure that someone else corrects the problem.



Two of the RAWs used in this FDOP are owned and maintained by the Confederated Salish and Kootenai Tribes. These stations will be managed by the Ronan Dispatch Center Manager.

The Montana DNRC does not have responsibility for any RAWs used in the analysis, therefore they do not have a representative listed.

#### **7. Agency GIS Specialists**

Serve as data stewards for updating and maintaining ArcGIS fire history data.

#### **8. Education/Mitigation /Prevention Specialists**

Changes in adjective ratings will be communicated to Agency PIO's to be communicated with the public through appropriate channels: website, media releases, signs, contacts, Facebook, etc.

Fire Prevention Technicians will be responsible for assuring signs display the appropriate fire danger levels. They will also be involved with updates/revisions to the Prevention and Restriction plans.

#### **9. Fire Planners**

Fire Planners will continue interagency coordination and provide updates to the FDOP.

#### **10. Wildland Fire Resources**

It is the responsibility of all wildland fire resources to be aware of the preparedness/staffing levels, dispatch response levels, daily fire indices, and their responsibilities or actions to be taken at each level.

Supervisors have the responsibility to provide and brief their personnel on the information contained in the pocket cards.

### **B. SEASONAL SCHEDULE**

#### **1. Snow Flag**

Beginning March 1<sup>st</sup> start monitoring snow flag data and conduct weekly quality control to ensure data is reporting correctly on the hour.

#### **2. Station Greenup and Freeze Dates are automated under the new NFDRS2016 program.**



## **VII. FIRE DANGER PROGRAM NEEDS**

### **A. WEATHER STATIONS**

1. Utilize the NFDRS weather station handbook to ensure weather station annual maintenance is completed. District RAWS Technicians will be responsible for coordinating RAWS maintenance with the LNF and BRF RAWS Coordinators. CSKT RAWS maintenance is contracted to Forest Technology Systems (FTS).

### **B. COMPUTER/EQUIPMENT**

1. In coordination with the LNF, BRF, and CSKT RAWS Coordinators, complete annual RAWS maintenance.

### **C. TRAINING**

1. Identify and provide training to new RAWS Technicians. The Lolo National Forest, Bitterroot National Forest, and Confederated Salish and Kootenai Tribes will identify RAWS Technicians and points of contacts for their respective stations. Alternate technicians can also be identified to build depth and training.
2. Support the development and provide opportunities for employees to attend, coach, or instruct RAWS Maintenance, S-491 (Intro to NFDRS) and Advanced National Fire Danger Rating System (ANFDRS).
3. Provide opportunities for fire dispatchers to become trained on WIMS.
4. Provide refreshers on WIMS, FireFamilyPlus, and NFDRS as necessary to stay current with policy and technology.
5. Provide training on the Fire Danger Operating Plan and pocket cards.

### **D. SEASONAL FIRE DANGER RISK ASSESSMENTS**

1. Continue with pre-season and monthly outlooks.
2. Evaluate conditions for prescribed burning as well.

### **E. OTHER PROGRAM NEEDS**

1. Update Missoula, Bitterroot, and Ronan Dispatch Center SOP's to incorporate changes in the revised FDOP and associated plans in the Appendices.
2. Maintain existing and establish new fuel moisture monitoring sites.
3. Establish SOP's for interagency fuel moisture sampling protocols.

4. Update Prevention Plans to include explanations of any new criteria used to determine Fire Danger Rating Adjectives.

## **APPENDICES**

### **Link to Fire Danger Operating Plan:**

[Northern Rockies Southwest Zone Interagency  
Fire Danger Operating Plan \(NR-SWZ FDOP\)](#)

### **Appendix A: Preparedness Plan**

[NR-SWZ Preparedness Plan](#)

### **Appendix B: Staffing Plan**

[NR-SWZ Staffing Plan](#)

### **Appendix C: Prevention Plan**

Bitterroot National Forest Wildfire Prevention Plan:

<https://documentcloud.adobe.com/link/track?uri=urn:aaid:scds:US:f01bde65-6153-4a39-acd3-8cc9a4889b90>

[Lolo National Forest Fire Prevention and Education Operating Plan](#)

### **Appendix D: Fire Restriction Plan**

[Missoula Area Restrictions and Closures Plan](#)

### **Appendix E: Response Plan**

[NR-SWZ Response Plan](#)

### **Appendix F: Northern Rockies Mobilization Plan**

[Northern Rockies Interagency Mobilization Guide](#)

### **Appendix G: Prescribed Fire Approval Plan**

[National Interagency Fire Center Reference Materials and Guides](#)



## **Appendix H: Topography**

### **Topography:**

The topography in the Lolo, DNRC, and CSKT FDRA's is generally a rugged mix of mountainous forests and valley bottoms with elevations ranging from approximately 2,400' to 4,000' in the lowest valley bottoms to 8,000' to 9,500' in the higher mountainous terrain. Slope over the area ranges widely from rolling foothills to sheer rocky cliffs.

The Flathead, Clark Fork, Blackfoot, and Bitterroot Rivers, and portions of Flathead Lake are the main water influences within the planning area. The Idaho/Montana, Reservation, Ninemile, Sapphire, Swan Range, and Mission Mountains are all major Divides located within the planning area.

The Mission Valley is a clear topological feature within the study area. The valley is wetter to the east along the toe of the slope of the Mission Mountains. The western portion of the Mission Valley is more arid and the entire valley is generally rolling and level with a constant elevation. The Missoula, Frenchtown, and Potomac Valleys to the south of the Mission Valley are generally rolling and level as well.

The topography in the Bitterroot Low and High FDRA's consists of a valley floor about 60 miles long, ranging in width from 4 to 10 miles. To the west, the Bitterroot Range rises abruptly from the valley floor with a vertical relief of about 5,000 feet and rising to over 10,000 feet in elevation. Breaking this front at intervals of 1 to 3 miles are 30 deep, rocky glaciated canyons. South facing slopes are steep and rocky and north facing slopes are heavily timbered and often decadent with considerable dead and down fuel.

To the east, vertical relief along the Sapphire Mountains is much less pronounced, at about 3,000 feet. Grassy foothills provide a relatively gradual transition from the valley floor to the crest of the Sapphires, at over 8,000 feet in elevation. Major streams are much less frequent and occur at intervals of 4 to 7 miles.

Slopes on the forest are characteristically steep. Gentle slopes, under 40% slope, lie adjacent to the larger streams, along the ridges, and are fairly extensive at higher elevations representing 30% of the forest. Mid-slopes between streams and ridges are moderately steep, 40%-60% slope, and represent 40% of the forest. Those rising above major streams are usually very steep, over 60% slope, representing 30 % of the forest.

## **Appendix I: Vegetation**

### **Lolo DNRC East**

This FDRA includes lands associated with the Missoula, Seeley Lake, and portions of the Ninemile Ranger District on the Lolo National Forest, Montana DNRC Missoula and Clearwater Units, Montana Fish, Wildlife, and Parks, Bureau of Land Management, U. S. Fish and Wildlife Service, private industry, and private ownership. Interstate 90 and Highway 83 and 200 are the main travel corridors through this FDRA.

Most of the area is dominated by mixed conifer with areas of grassland to the east. The northern portion has higher elevation mountainous terrain which lends itself more readily to lodgepole pine transitioning to whitebark pine and wetter, vegetation growth.

Lower elevations of the eastern Clark Fork River Drainage consist of grasses, forbs, and shrubs transitioning to warm, dry ponderosa pine and Douglas fir stands. Ninebark, serviceberry, rough and Idaho fescues, and bluebunch wheatgrass habitat types are present along with occasional grassy parks on southerly aspects along the Frenchtown Face and throughout the Rock Creek Corridor. These lower elevations all contain this vegetative structure and are located within the Community Wildfire Protection Zone of Missoula Valley, Lolo Creek, Ninemile Creek, Petty Creek, Rock Creek, Clark Fork River Drainage, and the Highway 200 corridor.

Vegetation at mid-elevations transitions into cool, dry, and moist interior Douglas fir stands. Much of the vegetation structure consists of mixed conifer stands including western larch, ponderosa pine, and Douglas fir with inclusions of western red cedar, grand fir and lodgepole pine. These locations are typically within human developed areas.

Vegetation in the higher elevations and north aspects are characterized by lodgepole pine and lower subalpine pine/Engelmann spruce habitat types with grasses and shrubs. High elevations in the Great Burn Proposed Wilderness, Rattlesnake Wilderness, Scapegoat Wilderness, Ninemile Divide, Reservation Divide, and portions of the Rock Creek Drainage consist primarily of whitebark and lodgepole pine habitat types. Increased fuel loadings and tree mortality may be seen at these higher elevations due to mountain pine beetle attacks over the last several decades. Vegetation in these higher elevations is pre-disposed to stand replacement fire due to the high fuel load accumulations and understory vegetation.

### **Lolo DNRC West**

This FDRA includes lands associated with Plains, Superior, and portions of the Ninemile Ranger District on the Lolo National Forest, Montana DNRC, Montana Fish, Wildlife, and Parks, private industry, and private ownership. Interstate 90, Highway 135, and Highway 200 are the main travel corridors through this FDRA.

The western portions of the Lolo NF and Montana DNRC lands have ponderosa pine, Douglas fir, and western larch at lower elevations near the river corridors and quickly transitions



through mixed conifer with shrub understory and western larch on wetter aspects into higher elevation lodgepole pine.

Lower elevations of the western Lolo NF and Montana DNRC lands consist of grasses, forbs, and shrubs transitioning to warm, dry ponderosa pine and Douglas fir stands. Ninebark, serviceberry, rough and Idaho fescues, and bluebunch wheatgrass habitat types are present with occasional grassy parks intermixed on southerly aspects all along the Lower Clark Fork River near Fish Creek, Superior, Plains, and Thompson Falls.

The higher elevations along the Flathead River Divide, Clark Fork River Divide, CC Divide, and the Idaho/Montana border can vary depending on aspect but are typically characterized as mixed conifer stands with lodgepole pine and subalpine fir/Engelmann spruce stands. Intermittently dispersed throughout these stands are grasses, shrubs, and litter. Fires in this fuel model would be more of a stand replacement event under very high to extreme conditions.

#### **CSKT East**

This FDRA includes lands owned by the Confederated Salish and Kootenai Tribe. Highway 93 is the main travel corridors through this FDRA. This FDRA extends into the Mission Mountain Wilderness.

The lower elevations on the east side of the Mission Valley are composed of wetlands and agricultural lands bordered by large areas of annual and perennial grasses, forbs, and shrubs mainly on the valley floor and south aspects. From valley floor to mid elevation, this grass vegetation type transitions to warm, dry ponderosa pine and Douglas fir.

Mid to high elevations of the Mission Mountains are depicted by mixed conifer stands consisting of lodgepole pine, Douglas fir, and subalpine fir/Engelmann spruce. Intermittently dispersed throughout these forested stands is a mix of grasses, shrubs, and litter with understory conifer development. Whitebark and lodgepole pine stands dominate higher elevations in the Mission Mountains Wilderness and the South Fork Jocko Tribal Primitive Area. Increased fuel loadings and tree mortality due to mountain pine beetle attacks over the last two decades are evident and pre-disposed the area to stand replacement fire.

#### **CSKT West**

This FDRA includes lands owned by the Confederated Salish and Kootenai Tribe, U.S Fish and Wildlife Service, and Montana Fish, Wildlife, and Parks. Highway 28, 93, and 200 are the main travel corridors through this FDRA.

The lower elevations on the west side of the Mission Valley are composed of wetlands and agricultural lands bordered by large areas of annual and perennial grasses, forbs, and shrubs mainly on the valley floor and south aspects. From valley floor to mid elevation, this grass vegetation type transitions to warm, dry ponderosa pine and Douglas fir.



The mid to high elevations within and bordering the Mission Valley are predominately mixed conifer stands including Douglas fir, lodgepole pine and subalpine fir/Engelmann spruce. Intermittently dispersed throughout these forested stands is a mix of grasses, shrubs, and litter with understory conifer development.

#### **Bitterroot Low (Below 6000')**

The Bitterroot Low FDRA includes lands associated with the Stevensville, Darby, Sula, and West Fork Ranger Districts on the Bitterroot National Forest, Montana DNRC, Montana State Trust, Montana, Fish, Wildlife, Parks, U. S. Fish and Wildlife Service, private industry, and private ownership. Highways 93 and 473 are the main travel corridors in this FDRA. The Bitterroot and West Fork of the Bitterroot River are the largest water features throughout this FDRA.

As the lower elevations of the Bitterroot Valley transition from grasslands into timber, the south and west aspects are dominated by warm and dry ponderosa pine habitat types with predominately a grass understory. Shrubs such as snowberry, bitterbrush, and chokecherry are also common. Extremely dry rocky slopes in the Darby and Trapper Creek Job Corps areas contain mountain mahogany. These habitat types were historically open stands managed by a frequent fire return interval. Without the presence of fire, Douglas-fir is commonly found in the understory.

North and east aspects in the lower elevations are still considered warm, relatively dry, and commonly support a Douglas-fir habitat type with a mix of ponderosa pine. In the absence of fire, Douglas-fir is the dominant species in the understory and is often found in dense clumps. Shrubs such as ninebark and snowberry along with pine grass and bunch grasses are frequently found here.

With an increase in elevation (4000-6000') and precipitation, Douglas-fir habitat types transition into relatively wetter stands with higher stand densities, greater forb and shrub component, and higher fuel loadings. A mix of lodgepole pine, grand-fir, ponderosa pine, and western larch (north aspects on Stevensville RD) are common. Huckleberry, ninebark, kinnikinnick, Oregon grape, pine grass, and elk sedge are present in the understory.

Canyons and steep drainage bottoms in the lower elevations often contain a wetter mix of species including Engelmann spruce, grand fir, Douglas-fir, red osier dogwood, foals huckleberry, Oregon grape, a variety of ferns, and moisture loving forbs. Heavy down woody accumulation is often present.

#### **Bitterroot High (Above 6000')**

The Bitterroot High FDRA includes lands associated with the Stevensville, Darby, Sula, and West Fork Ranger Districts on the Bitterroot National Forest, Montana State Trust, Montana, Fish, Wildlife, Parks, private industry, and private ownership.

As the elevation increases above 6000', Ponderosa pine drops out and Douglas-fir dominated habitat types transition to include a greater mix of lodgepole pine, subalpine fir and Engelmann

Spruce. Understories often consist of dense shrubs, forbs and grasses. Fools huckleberry (MEFE), alder, willow, huckleberry, bear grass and elk sedge are often common. Western larch is present on north aspects on the Stevensville Ranger District. Lodgepole pine dominated stands are also found at this elevation and may be dense stands with higher fuels loadings. Aside from western larch being fire tolerant, fire in many of these stands is often stand replacing.

At the highest elevations, subalpine cold habitat types exist including a mix of whitebark pine, lodgepole pine, subalpine fir, and subalpine larch. These stands tend to be more open grown with rocky soils and patchy shrubs, forbs and grasses. Mountain heather, grouse whortleberry, and smooth woodrush are common.

## **Appendix J: Climate**

### **Climate (Common to Lolo DNRC East, Lolo DNRC West, CSKT East, & CSKT West FDRA's):**

In general, all FDRA's have a northern Pacific coastal climate with cool summers and mild winters. Winter snowfall averages 39.5 inches on average occurring between October 30 and April 20. As with the rest of the state, summers are very sunny, and the average diurnal temperature variation is more than 30 °F from late June through late September, due to the relative aridity. The monthly daily average temperature ranges from 23.9 °F in December to 68.6 °F in July. There is an average of 24 days with temperatures above 90 °F, 45 days where the temperature does not rise above freezing, and 7.8 days with temperatures below 0 °F.

Prevailing winds are generally from the southwest except where terrain influenced. Strong wind events are normally associated with thunderstorms and cold frontal passages. Cold front passages are of particular concern during late summer and early fall when fuels conditions are at their driest and a fire start can result in large fire growth. Large fire growth has been observed, during the peak of the fire season, when prevailing winds align with drainages that run southwest to northeast.

### **Climate (Common to Bitterroot Low and Bitterroot High FDRA's):**

Climate zones on the Bitterroot Forest include: the semiarid and relatively warm valley bottoms; a broad range of cool, moist coniferous forests; and the cold, moist subalpine and alpine region characterized by bedrock escarpments, coarse rock debris, and cirque lakes and headwalls carved by alpine glaciation of the recent geologic past. This topographic variety provides a diverse mosaic of plant and animal communities, and distinctive panoramas of high mountains and broad valleys. This zone is heavily forested, but the growing season is very short

The Bitterroot Valley is semiarid with annual precipitation less than 14 inches. Precipitation increases with elevation. Approximately 10 percent of the Forest receives less than 20 inches of annual precipitation. About 30 percent of the Forest receives 20-30 inches of precipitation annually.

Precipitation on 60 percent of the Forest is above 30 inches. It ranges from an annual average of 50 inches on the Sapphire divide, to 100 inches in higher elevations of the Bitterroot Range. Approximately two-thirds of the precipitation falls as snow, the primary source for ground water recharge and streamflow.



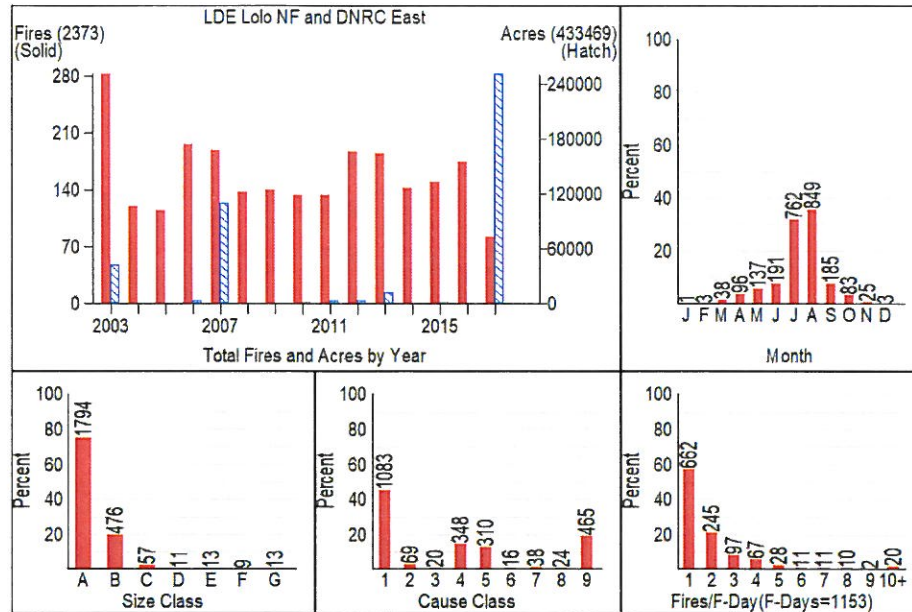
## Appendix K: Fire Occurrence

The Fire Cause Classes Table provides a crosswalk with the Cause Class Graph in the FireFamilyPlus FDRA modelling.

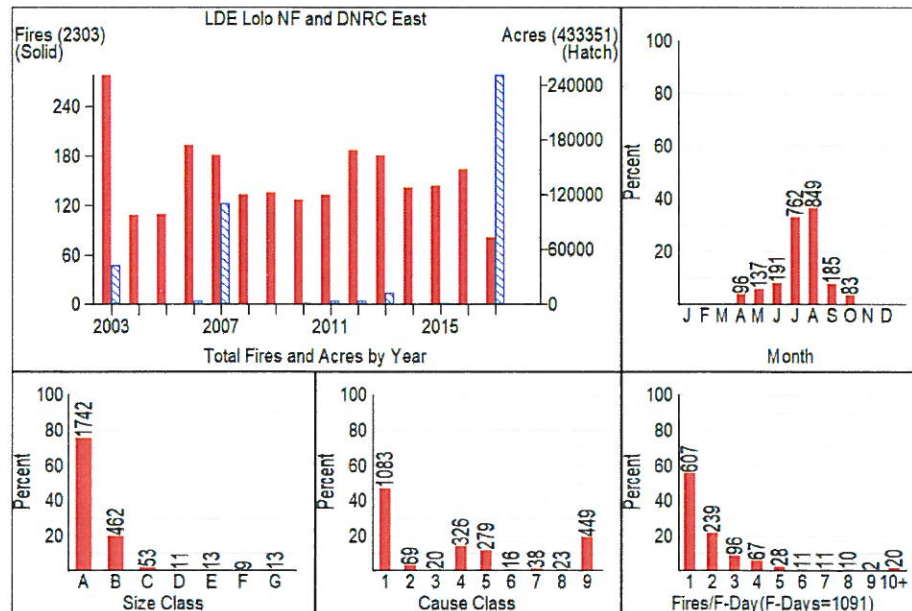
Fire Cause Classes Table	
1	Lightning
2	Equipment
3	Smoking
4	Campfire
5	Debris Burning
6	Railroad
7	Arson
8	Children
9	Miscellaneous

## LDE: Lolo NF & DNRC East

Fire Analysis Yearly Timeframe: January 1-December 31: 2003-2017.

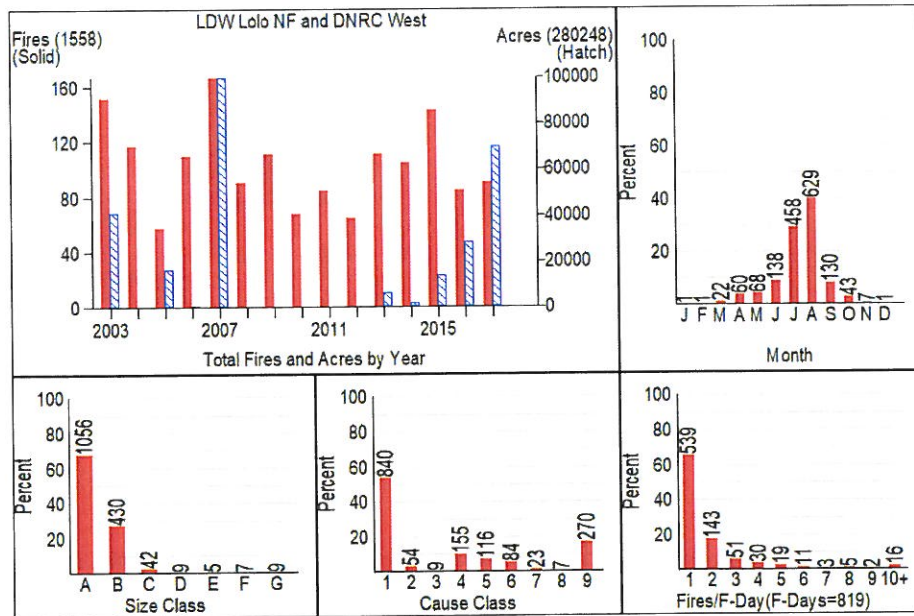


Fire Analysis Timeframe: April 1-October 31: 2003-2017.

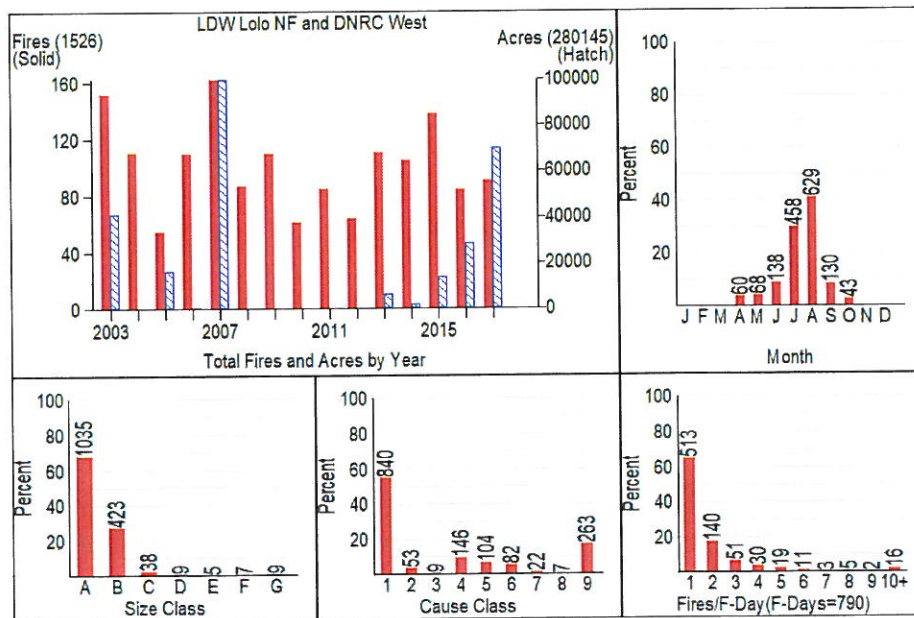


## LDW: Lolo NF & DNRC West

Fire Analysis Yearly Timeframe: January 1-December 31: 2003-2017.



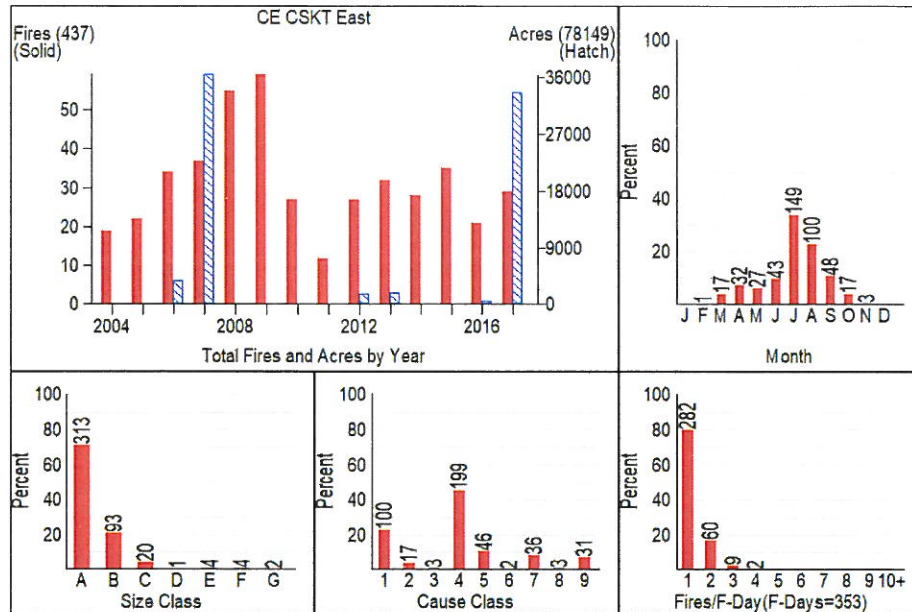
Fire Analysis Timeframe: April 1-October 31: 2003-2017.



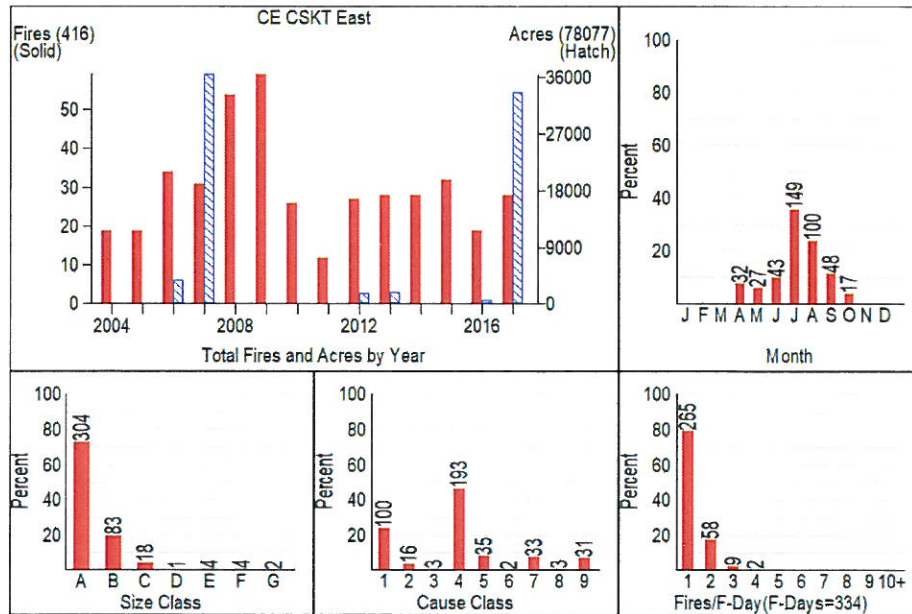


## CE: CSKT East

Fire Analysis Yearly Timeframe: January 1-December 31: 2004-2017.

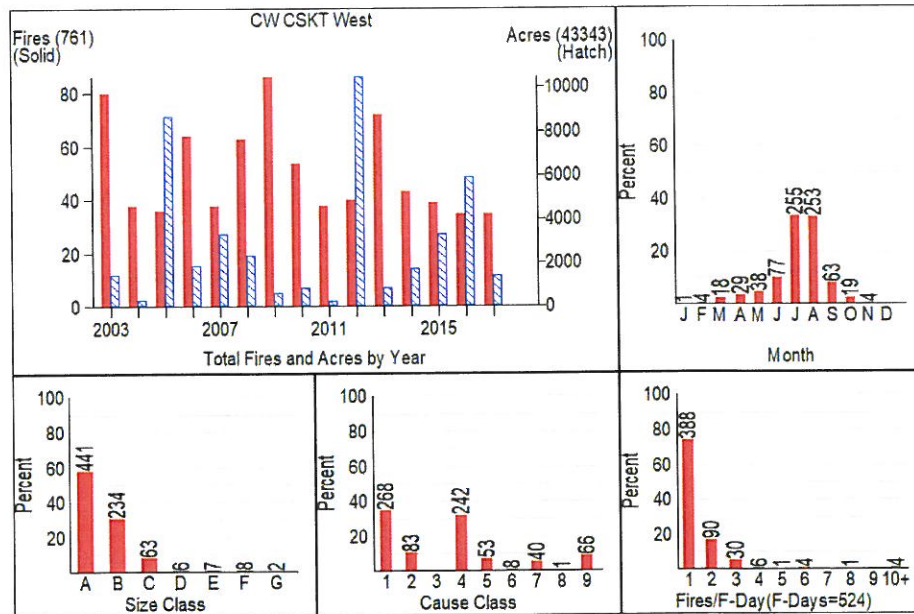


Fire Analysis Timeframe: April 1-October 31: 2004-2017.

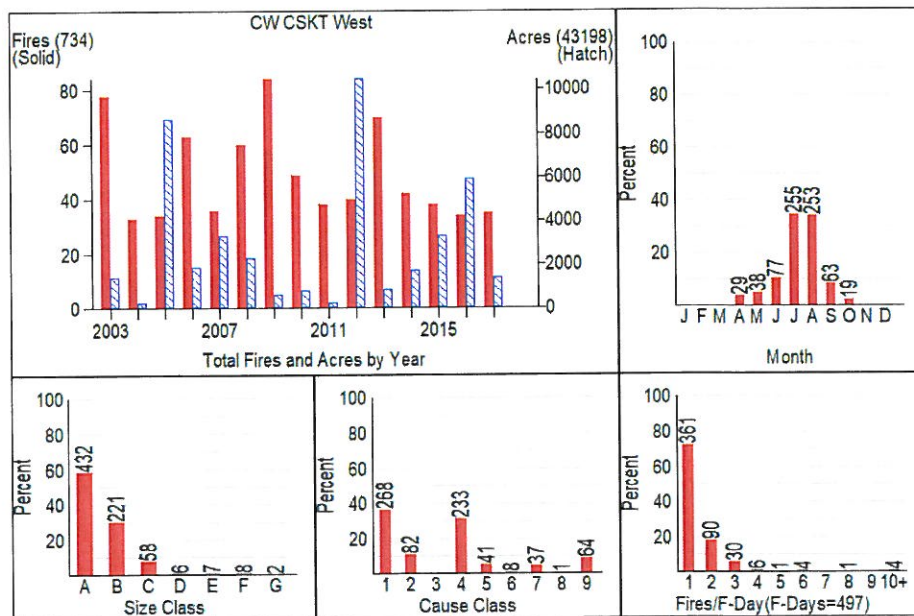


## CW: CSKT West

Fire Analysis Yearly Timeframe: January 1-December 31: 2003-2017.

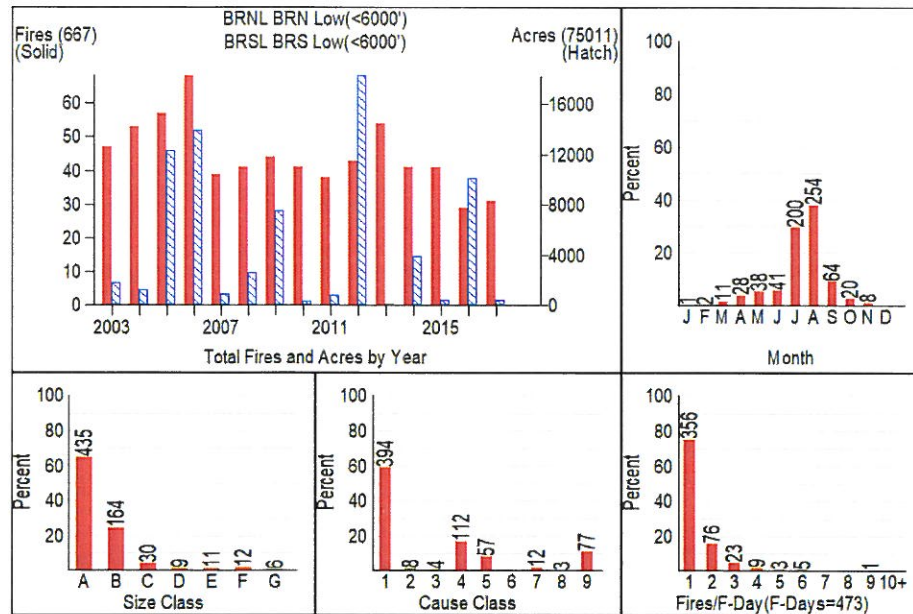


Fire Analysis Timeframe: April 1-October 31: 2003-2017.

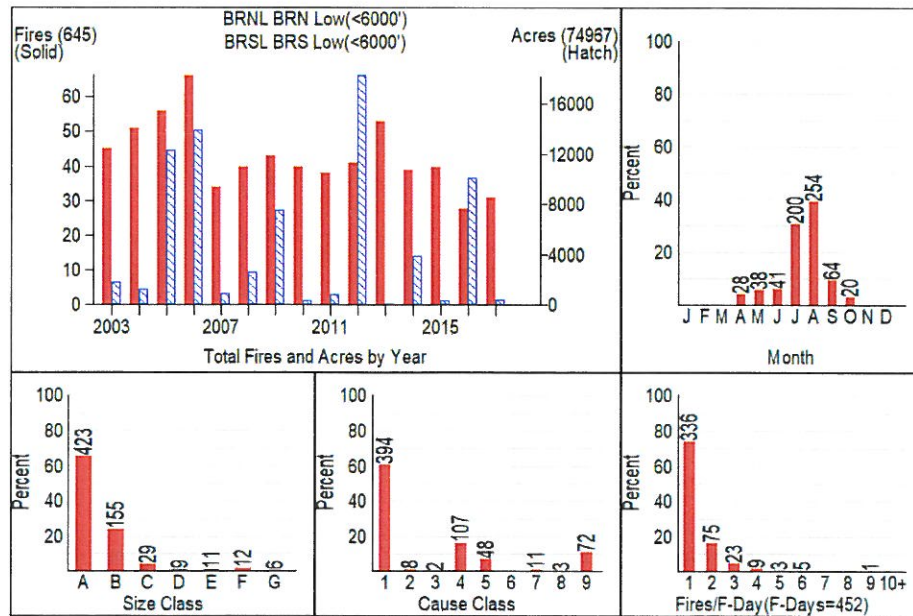


## BRL: Bitterroot NF Low

Fire Analysis Yearly Timeframe: January 1-December 31: 2003-2017.



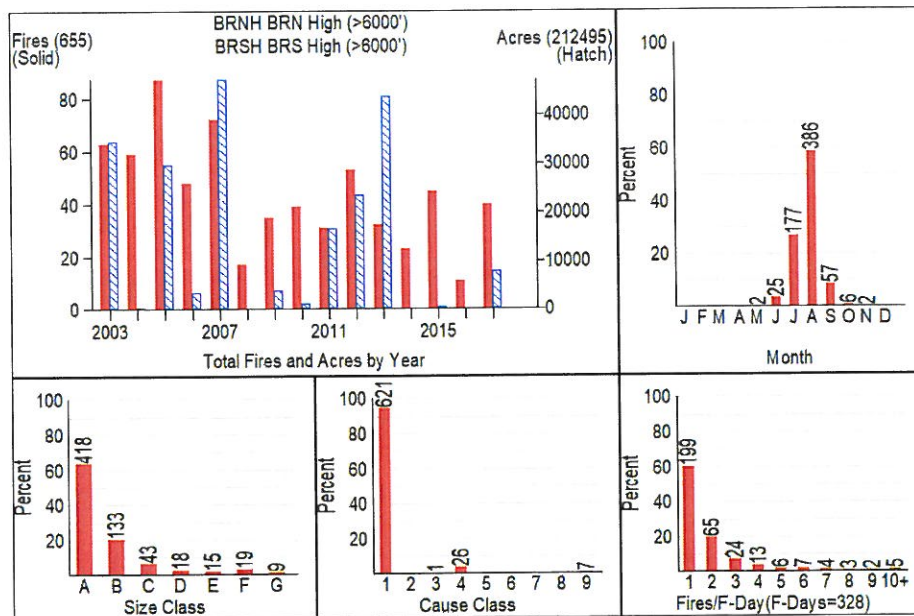
Fire Analysis Timeframe: April 1-October 31: 2003-2017.



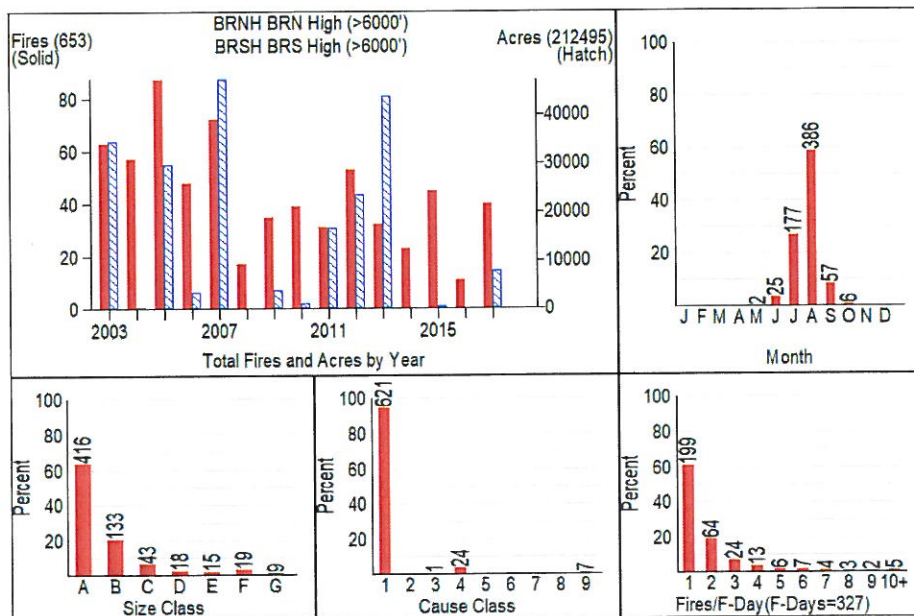


## BRH: Bitterroot NF High

Fire Analysis Yearly Timeframe: January 1-December 31: 2003-2017.



Fire Analysis Timeframe: April 1-October 31: 2003-2017.



## Appendix L: Weather Station and Special Interest Groups Data

This table displays data associated with the RAWS used in this analysis.

Station Name	WIMS ID	FDRA	Agency/ Owner	Elev	Latitude	Longitude
Ninemile	241507	Lolo DNRC East Lolo DNRC West	FS	3314	47.071333	-114.401389
Seeley Lake	241208	Lolo DNRC East	FS	4130	47.175972	-113.444389
Blue Mtn	241513	Lolo DNRC East	FS	3412	46.820725	-114.100889
Plains	241206	Lolo DNRC West	FS	2481	47.466222	-114.879611
St. Regis	241302	Lolo DNRC West	FS	2678	47.307111	-115.107611
Hot Springs	241211	CSKT West	CSKT	2730	47.613028	-114.615389
Ronan	241403	CSKT East	CSKT	3234	47.536772	-114.098936
Smith Creek	242912	Bitterroot Low	FS	5650	46.439581	-114.226822
West Fork	242907	Bitterroot Low	FS	4420	45.815556	-114.258333
Little Rock Creek	242914	Bitterroot Low	FS	5507	46.037828	-114.262708
Sula	242905	Bitterroot Low	FS	4570	45.820728	-113.953831
Tepee Point	242910	Bitterroot High	FS	6629	45.933428	-113.742019
Gird Point	242911	Bitterroot High	FS	6950	46.193217	-113.922581
Deer Mt	242902	Bitterroot High	FS	7282	46.025492	-114.055208
Hells Half	101019	Bitterroot High	FS	8100	45.645478	-114.627978

**Special Interest Groups Data:**

**Lolo DNRC East SIG:**

<b><i>Special Interest Group (SIG): Lolo DNRC East (LDE)</i></b>	
<b><i>Station / WIMS Number</i></b>	<b><i>Station Name</i></b>
241507	Ninemile
241508	Seeley Lake
241513	Blue Mtn

Lolo DNRC East SIG

**Lolo DNRC West SIG:**

<b><i>Special Interest Group (SIG): Lolo DNRC West (LDW)</i></b>	
<b><i>Station / WIMS Number</i></b>	<b><i>Station Name</i></b>
241507	Ninemile
214302	St. Regis
241206	Plains

Lolo DNRC West SIG

**Bitterroot Low SIG:**

<b><i>Special Interest Group (SIG): Bitterroot Low (BRL)</i></b>	
<b><i>Station / WIMS Number</i></b>	<b><i>Station Name</i></b>
242912	Smith Creek
242907	West Fork
242905	Sula
242914	Little Rock Creek

Bitterroot Low SIG

**Bitterroot High SIG:**

<b><i>Special Interest Group (SIG): Bitterroot High (BRH)</i></b>	
<b><i>Station / WIMS Number</i></b>	<b><i>Station Name</i></b>
242911	Gird
242910	Teepee Point
242902	Deer Mt
101019	Hells Half

Bitterroot High SIG

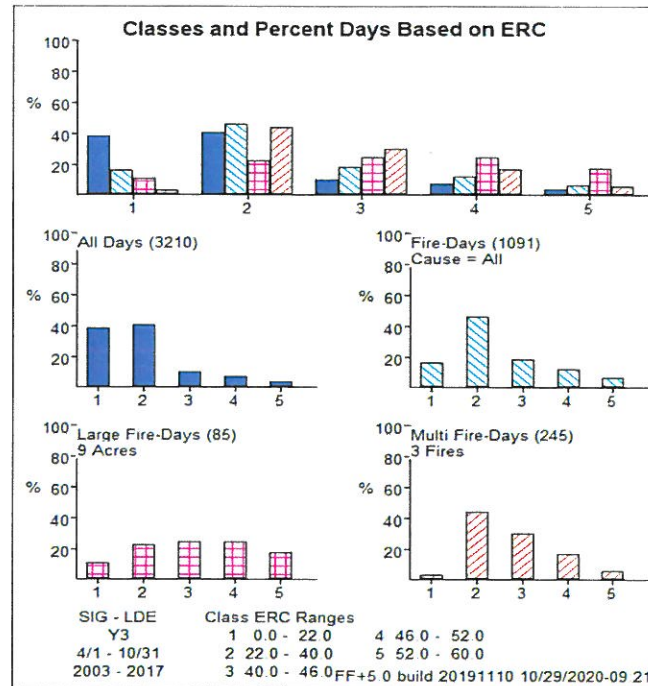


## Appendix M: FireFamilyPlus Analysis

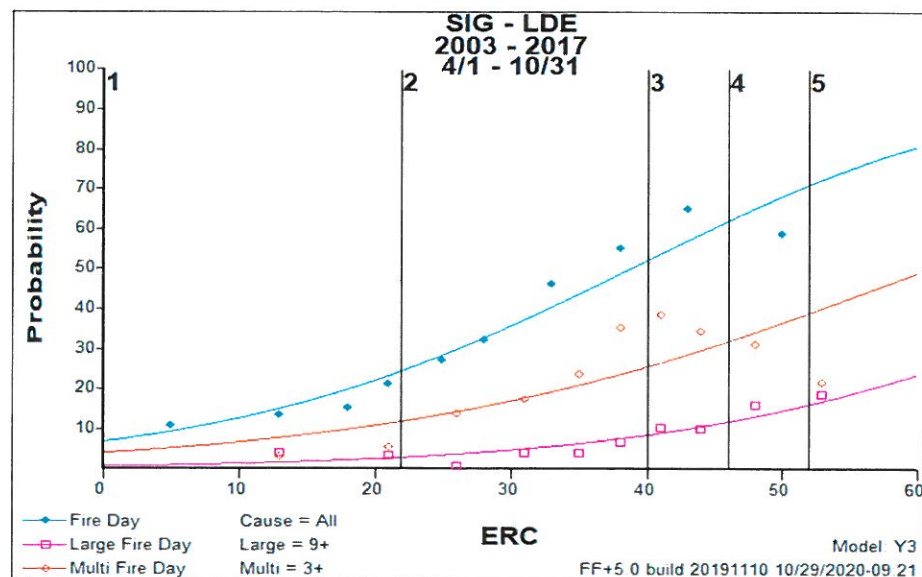
### FireFamilyPlus ERC Class Percentages, Graphs, & Decision Thresholds

#### LDE: Lolo NF & DNRC East

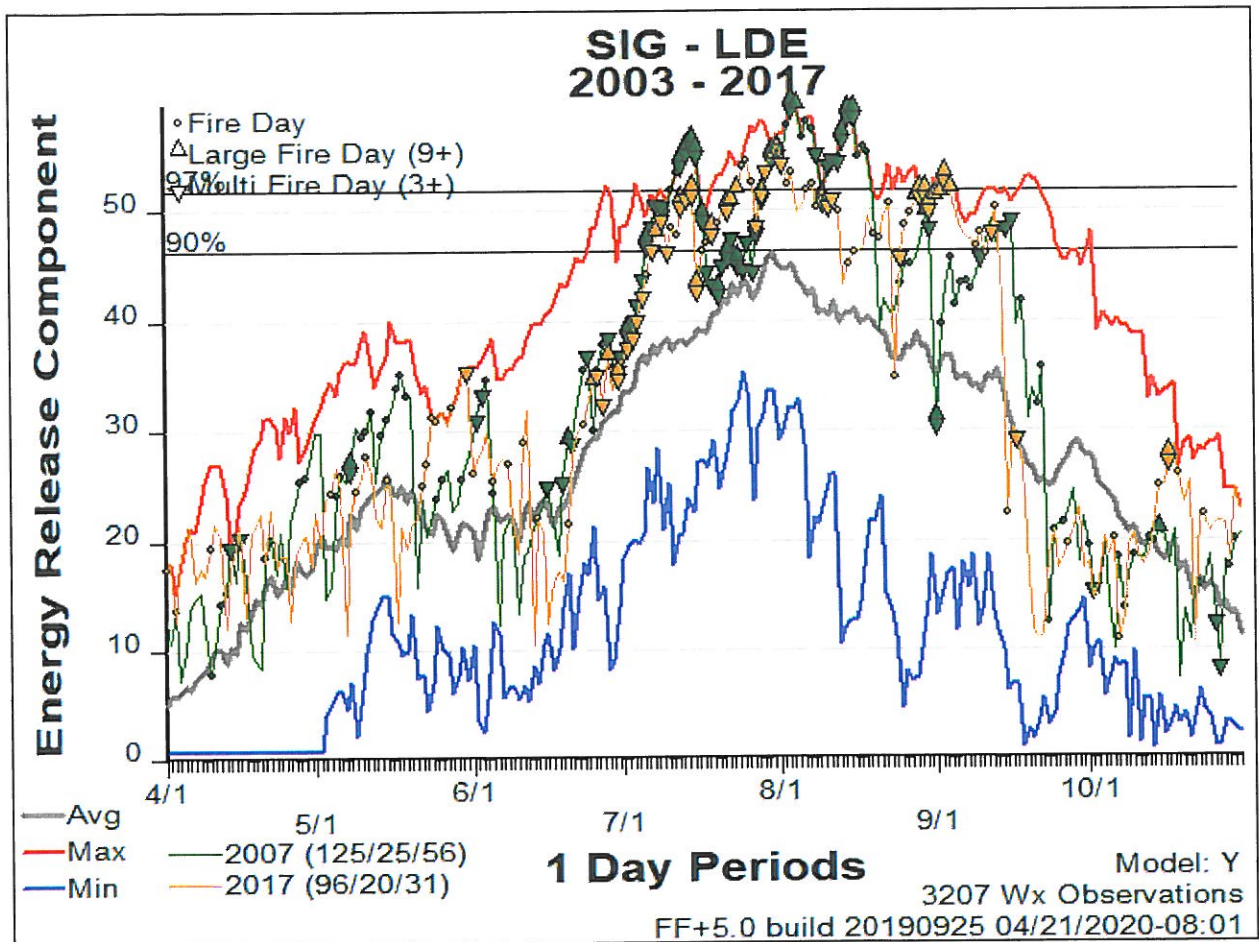
ERC Decision Thresholds & Class Percentages: April 1-October 31: 2003-2017.



ERC Fire Day, Large Fire Day, Multi Fire Day: April 1-October 31: 2003-2017.

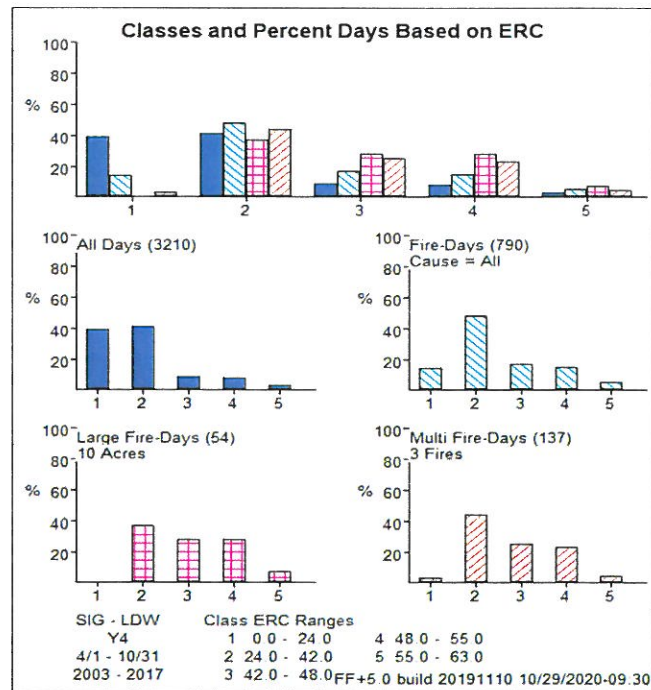


ERC Statistics Graph: April 1-October 31: 2003-2017.

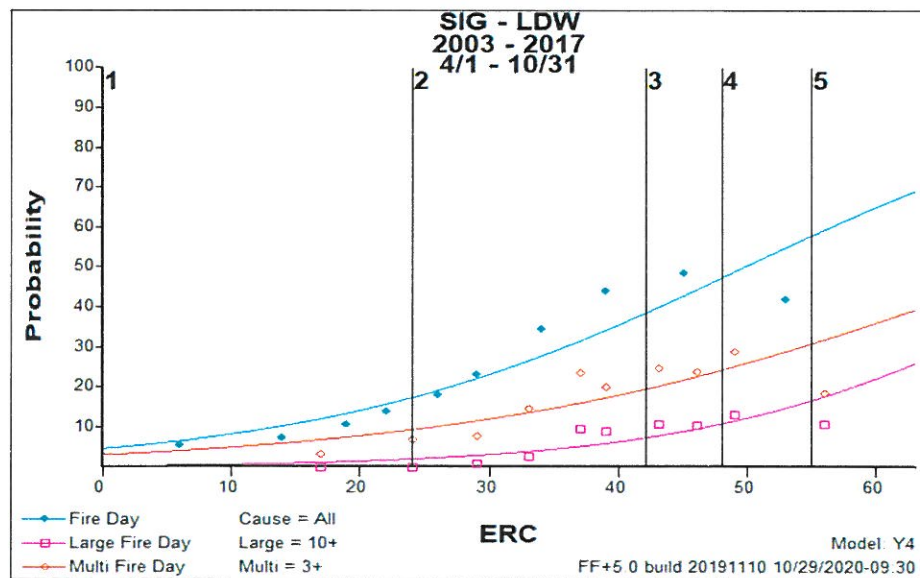


## LDW: Lolo NF & DNRC West

ERC Decision Thresholds & Class Percentages: April 1-October 31: 2003-2017.

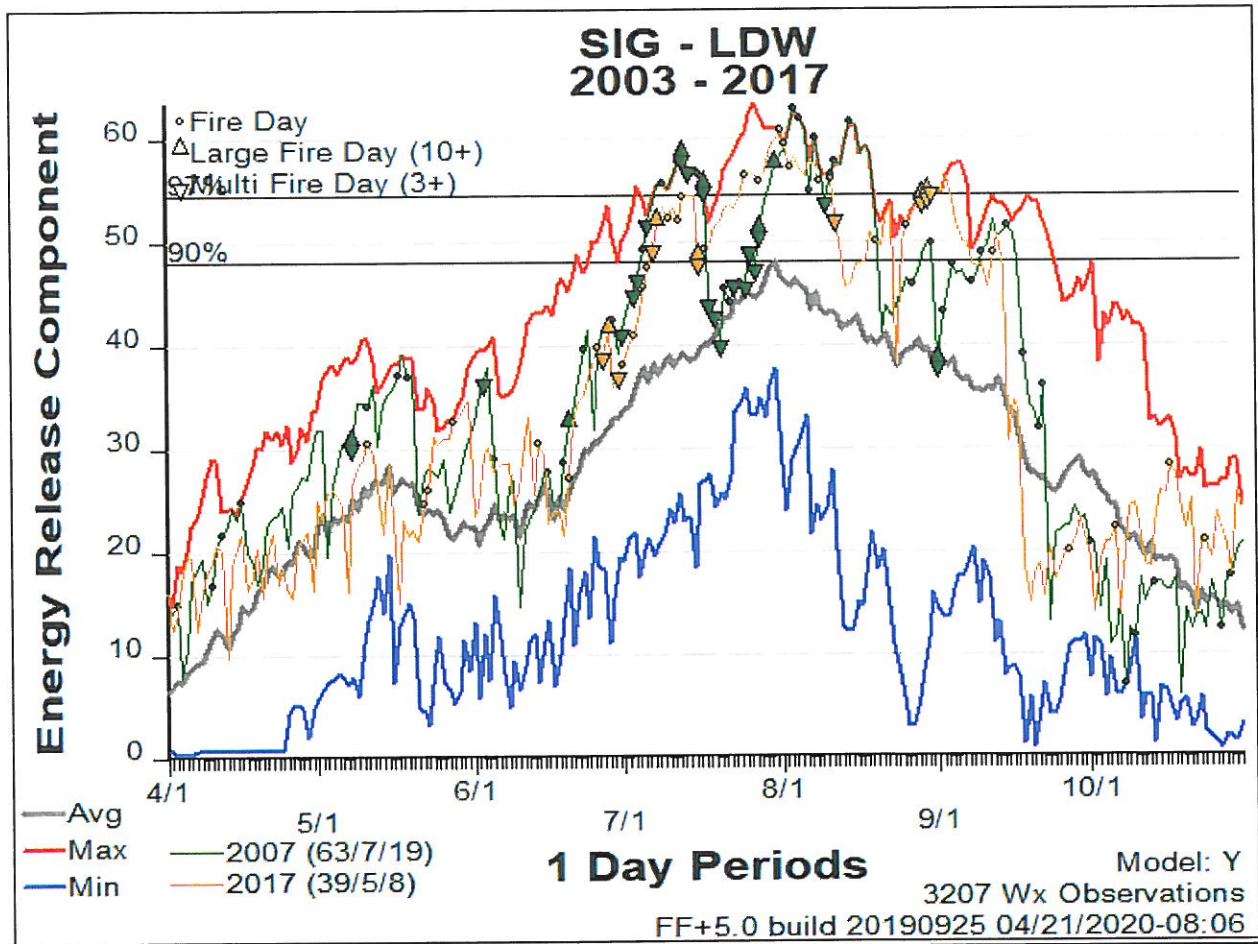


ERC Fire Day, Large Fire Day, Multi Fire Day: April 1-October 31: 2003-2017.



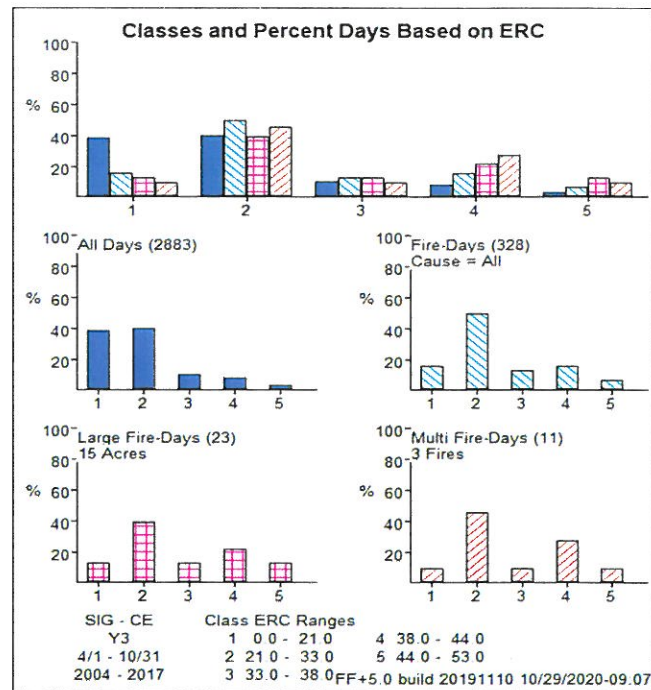


ERC Statistics Graph: April 1-October 31: 2003-2017.

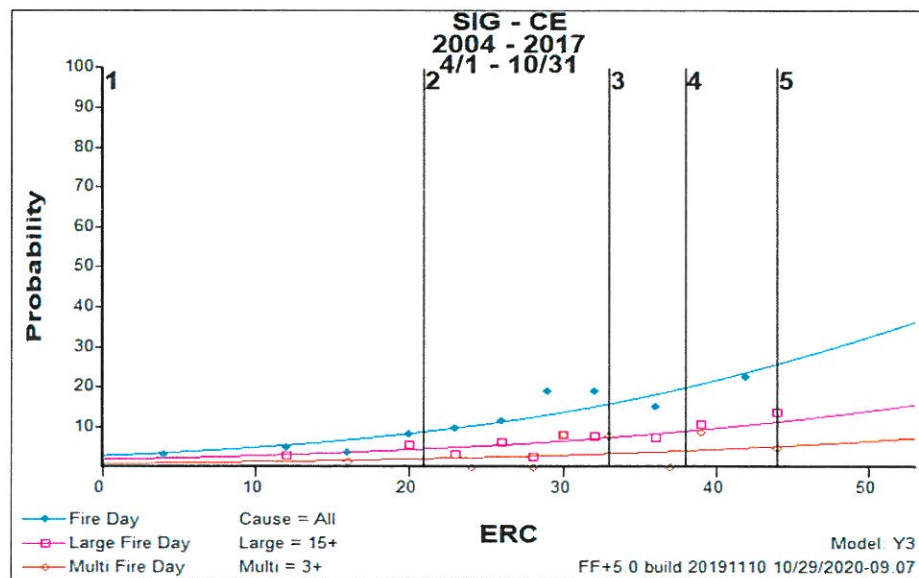


**CE: CSKT East**

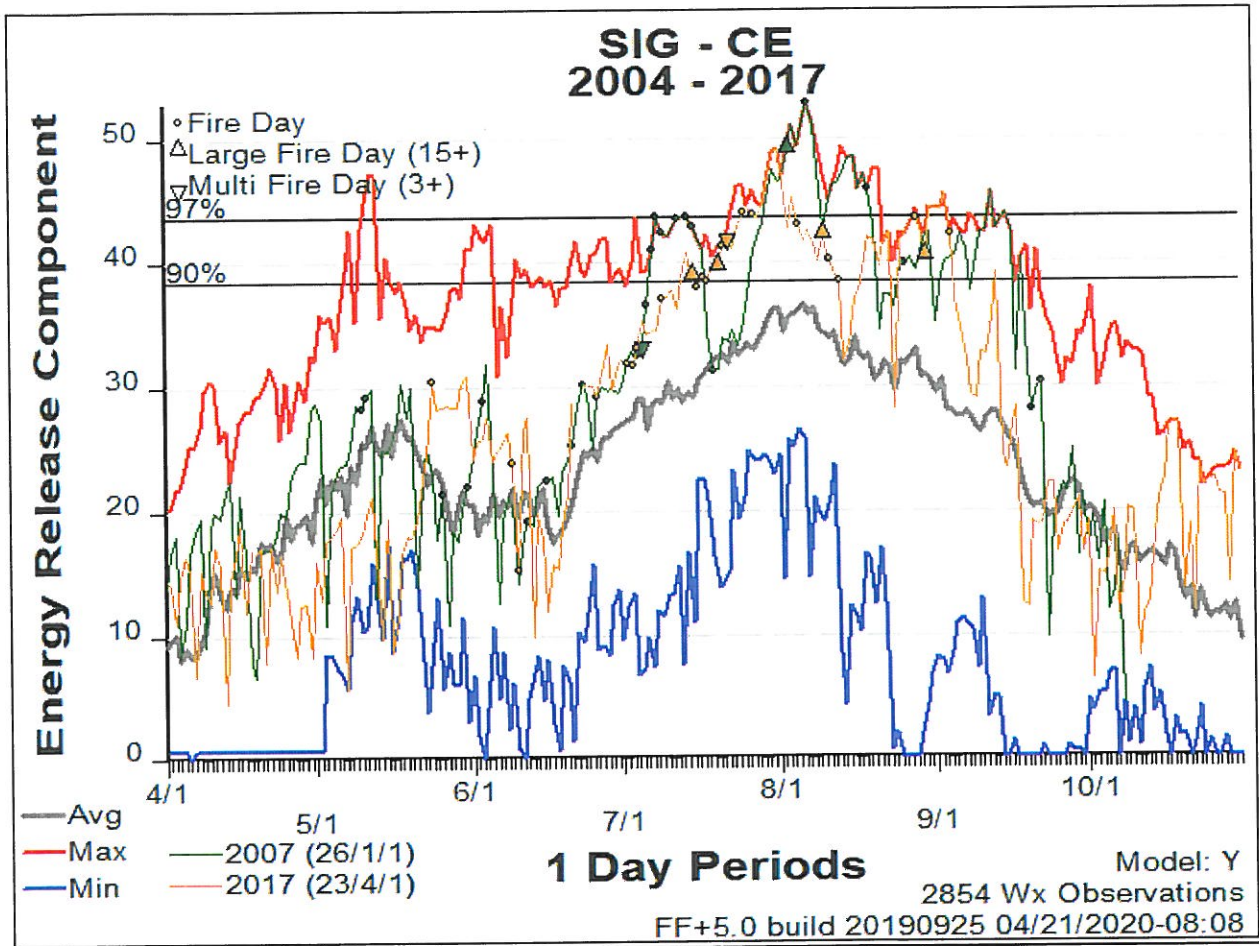
ERC Decision Thresholds & Class Percentages: April 1-October 31: 2004-2017.



ERC Fire Day, Large Fire Day, Multi Fire Day: April 1-October 31: 2004-2017.



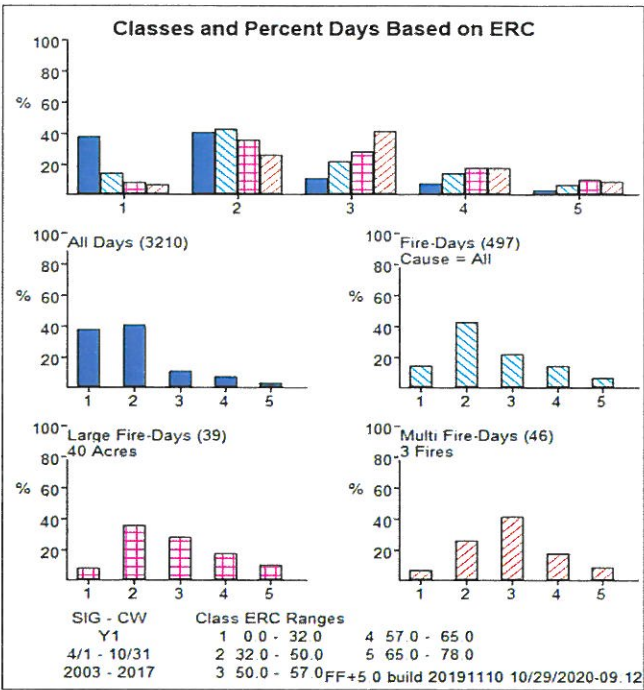
ERC Statistics Graph: April 1-October 31: 2004-2017.



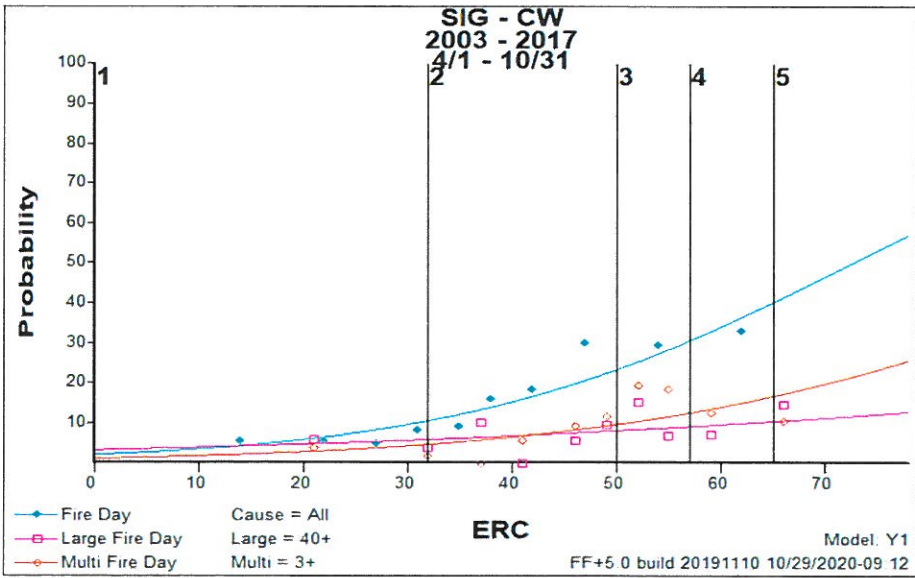


**CW: CSKT West**

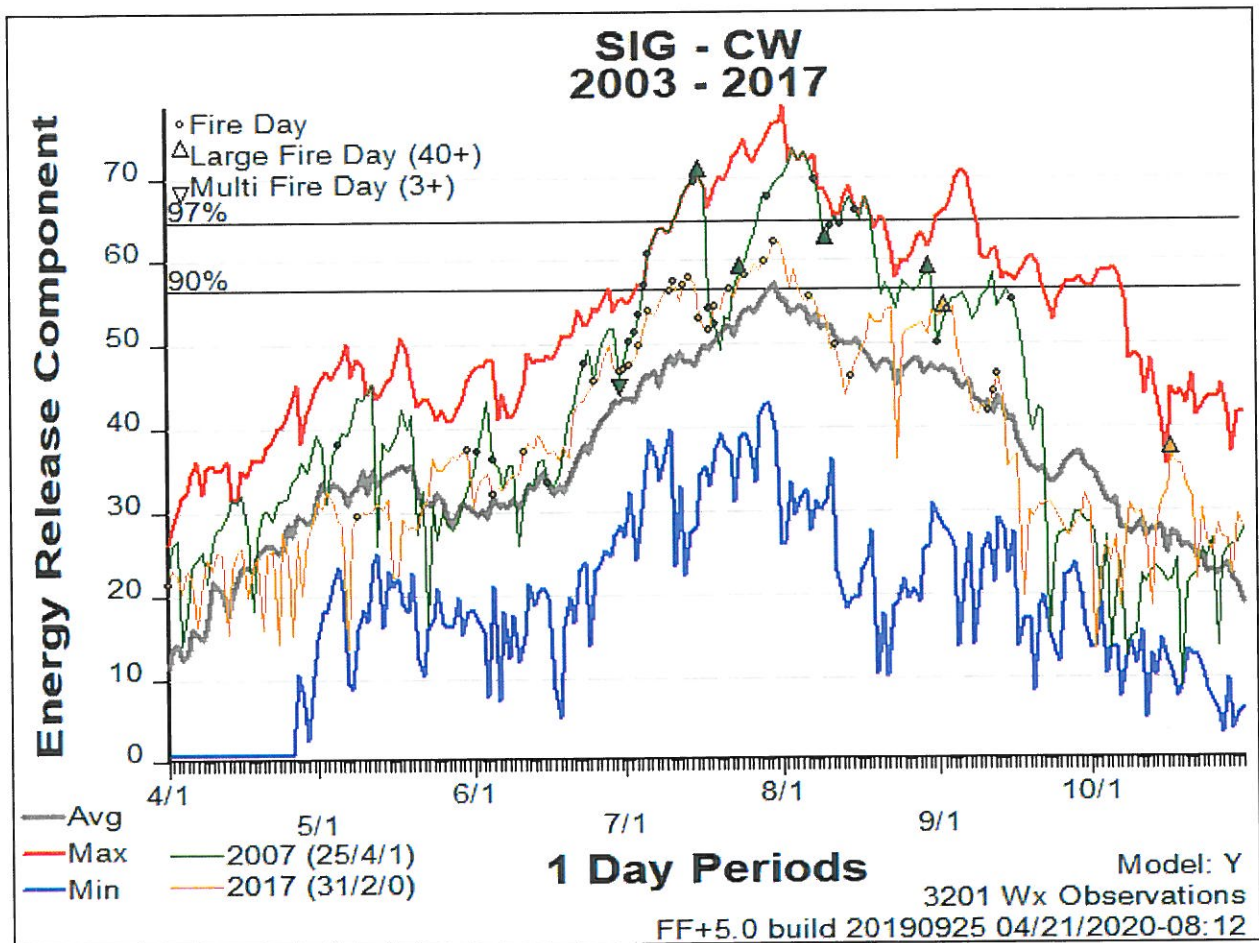
ERC Decision Thresholds & Class Percentages: April 1-October 31: 2003-2017.



ERC Fire Day, Large Fire Day, Multi Fire Day: April 1-October 31: 2003-2017.

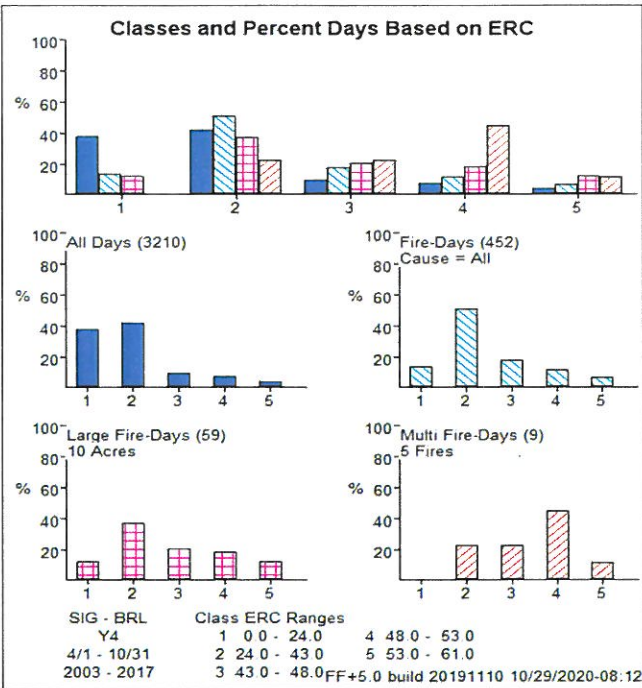


ERC Statistics Graph: April 1-October 31: 2003-2017.

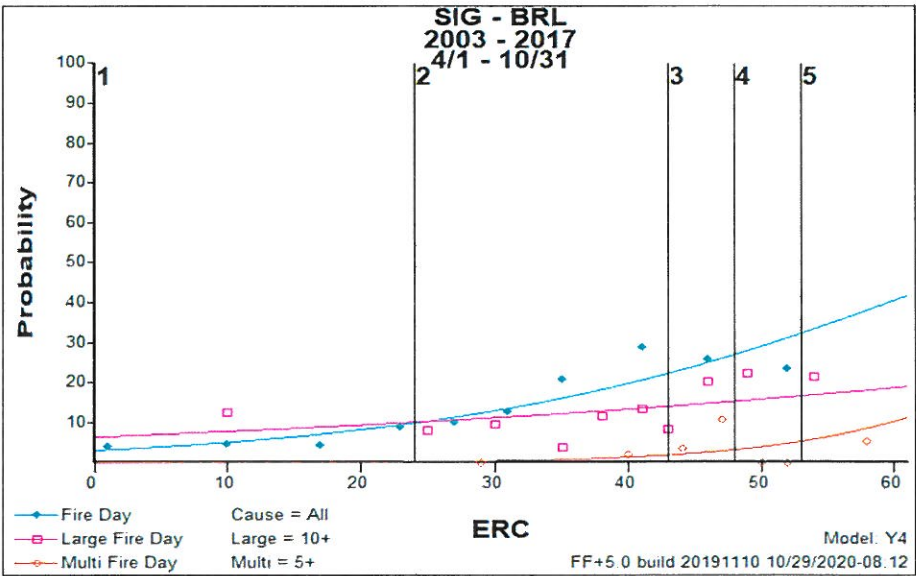


**BRL: Bitterroot Low**

ERC Decision Thresholds & Class Percentages: April 1-October 31: 2003-2017.

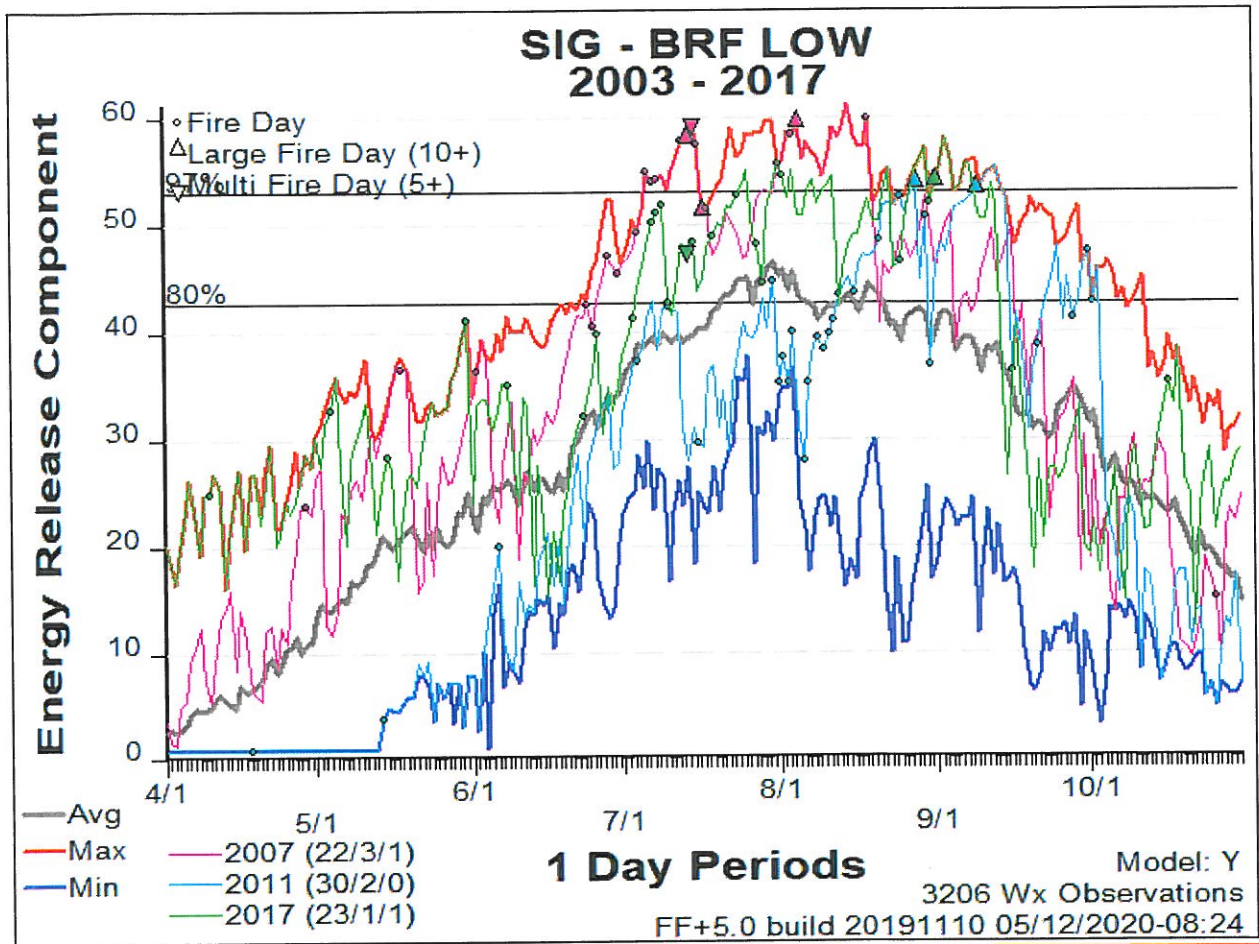


ERC Fire Day, Large Fire Day, Multi Fire Day: April 1-October 31: 2003-2017.



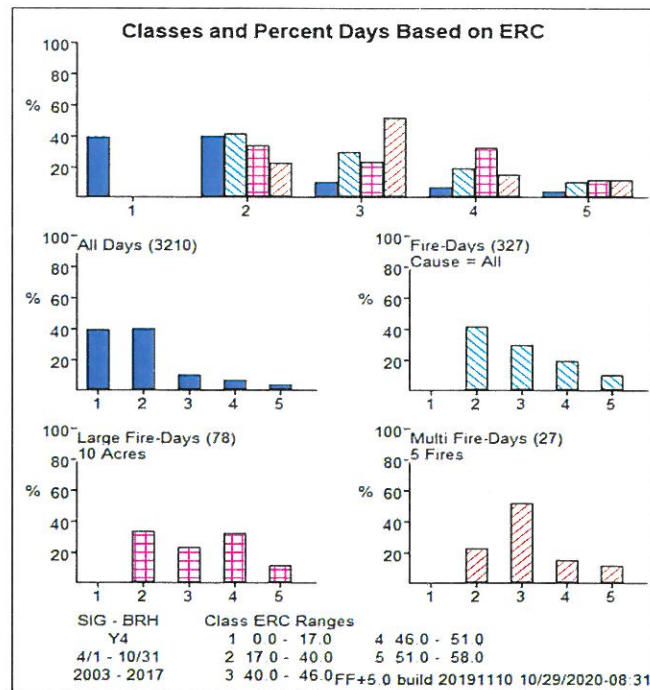


ERC Statistics Graph: April 1-October 31: 2003-2017.

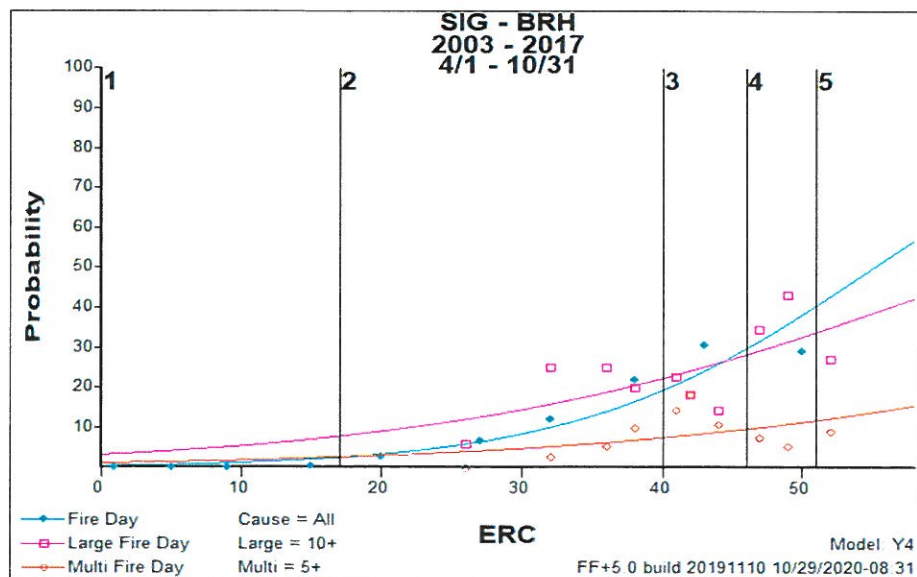


## BRH: Bitterroot High

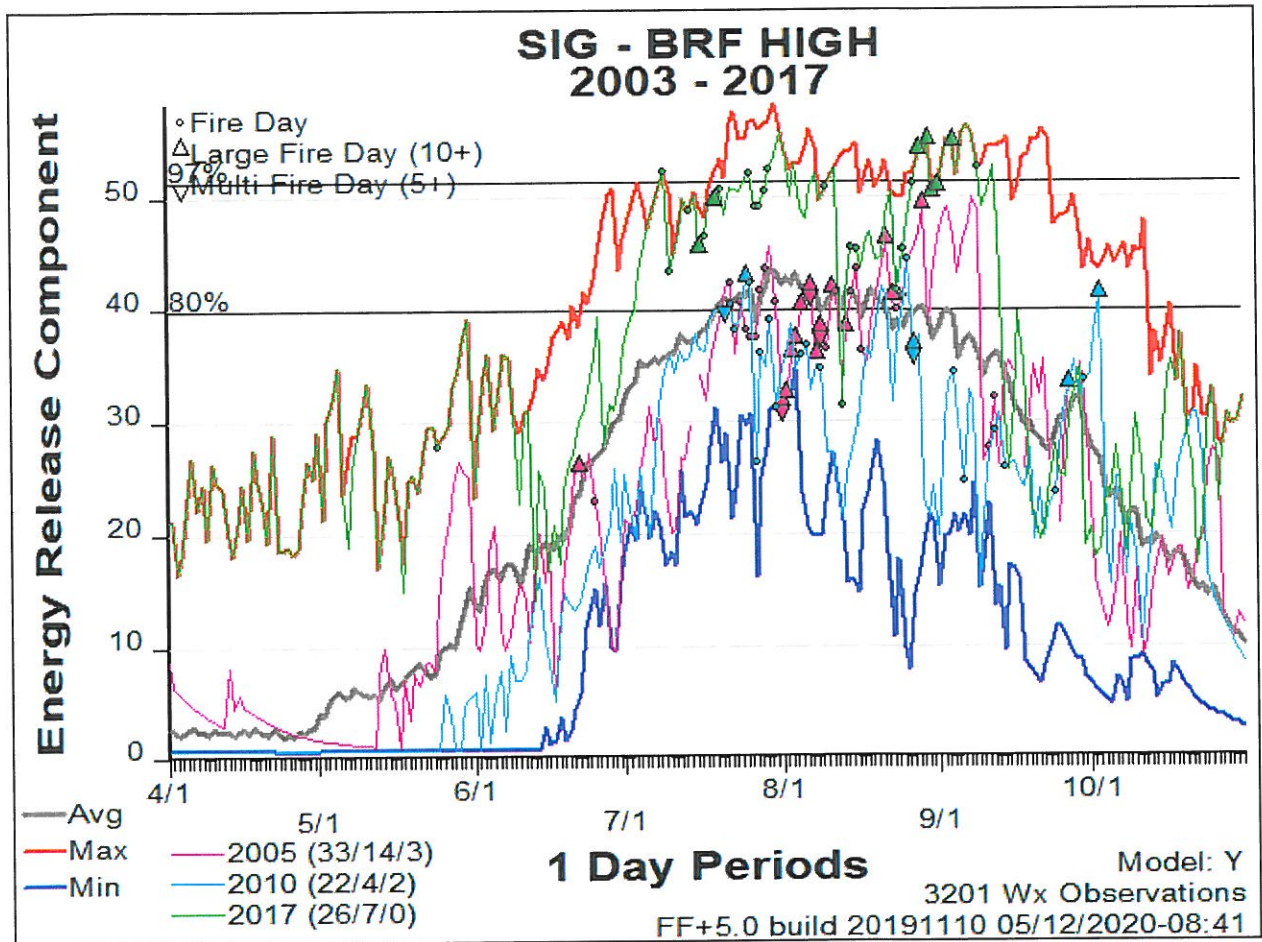
ERC Decision Thresholds & Class Percentages: April 1-October 31: 2003-2017.



ERC Fire Day, Large Fire Day, Multi Fire Day: April 1-October 31: 2003-2017.



ERC Statistics Graph: April 1-October 31: 2003-2017.





## MODIS BI Graphs

Two thresholds were used to split the full spectrum of BI values into three separate response levels. The first BI threshold (separating Low and Moderate) is based on the relationship between BI and the fire activity observed by the Moderate Resolution Imaging Spectroradiometer (MODIS) instrument. An “active fire day” is defined as a day when MODIS detected at least one hotspot in a FDRA, and a “non-active fire day” is a day when MODIS did not detect any hotspots in a FDRA. Ideally, the first BI threshold would be selected so that (a) all active fire days occur above this value; and (b) all non-active fire days occur below this value. In this perfect scenario the true positive rate would be 1.0 (i.e., 100%) and the false positive rate would be 0.0 (i.e., 0%). In reality, however, the overlap in the weather conditions during which fires are burning or not burning in a FDRA forces a trade-off in the threshold selection. Therefore, the first BI threshold is selected to maximize the number of active fire days whilst minimizing the number of non-active fire days. For example, the first threshold for the Lolo DNRC West (LDW) is set to BI=26. Between 2003 and 2017, nearly 70% of all active fire days occurred above this threshold (true positive rate TPR=0.70), while 33% of non-fire days occurred above this threshold (false positive rate FPR=0.33).

The second BI threshold (separating Moderate and High) is selected solely based on the climatology of each FDRA and is set to the 97% percentile. The performance of the second BI threshold is again evaluated based on the TPR and FPR, but with regard to “very active fire days”, or days when MODIS observed an active fire pixel with a fire radiative power (FPR) value greater than the 95% percentile. Across all FDRA’s in the SWZ, the second BI Threshold captured approximately one-third of all very active fire days (TPR≈0.70). The trade-off is that nearly all days that were not very active occurred below the second BI threshold (FPR<0.02).

## SW Zone FDRA's BI Decision Thresholds using MODIS data:

Lolo DNRC East: April 1-October 31; 2003-2017.

Lolo DNRC West: April 1-October 31; 2003-2017.

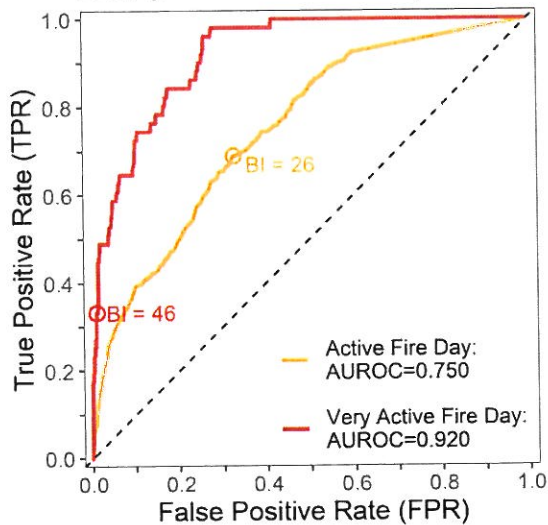
CSKT West: April 1-October 31; 2003-2017.

CSKT East: April 1-October 31; 2004-2017.

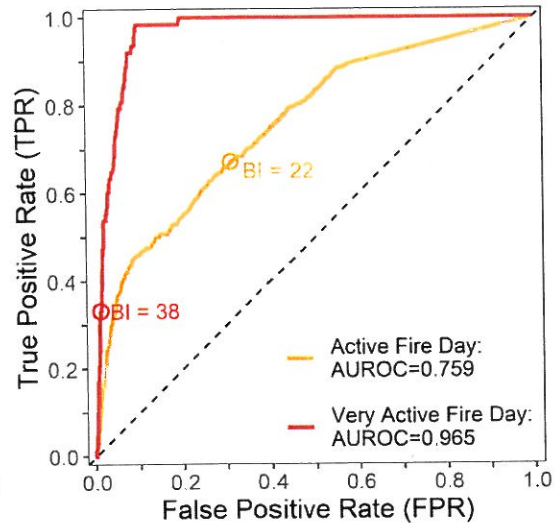
Bitterroot Low: April 1-October 31; 2003-2017.

Bitterroot High: April 1-October 31; 2003-2017.

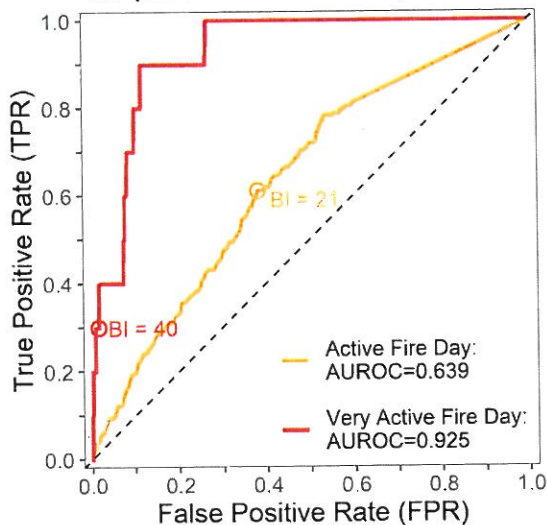
**LDW (Jan 2003 - Dec 2017)**



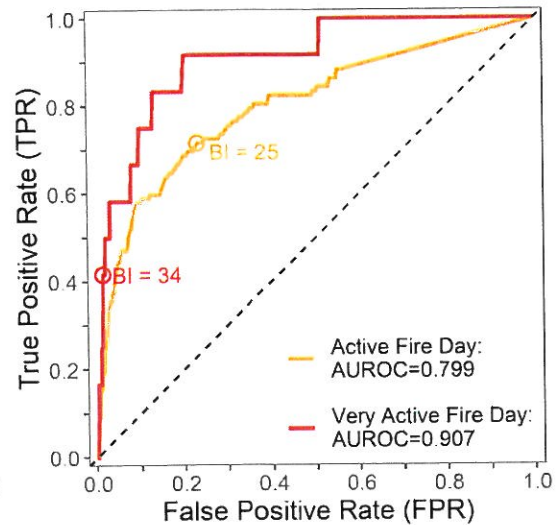
**LDE (Jan 2003 - Dec 2017)**

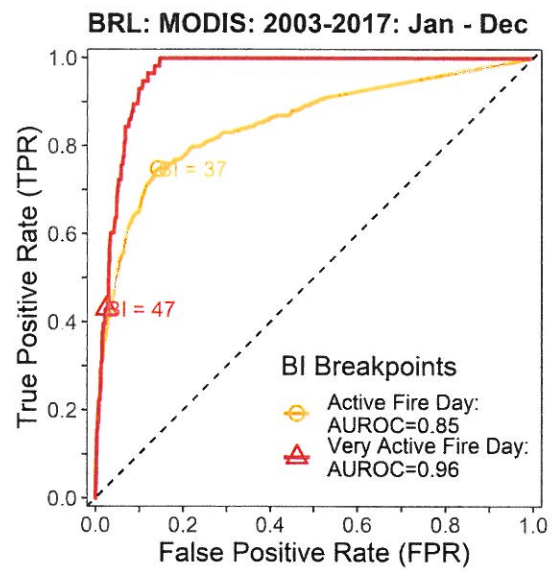
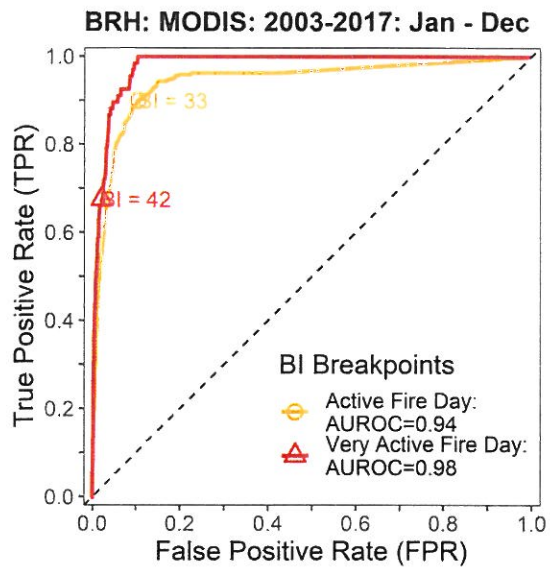


**CW (Jan 2003 - Dec 2017)**



**CE (Jun 2004 - Dec 2017)**







## Appendix N: Lolo and Bitterroot Fuel Monitoring Sites

### Lolo National Forest, Ninemile Ranger District Fuel Monitoring Sites:

Fuel Monitoring Site	Latitude	Longitude	Elevation	Aspect	Fuel Model	Fuels Sampled
Ninemile C1	47-05-45	114-24-53	3,595	South	TL8	1 hr., 10 hr., 100 hr., 1000 hr., DF, Snowberry
Ninemile C2	47-05-40	114-24-40	3,650	West	TL8	1 hr., 10 hr., 100 hr., 1000 hr., DF, Snowberry
Ninemile C3	47-05-37	114-24-14	3,675	South	TL8	1 hr., 10 hr., 100 hr., 1000 hr., DF, Snowberry

### Lolo National Forest, Missoula Ranger District Fuel Monitoring Sites:

Fuel Monitoring Site	Latitude	Longitude	Elevation	Aspect	Fuel Model	Fuels Sampled
Butte Lookout	46-42-54	114-21-48	5,300	West	GS2	1 hr., 10 hr., 100 hr., 1000 hr., Alder, DF, Huckleberry
Cooper Creek	46-43-12	114-21-30	5,200	West	GS2	1 hr., 10 hr., 100 hr., 1000 hr., Alder, DF, Huckleberry
Cooper Creek 2	46-43-40	114-21-22	5,100	West	GS2	1 hr., 10 hr., 100 hr., 1000 hr., Alder, DF, Huckleberry

### Bitterroot National Forest, Stevensville, Sula, & West Fork Ranger Districts Fuel Monitoring Sites:

Fuel Monitoring Site	Latitude	Longitude	Elevation	Aspect	Fuel Model	Fuels Sampled
Smith Creek, Stevensville RD	46-26-22	114-13-37	5,650	Southeast	GR2	10 hr., 100 hr., 1000 hr., DF, PP, LPP, kinnikinnick
Tepee, Sula RD	45-55-44	113-44-32	6,257	South	GR2	1 hr., 10 hr., 1000 hr., DF, PP, Snowberry
Lost Trail, Sula RD	45-41-34	113-58-11	7,729	West	TU1	1 hr., 10 hr., 1000 hr., SAF, LPP, WBP
Blue Joint, West Fork RD	45-42-14	114-20-13	4,950	South	TL8	1 hr., 10 hr., 100 hr., 1000 hr., DF, LPP, PP, Snowberry
Nez Pass, West Fork RD	45-43-01	114-30-13	6,517	Northeast	GS2	1 hr., 10 hr., 100 hr., 1000 hr., DF, SAF, LPP, beargrass, huckleberry