Mid-Columbia River National Wildlife Refuge Complex

National Fire Danger Rating - Fire Danger Operating Plan

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Fire Danger Operating Plan

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I. INTRODUCTION

This plan is intended to document a decision-making process for agency administrators, fire managers, dispatchers, agency cooperators, and firefighters by establishing agency planning and response levels using the best available scientific methods and historical weather/fire data. 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) modeling. This plan is an Operating Plan for the Mid-Columbia River National Wildlife Refuge Complex which includes the following refuges: Cold Springs, Columbia, Conboy Lake, McKay Creek, McNary, Toppenish and Umatilla National Wildlife Refuges and Hanford Reach National Monument.

Guidance and policy for development of a Fire Danger Operating Plan can be found in the *Interagency Standards for Fire & Aviation Operations* (*Red Book*).

This plan helps quantify elements in the decision-making process for agency administrators, fire managers, dispatchers, agency cooperators, and firefighters by establishing agency planning and response levels using the best available scientific methods and historical weather/fire data. In addition, this plan outlines procedures for developing seasonal risk analysis and defines fire severity trigger points. Most importantly, this plan addresses the *Thirtymile Fire Accident Prevention Action Items* by providing the direction necessary to convey fire danger awareness to fire management personnel of escalating fire potential. This awareness is critical when wildland fire danger levels are at severe thresholds which may significantly compromise safety and control.

This is the first comprehensive Fire Danger Operating Plan written for the Mid-Columbia River Complex. This plan identifies two fire danger rating areas, the Columbia Basin FDRA and the Conboy Refuge FDRA. The need for two rating areas is based on differing fuels, weather and topography of the two areas. This is a dynamic document and will be revisited following the 2012 fire season to revalidate and edit as needed.

It is important to note that this plan follows the design and much of the wording of the Northern Utah Interagency Fire Danger Operating plan which has been developed and tested over the course of many years with the efforts of a professional interagency workforce in conjunction with its use as a training template for the Advanced NFDRS course taught at the National Advanced Fire and Resource Institute (NAFRI). The Northern Utah plan has been utilized as an example for many other Fire Danger Operating Plans throughout the United States.

II. OBJECTIVES

- Provide a tool for agency administrators, fire managers, dispatchers, agency cooperators, and firefighters to correlate fire danger ratings with appropriate fire business decisions in the Columbia Basin of South-central Washington and North-central Oregon.
- Delineate fire danger rating areas (FDRAs) in the Columbia Basin with similar climate, vegetation, and topography.
- Maintain a fire weather-monitoring network consisting of Remote Automated Weather Stations (RAWS) which comply with *NFDRS Weather Station Standards* (PMS 426-3).
- Determine fire business thresholds using the Weather Information Management System (WIMS), National Fire Danger Rating System (NFDRS), Fire Family Plus software, and by analyzing historical weather and fire occurrence data.
- Define roles and responsibilities to make fire preparedness decisions, manage weather information, and brief fire suppression personnel regarding current and potential fire danger.
- Determine the most effective communication methods for fire managers to communicate potential fire danger to cooperating agencies, industry, and the public.
- Identify seasonal risk analysis criteria and establish general fire severity thresholds.
- Identify the season-ending event using the Term module of the Fire Family Plus software.
- Identify the development and distribution of fire danger pocket cards to all personnel involved with fire suppression activities within the Columbia Basin and Conboy Refuge Fire Danger Rating Areas.
- Identify program needs and suggest improvements for the Fire Danger Operating Plan.

III. INVENTORY AND ANALYSIS

In order to apply a system which will assist managers with fire management decisions, the problems must be inventoried and analyzed to determine the most appropriate management control mechanism which will adequately address the issues.

1. Involved Parties

This plan will affect a wide range of entities. However, these entities can be grouped into three primary categories:

a. Agency:

Employees of the federal, state, and local governments involved in the cooperative effort to suppress wildland fires. This includes FWS, BLM, USFS, DOE, BIA, Tribal, State and County Fire District personnel.

b. Industry:

Are defined as organizations that either utilize the natural resources or have permits to conduct activities on federal, state, or private lands for commercial purposes. These entities include utility companies (power/phone), farmers, hazardous material disposal sites, railroads, building construction, etc.

c. Public:

Individuals who use the land for recreational purposes such as hiking, birding/wildlife viewing, hunting, fishing or general travel. This group also includes those living within the wildland/urban interface and adjacent to refuges.

2. Fire Problem Analysis

Eighty two percent of all fires in the Columbia Basin are human caused. The main sources are debris burning, roadside incidents/car fires, train track ignitions, warming fires used by hunters and other users, and fireworks. While car and train fires are more difficult to prevent, education and prevention messages can have a big impact on the remaining problem fire types. It will be essential for Refuge Complex to develop and implement their fire prevention plan and work to keep fire mindfulness in the public eye.

The following Problem Analysis table demonstrates the differences between the target groups (Agency, Industry, and Public). 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. In addition, each action will result in positive and/or negative impacts to the user groups. Consequently, the decision tool which would be most appropriate would depend upon the sensitivity of the target group to the implementation of the action. In selecting a component and/or index, several factors must be considered:

a. Problem/Issue

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, such as the point when fire activity becomes a burden to the local suppression forces.

b. Management Action (Application)

This is the decision(s) which will affect the public, industry, or agency personnel. This includes fire management applications which can be used to formulate decisions regarding the potential issues which have been identified for the specific area. Management actions represent a way to link fire danger information with fire management decisions which affect specific target groups. Consider the appropriate set of decision thresholds to address the issue (i.e., Dispatch Level, Staffing Level, Preparedness Level, Adjective Rating, Public/Industrial Restrictions, etc.).

c. Target Group

The group of people commonly associated with the problem (Agency, Industry, or Public).

d. Degree of Control

This is a general description of how much control the agencies have over these entities (High → Low) and how quickly a target group can respond to management actions.

e. Communication

Forms of communication used with the user group (face-to-face, radio, telephone, email, newspaper, television, signing/posting, text-messaging, etc.).

f. Potential Impacts

The potential impacts on the target group and the likely consequences of a good (or bad) decision.

g. Component/Index

Sensitivity of the NFDRS outputs should be consistent with the ability to react (or communicate) to the target group. Memory and variability of the selected component or index must be understood to appropriately match the task and user group. If a situation where control and ability to communicate with the target group is high, the component and/or index which would be most appropriate should also be highly reactive to changing conditions (i.e., Ignition Component, Spread Component). If the situation was reversed where the control and ability to communicate with the target group is low, the appropriate component and/or index should not vary significantly over time (i.e., Energy Release Component).

3. Fire Problem Analysis Chart

PROBLEM	MANAGEMENT ACTION (CONTROL MECHANISM)	TARGET GROUP AGENCY	TARGET GROUP INDUSTRY	TARGET GROUP PUBLIC	DEGREE OF CONTROL	COMMUNICATION	POTENTIAL IMPACTS	COMPONENT / INDEX
Unattended (and escaped) Campfires/warming fires on refuges	Fire Restrictions (web, radio, TV, newspaper) Roadside Prevention Signs based on **Adjective Rating** Level Patrols	USFWS Fire Districts		Picnickers Hunters Fishers	Moderate	Communicated in briefings once per day to agency personnel for implementation. The intent is to raise the awareness of potential fire danger in simple, easy to communicate terms via local radio, TV, newspaper, "Smokey's Arm" sign at the entrance to developed recreation areas.	Public Anger and Resistance LEO, recreation, and fire patrol workload, LEO Workload Agency Prevention Costs vs. Suppression Costs	Energy Release Component
Fires caused by downed power lines during periods of high wind events	Modify daily operational activities based on **Adjective Rating** Level	Duty Officer	Power Company		Moderate	Duty Officer retrieves the forecasted fire danger from WIMS and communicate this information to fire management personnel. Duty Officer then will communicate with Bonneville Power company.	Loss of Productivity Loss of Credibility Socio-Economic	Burning Index
Suppression resources committed to multiple fires	Preposition resources based on **Staffing Level**	Duty Officer			High	Duty Officer retrieves the actual and forecasted fire danger indices from WIMS and orders/releases resources based upon the Step-up Plan.	Agency Mob/Demob Costs vs. Suppression Costs	Burning Index
Initial fire response with little or no information available	Initial Response Plan based upon **Staffing Level** and fire location	Duty Officer Dispatch			High	Duty Officer retrieves the actual or forecasted fire danger indices from WIMS and dispatches pre-attack plan resources to reported fire based on dispatch level/zone.	Staffing Cost vs. Suppression Cost	Burning Index
Suppression resources unavailable after work hours and/or on scheduled days off	Extended or Supplemental staffing based upon **Staffing Level**	Duty Officer Dispatch Agency Administrator			High	Duty Officer retrieves the actual or forecasted fire danger indices from WIMS and notifies agency administrator, dispatch and fire resources. Dispatch notifies respective agency personnel via telephone or radio.	Agency Costs vs. Suppression Costs	Burning Index
Fires caused by target shooting	Roadside Prevention Signs based on **Adjective Rating** Level	Dispatch Engine Captains Fire Control	Shooting ranges and gun	Recreationists/Target Shooters	Moderate	Communicated by Dispatch Center staff once per day to agency personnel for implementation.	Public Anger and Resistance Loss of	Energy Release Component

	Closure based upon **Preparedness Level**		shops			Increase level of public awareness of fire danger via local radio, TV, newspaper, adjective rating signs at typical problem areas.	Credibility LEO/fire patrol workload	
Fires caused by Debris Burning	Roadside Prevention Signs based on **Adjective Rating** Level Closure based upon **Preparedness Level**	Cooperators Agricultural Burning Control Agencies	Agricultur al Burners	Debris Burners	Moderate	Increase level of public awareness of fire danger via local radio, TV, newspaper, adjective rating signs at typical problem areas.	Public Anger and Resistance Loss of Credibility LEO/fire patrol workload	Burning Index

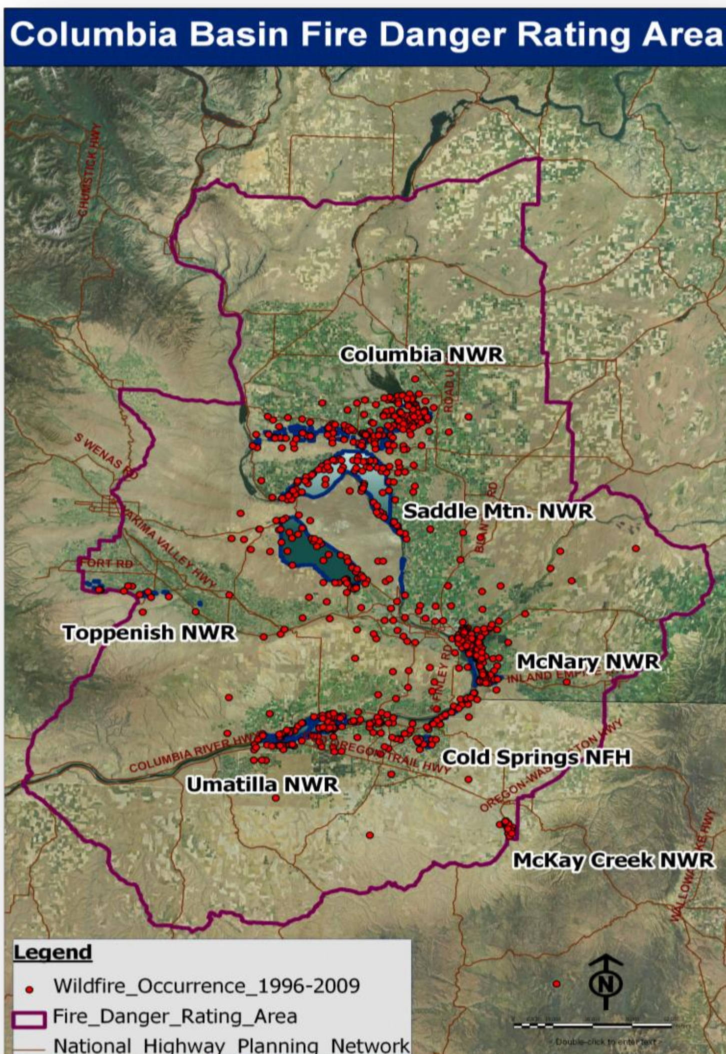
4. Fire Danger Rating Areas

A Fire Danger Rating Area (FDRA) is a geographic area relatively homogenous in *climate*, *vegetation* and *topography*. It can be assumed that the fire danger within a region is relatively uniform. For the Mid-Columbia River National Wildlife Refuge Complex, two fire danger rating areas have been defined: the Columbia Basin FDRA and the Conboy Refuge FDRA. The wildland fire occurrences within these areas were subsequently identified and this set of information is used to determine the appropriate fire danger indices to use to best predict when individual and large fires may occur.

Columbia Basin FDRA Description

a. Location:

The Columbia Basin FDRA is geographically defined the unforested area east of the Cascades, west of the Palouse Prairie, south of the Okanogan Highlands and northwest of the Blue Mountains. The Columbia Basin FDRA encompasses over 9,433,307 acres and there are 270,000 acres of Refuge managed lands within the analysis area.



b. Vegetation and Fuels

The Columbia Basin FDRA is comprised of shrub-steppe upland habitats, open water, sloughs, shallow marsh, seasonal wetlands, woody riparian areas, croplands, and islands.

Shrub-steppe upland habitats make up the majority of vegetation in refuges of the Columbia Basin FDRA. This semiarid vegetation is dominated by sagebrush, cheatgrass and bitterbrush, and contains areas of dune vegetation, cliff and talus, and local riparian and wetland vegetation types. Because of the area's arid climate and sandy soils, native plant community recovery is slow. Recovery is further hampered in the fragile uplands due to their susceptibility to invasive plant establishment on disturbed sites. Upland vegetation currently found on the refuge is dominated by introduced annual grasses and some native shrubs. There are very few remnant patches of native vegetation (i.e., shrubs with interspersed bunchgrasses).

This FDRA has been impacted by large fires in the past and has many areas dominated by cheatgrass. Most wind driven wildfires typically grow large due to the significant continuity of cheatgrass in the area and long resource response times. National Fire Danger Rating System (NFDRS) Fuel Model A (Western Annual Grass) is the dominate fuel model in this FDRA. However, Fuel Model A does not correlate as well as Fuel Model R (Hardwood Litter) with historical fire occurrence. In this FDRA, NFDRS Fuel Model R correlates well large fires and Burning Index.

c. Climate

The Columbia Basin is characterized by a semiarid climate, climate class 1. Average annual rainfall for the majority the Basin is less than ten inches. McKay Creek, included in this FDRA receives less than fifteen inches of precipitation/year.

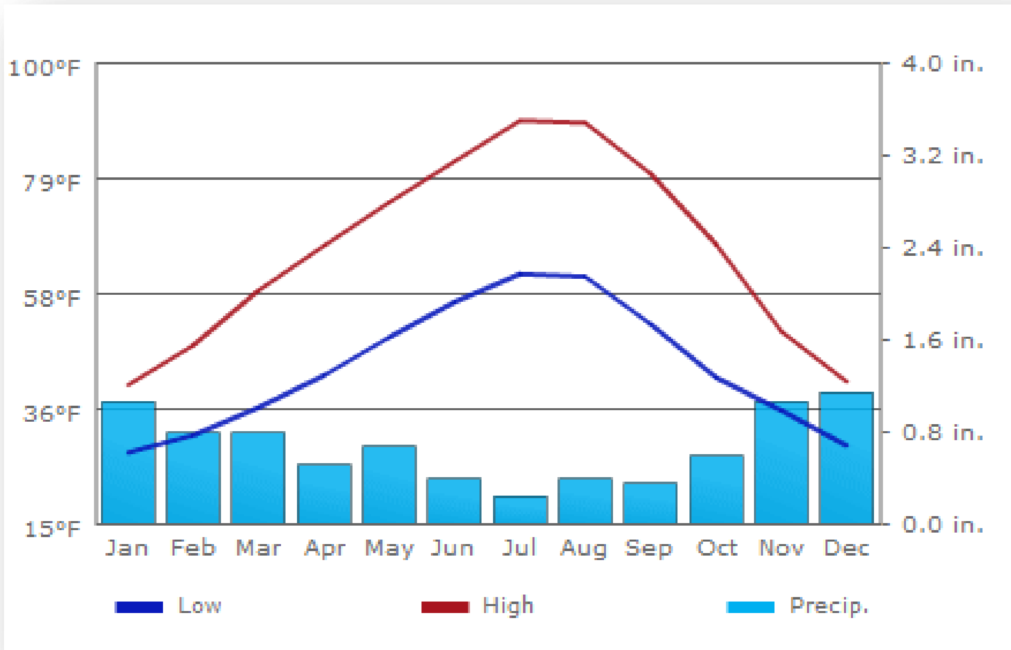
Snow may occur from November to March, but averages less than five inches per year. Precipitation mainly occurs in the winter, with almost half the annual total falling from November to February; less than an inch usually falls from July to September, the driest months (WRCC 2011).

d. Fire Weather Forecast Zones and Predictive Service Areas

Fire Weather Zones (FWZs) are used by the National Weather Service to categorize areas for more detailed fire weather forecasting. Predictive Service Areas (PSAs) are areas defined by Northwest Coordination Center Predictive Services Offices to define areas with relatively homogeneous groups of RAWs stations that all react similarly to daily weather regimes. The following table identifies the areas and zones in the Columbia Basin Fire Danger Rating Area (also see appendix z):

PSAs	FWZs
E3	673
	675
	631

Kennewick Climate Graph - Washington Climate Chart



Totals and averages

Annual average high temperature	**65.3 °F**
Annual average low temperature	**43.6 °F**
Average temperature	54.5 °F
Average annual precipitation	8.0 in.

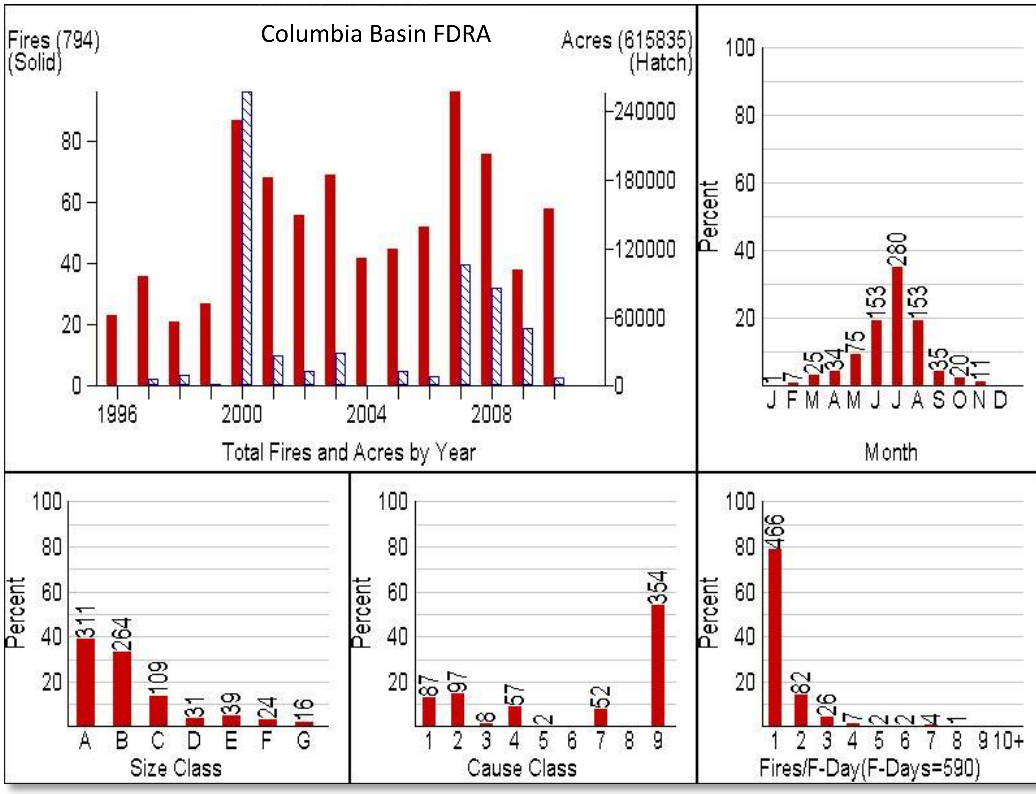
http://www.usclimatedata.com/climate.php?location=USWA0205

e. Topography:

Generally, fire occurrence in this area is considered in slope class 1. The Basin FDRA ranges in elevation from 170 feet at the Columbia River below the John Day Dam to 3600 feet on Rattlesnake Mountain on the Saddle Mountain/Hanford Reach NM.

f. Columbia Basin FDRA Fire Occurrence

Over a fifteen year period, the FDRA has averaged 53 fires annually (data description). Jun, July and August have 74% of the annual total fire occurrence. Fires in July make up almost 35% of the yearly total.



Size Class:
A = 0 - 0.25
B = 0.30 - 9
C = 10 - 99
D = 100 - 299
E = 300 - 999
F = 1000 - 4999
G = 5000 +

Cause Class:
1 = Lightning
2 = Equipment
3 = Smoking
4 = Campfire
5 = Debris Burning
6 = Railroad
7 = Arson
8 = Children
9 = Miscellaneous

g. Fire Season Ending Event Criteria for the FDRA

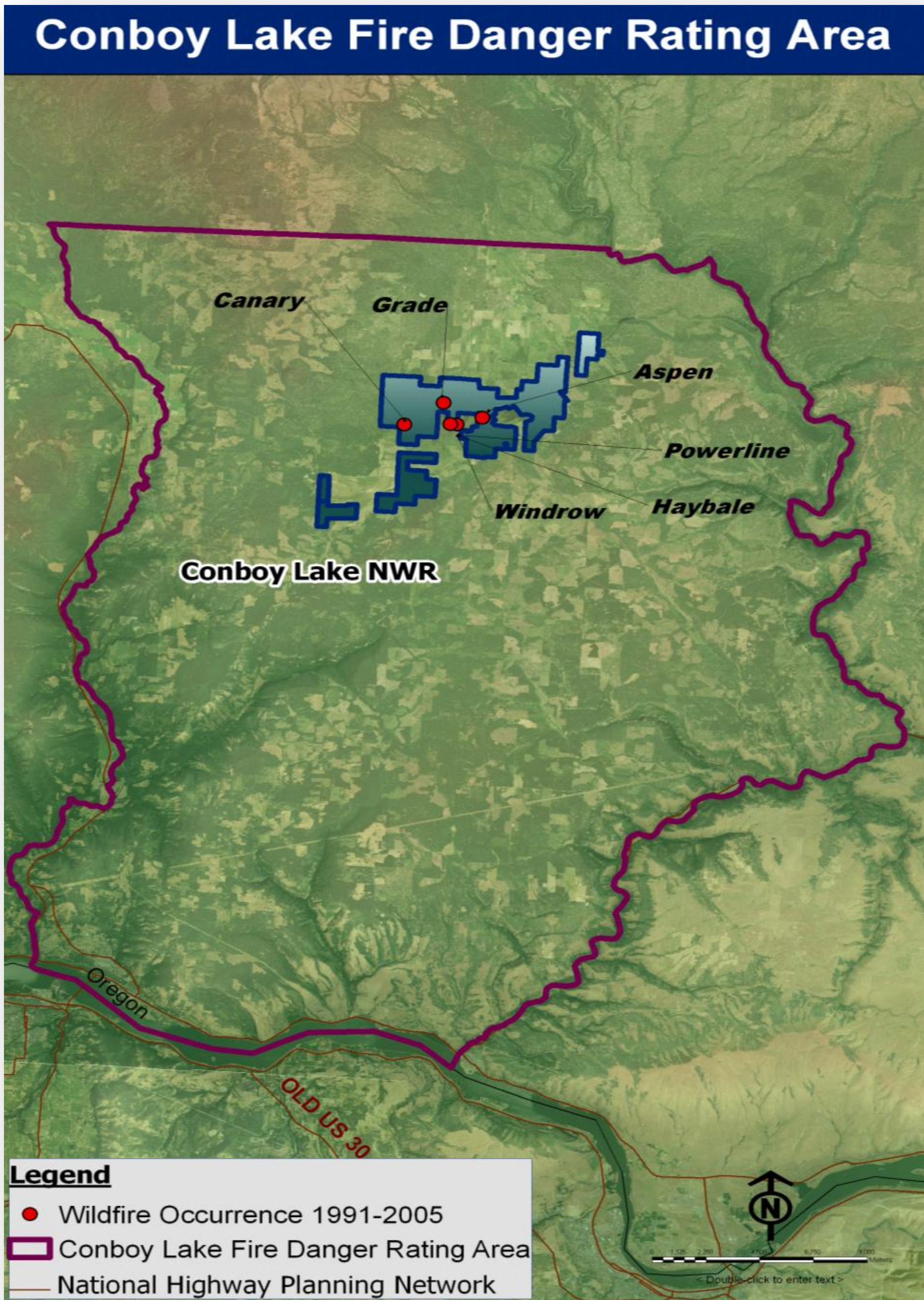
Season Ending Event Criteria: When the ERC for the Columbia Basin SIG falls below the 75th percentile (ERC value = 68) and does not recover. This criterion was developed by analyzing fire occurrence and the corresponding NFDRS climatological information, in this case Energy Release Component (ERC). The 75th percentile ERC was identified as the point where historically 75% of the fires in the season have already occurred and all of the previous large fires were ignited earlier in the year.

Based on the criteria above, annually on September 8th there is a 50% probability the fire season has ended for the year. (See appendix j)

Conboy Refuge FDRA Description

a. Location:

The Conboy Refuge FDRA is located on the east slope of the Cascade Mountains at the base of 12,307-foot Mount Adams in southern Washington. The Conboy Refuge FDRA encompasses over 259,667 acres 7,100 acres of Refuge lands.



b. Vegetation and Fuels

The fuel complex of the Conboy Refuge FDRA encompasses the historic Conboy/Camas lakebeds, a shallow marshy wetland area drained by early settlers. Conifer forests, grasslands, shallow wetlands, and deep water characterize the area.

There are timbered and alpine like meadows of the Conboy Lakes NWR. NFDRS Fuel Model G is being used for Burning Index and Energy Release Component in this FDRA.

c. Climate:

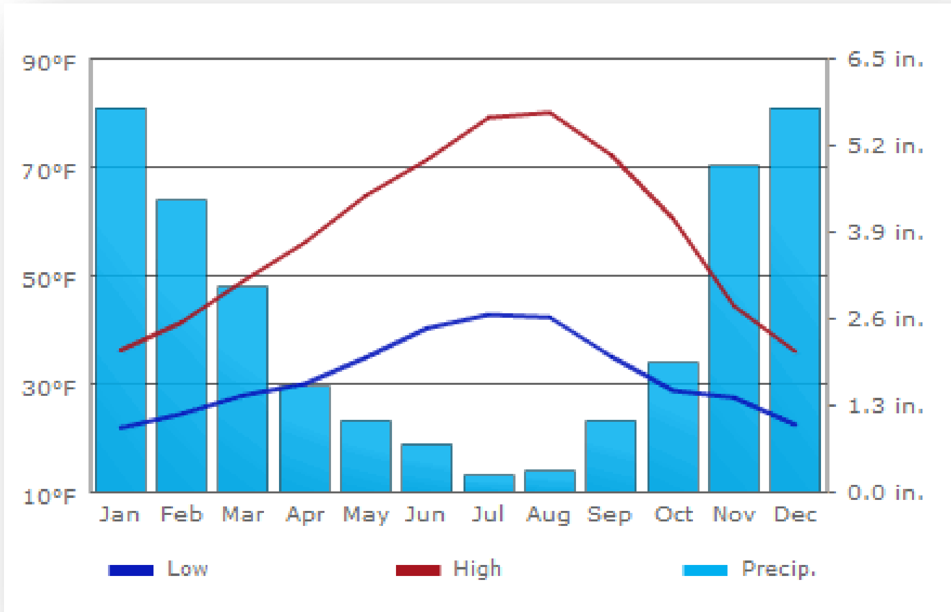
The burning season is shorter at Conboy Lake as a result of elevation, increased precipitation and snow accumulations, which result in higher fuel moistures in the larger fuel sizes. Shade component and wind speed reductions in the timbered areas also contributes to slower drying and longer periods when fire will not spread at an alarming rate. The Conboy Refuge FDRA is characterized by a Mediterranean climate with the wettest months in December and January and the driest months being July and August. High and low temperatures follow that same trend. Fires in this FDRA are typically in climate class 2 (Sub humid).

d. Fire Weather Forecast Zones and Predictive Service Areas

Fire Weather Zones (FWZs) are used by the National Weather Service to categorize areas for more detailed fire weather forecasting. Predictive Service Areas (PSAs) are areas defined by Northwest Coordination Center Predictive Services Offices to define areas with relatively homogeneous groups of RAWs stations that all react similarly to daily weather regimes. The following table identifies the areas and zones in the Conboy Fire Danger Rating Area (also see appendix z):

PSAs	FWZs
C1	631

Glenwood Climate Graph - Washington Climate Chart



Totals and averages

Annual average high temperature	**57.4 °F**
Annual average low temperature	**31.3 °F**
Average temperature	44.4 °F
Average annual precipitation	30.7 in.

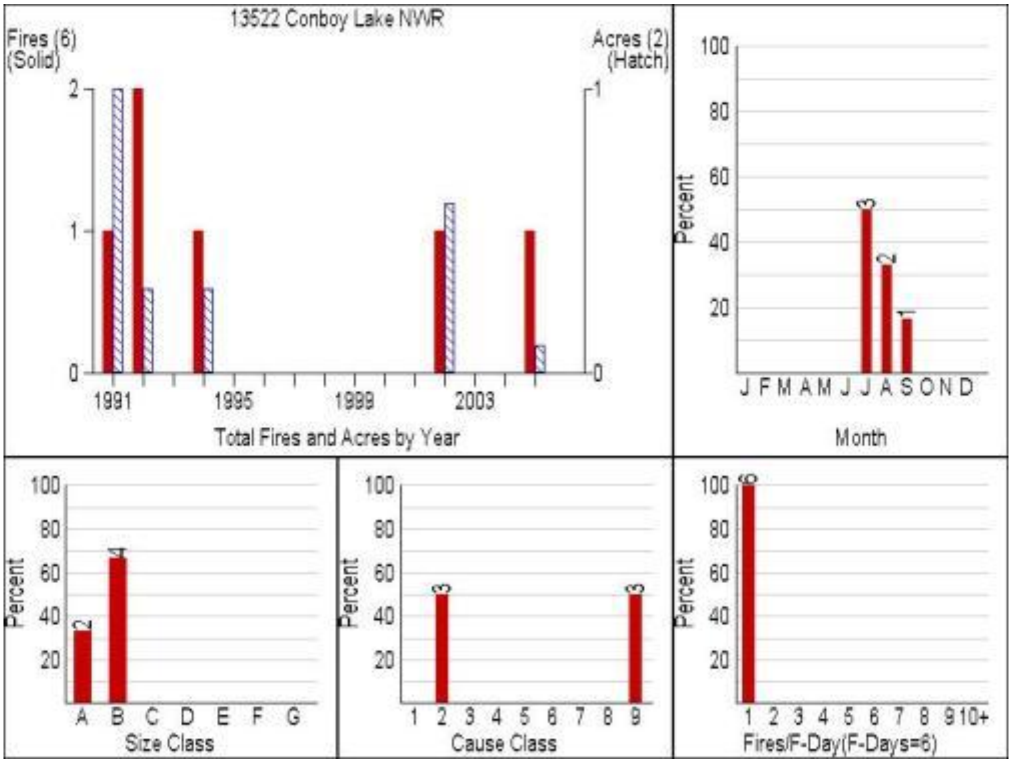
http://www.usclimatedata.com/climate.php?location=USWA0163

e. Topography:

This FDRA contains a wide and varied range of topographic features, slopes, exposures, fuel types, and amounts of available fuel, but also contains a lot of managed water, which results in reduced starts and more favorable conditions and features to aid suppression efforts in stopping the spread of unwanted fires. Conboy Lake presents timbered fuel types broken up by roads, natural features, meadows and water management improvements. Access in many cases is limited by existing roads, broken uneven terrain, loose sandy soils which can not be driven in with conventional vehicles, and bodies of water or marshlands. Elevations in the FDRA range 1,700 to 2,400 ft. Fire occurrence in this area is generally considered in slope class 2.

f. Conboy FDRA Fire Occurrence

Only six fires have occurred in this FDRA over the period 1991 – 2005.



Size Class:
A = 0 - 0.25
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D = 100 - 299
E = 300 - 999
F = 1000 - 4999
G = 5000 +

Cause Class:
1 = Lightning
2 = Equipment
3 = Smoking
4 = Campfire
5 = Debris Burning
6 = Railroad
7 = Arson
8 = Children
9 = Miscellaneous

g. Fire Season Ending Event Criteria for the FDRA

Criteria: When the ERC for the Greyback RAWS falls below the 75th percentile (≥ 59) and does not recover. This criterion was developed by analyzing fire occurrence and the corresponding NFDRS climatological information, in this case Energy Release Component (ERC). The 75th percentile ERC was identified as the point where historically 75% of the fires in the season have already occurred and all of the previous large fires were ignited earlier in the year.

There is an equal probability of a season-ending event occurring before or after the 50th percentile date. For the Conboy Refuge FDRA, this occurs near September 21st

5. Weather Patterns that Influence Fire Growth across the Columbia Basin

Identifying synoptic weather patterns that are associated with large fire growth gives the Fire Manager one more tool to prepare and manage wildland fire. Large fire growth across the Columbia Basin is largely determined by winds. This should not be surprising to area fire managers. Few events like those described here minimally occur each fire season. Typical wind events result from surface low pressure located east of the Cascades ideally centered over, but not limited to, Columbia Basin combined with high pressure building west of the Cascades. Appendix aa contains a more complete description of these patterns.

6. Wildland Fire Occurrence within the Analysis area

a. Fire Occurrence Analysis Data set

Fifteen years (1996-2010) of fire occurrence data was used for the statistical analysis. Department of Interior FWS fire occurrence data was obtained from the *FAM-WEB fire weather data* system. Fires that occurred on USFWS Refuges or were threats to the Refuges were used. Duplicate fires were eliminated (to the extent possible) to avoid misrepresentation (skewing) of the statistical correlation with large and multiple fire days. FireFamily Plus software was utilized to produce statistics and graphs.

b. Fire Occurrence Summary

For the period of record in this analysis (1996 – 2010), **53** fires a year on average either threaten or occurred on US Fish and Wildlife Service managed lands. The largest number of fires occurred in 2007 at 96 in, with a low of 21 in 1998. Lightning caused fires make up a very small proportion of the fire occurrence at 11%. Most fires occurred in July.

c. Large Fire Occurrence Summary

Of the 10 largest fires recorded, two (2) occurred at the end of June, five (5) in July and three (3) primarily in early – mid August. The following is a list of the 10 largest fires on record for the FDRA:

Discovery Date	*Latitude*	*Longitude*	*Fire Name*	*TotalAcres*	*Cause(USFS)*
6/27/2000	46.5719	-119.773	24 COMMAND*	163884	2
6/29/2008	45.6619	-119.768	COAL PLANT	78000	1
8/16/2007	46.5336	-119.881	WAUTOMA*	72641	9
8/20/2009	46.4983	-119.947	DRY CREEK COMPLEX	48902	1
7/24/2003	46.5833	-119.967	UMTANUM RIDGE	20000	9
7/13/2007	46.6214	-119.381	OVERLOOK*	17946	1
7/28/2001	46.0194	-118.946	PORTKELLY*	9929	9
7/28/2006	45.9833	-118.967	HATCH GRADE	8000	2
8/9/2005	46.3839	-119.317	MCLANE*	6851	0
7/28/1998	46.5206	-119.716	ELKMEADOW*	6500	1

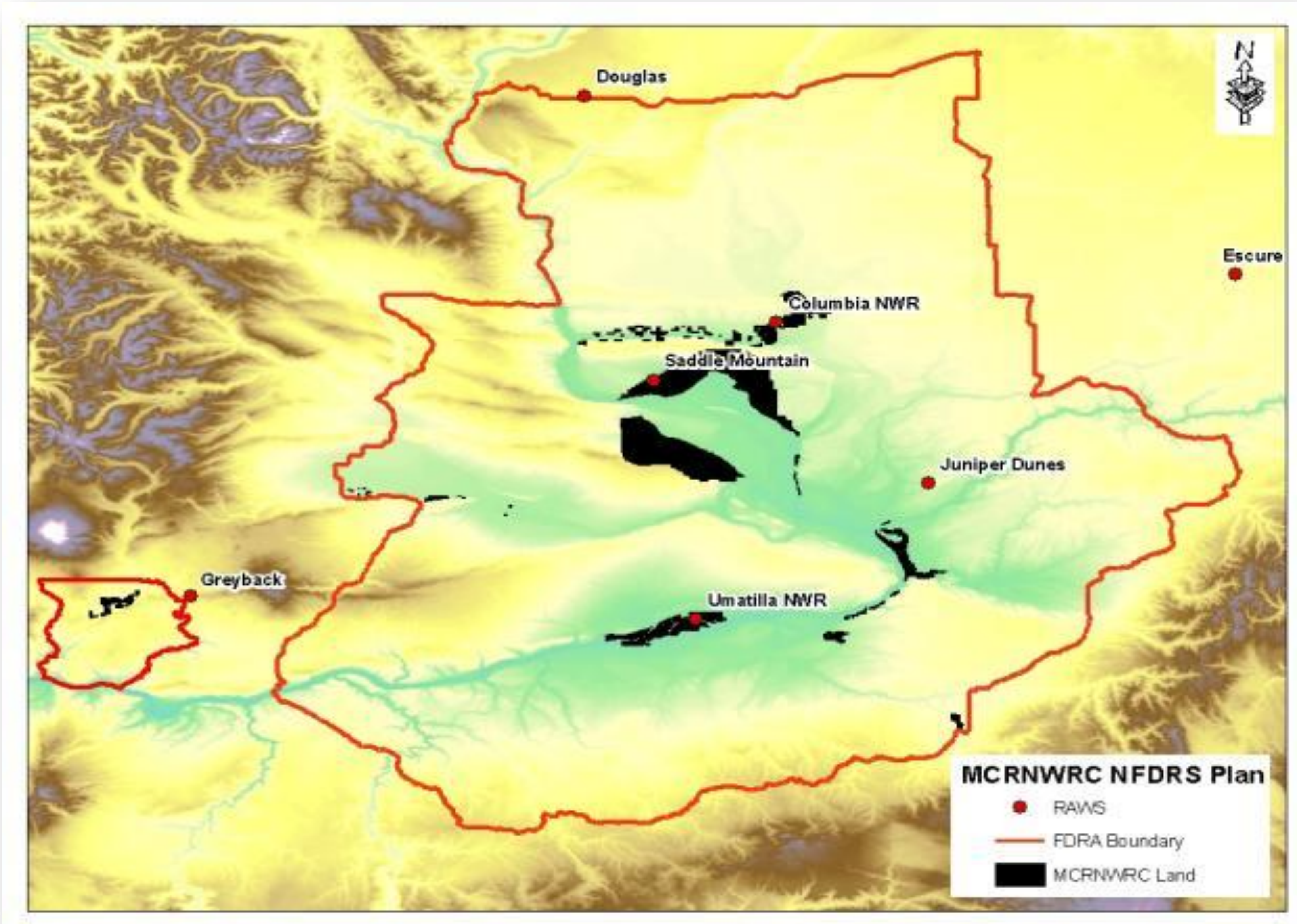
* = On Refuge Fires

7. Weather Stations

a. Description

The Mid-Columbia River National Wildlife Refuge Complex manages three active RAWS: Columbia, Saddle Mountain and Umatilla. The BLM manages three additional RAWS within the Columbia Basin: Douglas, Escure and Juniper Dunes. The Washington State Division of Natural Resources manages the Greyback RAWS that is near the Conboy Wildlife Refuge. All of these stations comply with NWCG NFDRS Weather Station Standards (*http://www.nwcg.gov/pms/pubs/PMS426-3.pdf*).

b. Map of the locations of the Remotely Automated Weather Satiations (RAWS)



c. RAWS Summary (Table)

Station ID	Station Name	Status	Agency/Owner	Data Years	Elevation	Reporting Time
351316	Umatilla NWR	Active	FWS	1999-present	270	XX:29:40
452601	Douglas	Active	BLM	1990-present	2530	XX:48:50
452701	Saddle Mountain	Active	FWS	2002-present	650	XX:30:00
453102	Columbia NWR	Active	FWS	1993-present	855	XX:29:50
453201	Juniper Dunes	Active	BLM	1987-present	979	XX:49:00
453601	Escure	Active	BLM	2001-present	1740	XX:41:50
452404	Greyback	Active	WASDNR	1991-present	3800	XX:09:30

8. Fire and Weather Station Analysis Summary

The FireFamilyPlus FIRES regression analysis was performed to determine statistically which combination of weather station observations, NFDRS fuel model, and NFDRS index best correlates to historic fire occurrence (both individual occurrence and large fire) in the Columbia Basin. Six single weather stations were considered, along with every possible combination of those weather stations grouped into Special Interest Groups (SIGs) of two to six stations. The single stations and SIGs were then run in the FIRES analysis with all 20 NFDRS fuel models for Burning Index (BI) and Energy Release Component (ERC). The FIRES analysis uses a logistic regression and the goal is to rate models (indexes) by reviewing;

a. Chi-square

Goodness of fit. For Chi-square lower is better, less than 13 is considered excellent and less than 20 is good, but over 26 is not good.

b. R – Squared

For R-squared, the closer the value is to one, the better the logistic model fits the data.

c. P – Range

Range of probabilities over the range of the predictor variable (P-Range). A range of 0.1 to 0.9 is very good, while a range of 0.2 to 0.3 is useless.

d. Distribution

A wider range of data points allows more flexibility in setting levels. Having 90 percent of the observations in only one or two classes does not allow much decision space. See appendix F for a sample of the best results of the FIRES data analysis.

A fairly good fit (see table below) with BI to the large fires on the Mid-Columbia River National Wildlife Refuge Complex within the Columbia FDRA from 1996-2010 was found using a SIG of the Juniper Dunes, Saddle Mountain, Umatilla and Escure RAWS with fuel model R. Analysis of the relationship between fire occurrence and ERC did not generate a good statistical fit. We relied upon the G fuel model for the ERC relationship since the Predictive Services branch at the Northwest Communication Center uses model G in all of their fire danger products. Specifically, the 7-Day Significant Fire Potential assessment, the PSA ERC Severity Graphs, as well as the 10-Day Predicted ERC and 100 Hr Fuel Moisture by PSA assessment all use Model G for their basic fuel model for analysis.

There are not enough historic fires to do any statistical analysis for the Conboy FDRA, so the ERC fuel model G from the Greyback RAWS will be tracked for when values trend above the 90th percentile.

Table below is an excerpt from Appendix F (Weather Station Data Analysis)

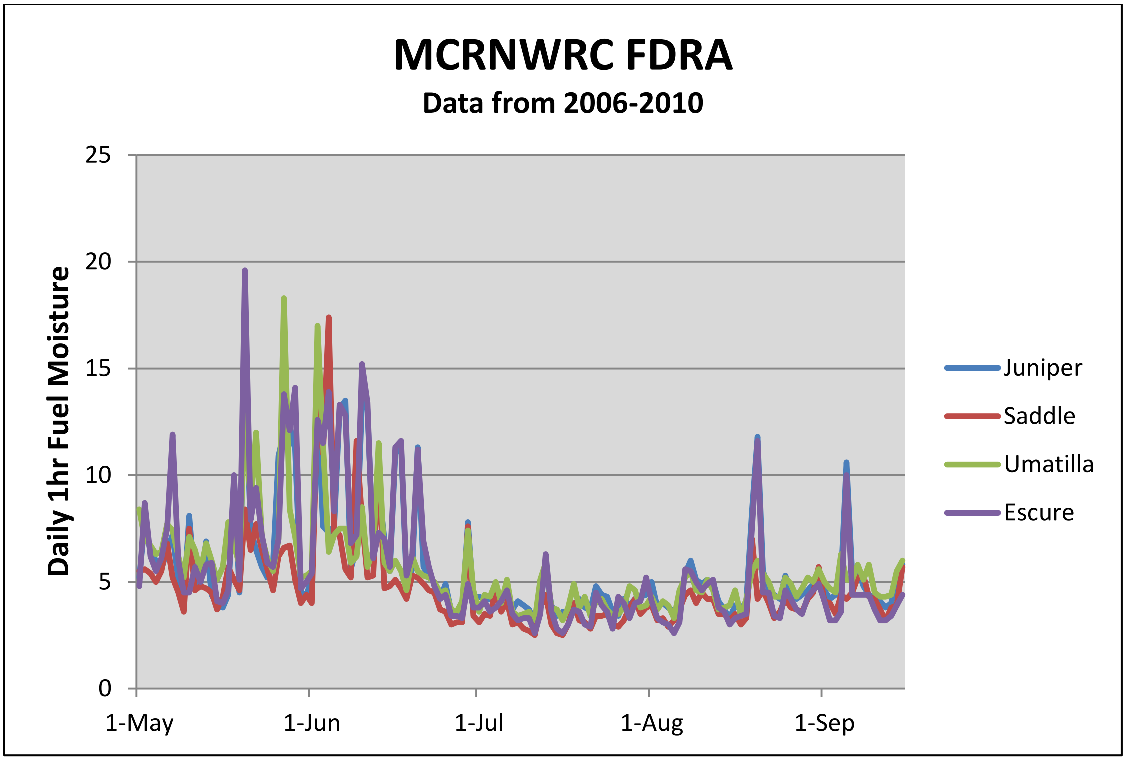
SIG	Variable	Model	FIRE DAY R² Higher Better	Chi² Lower Better	P-Val Higher Better	P-Range Larger Better	LARGE FIRE DAY Acres	R² Higher Better	Chi² Lower Better	P-Val Higher Better	P-Range Larger Better
Umatilla	BI	7A1AE1	0.88	5.5	0.7031	0.14 - 0.57	100 (C)	0.57	6.78	0.561	0.08 - 0.47
Umatilla	BI	7T1AE1	0.81	7.77	0.4563	0.16 - 0.55	100 (C)	0.47	8.19	0.4152	0.10 - 0.44
Douglas	BI	7A1AE1	0.77	4.15	0.8434	0.16 - 0.37	100 (C)	0.56	5.03	0.7542	0.08 - 0.38
Douglas	BI	7T1AE1	0.43	19.04	0.0146	0.17 - 0.38	100 (C)	0.72	4.11	0.8473	0.10 - 0.38
Saddle Mtn	BI	7A1AE1	0.64	14.15	0.0779	0.09 - 0.51	100 (C)	0.07	7.73	0.4606	0.10 - 0.21
Saddle Mtn	BI	7T1AE1	0.75	8.22	0.4119	0.12 - 0.54	100 (C)	0.19	13.73	0.0891	0.07 - 0.33
Columbia	BI	7A1AE1	0.85	6.59	0.5817	0.10 - 0.49	100 (C)	0.56	7	0.5364	0.07 - 0.38
Columbia	BI	7T1AE1	0.74	16.16	0.0401	0.11 - 0.63	100 (C)	0.5	8.96	0.3458	0.10 - 0.47
Juniper Dunes	BI	7A1AE1	0.92	3.52	0.8977	0.10 - 0.55	100 (C)	0.23	13.45	0.0972	0.10 - 0.36
Juniper Dunes	BI	7T1AE1	0.84	7.26	0.509	0.13 - 0.49	100 (C)	0.64	6.03	0.6442	0.09 - 0.42
Escure	BI	7A1AE1	0.82	5.81	0.668	0.13 - 0.49	100 (C)	0.15	9.82	0.2777	0.09 - 0.29
Escure	BI	7T1AE1	0.75	5.82	0.6671	0.16 - 0.43	100 (C)	0.26	12.86	0.1168	0.09 - 0.31
SIG – Columbia Basin	BI	7R	0.87	7.71	0.4624	0.07 - 0.57	100 (C)	0.89	1.92	0.9834	0.03 - 0.52
SIG - Jun_Sad_Uma	BI	7R	0.84	9.91	0.2711	0.07 - 0.58	100 (C)	0.87	2.19	0.9745	0.03 - 0.52
SIG - Jun_Sad_Uma_Es	BI	7H	0.8	13.01	0.1115	0.08 - 0.59	100 (C)	0.85	2.66	0.9539	0.04 - 0.52
SIG - Jun_Uma_Esc	BI	7P	0.82	9.17	0.3282	0.08 - 0.55	100 (C)	0.86	2.83	0.9448	0.03 - 0.51
SIG - Jun_Sad_Uma_Es	BI	7U	0.76	16.28	0.0386	0.07 - 0.59	100 (C)	0.9	1.62	0.9905	0.04 - 0.50
SIG - Jun_Sad_Uma_Es	BI	7E	0.84	8.89	0.3516	0.08 - 0.60	100 (C)	0.89	1.8	0.9866	0.04 - 0.50
SIG - Jun_Sad_Uma	BI	7U	0.81	12.22	0.1416	0.07 - 0.58	100 (C)	0.82	2.7	0.9517	0.04 - 0.50
SIG - Jun_Sad_Uma	BI	7C	0.92	4.83	0.7756	0.08 - 0.58	100 (C)	0.76	4.17	0.8413	0.04 - 0.50
SIG - PSA E3	BI	7C	0.82	7.7	0.4633	0.09 - 0.49	100 (C)	0.71	6.84	0.5542	0.04 - 0.50

*SIG Columbia FDRA - Juniper Dunes, Saddle Mountain, and Umatilla RAWS
**SIG-PSA E3 – Douglas, Juniper Dunes, and Escure RAWS

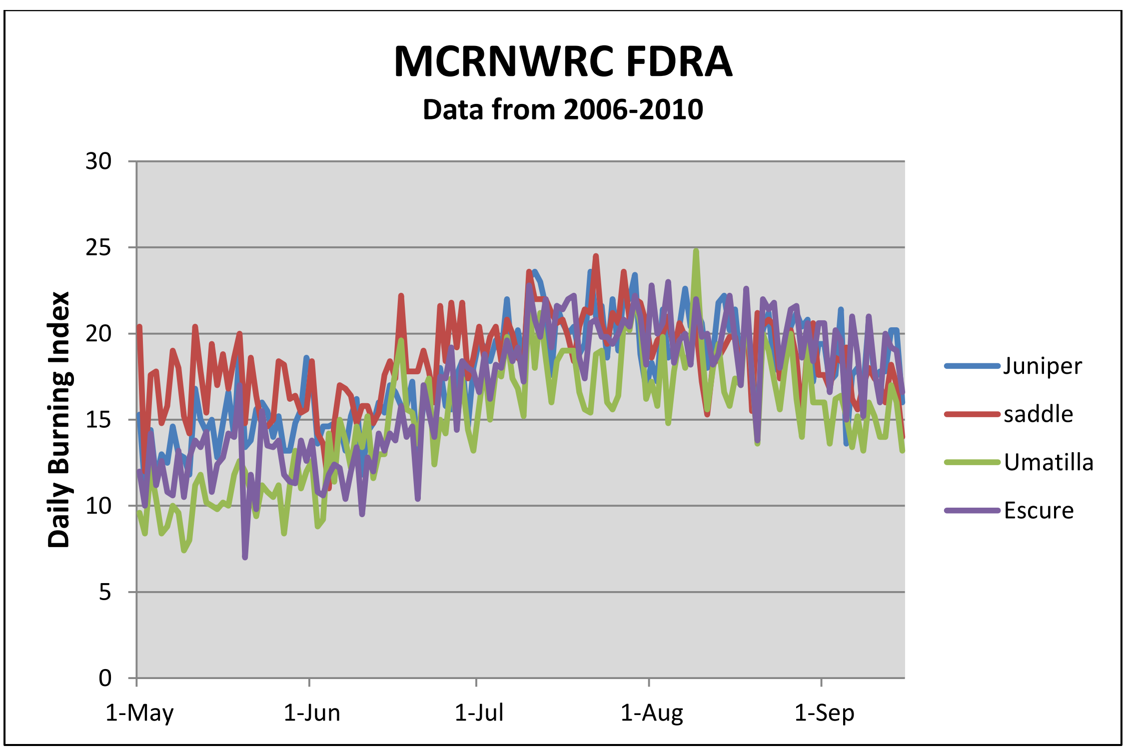
9. Special Interest Groups (SIGs)

Remote Automated Weather Stations located in different geographical locations with common sensitivity to NFDRS model inputs can be grouped together to form a SIG. A technique developed by Michael Fosberg and William Furman utilizes the 1-hour timelag fuel moisture as the integrator of temperature and relative humidity to help define fire climate zones. One-hour fuel moistures along with ERC and BI were analyzed to determine the level of correlation between the stations in this fire danger rating area and to look for potential outliers that should not be grouped in to SIG's.

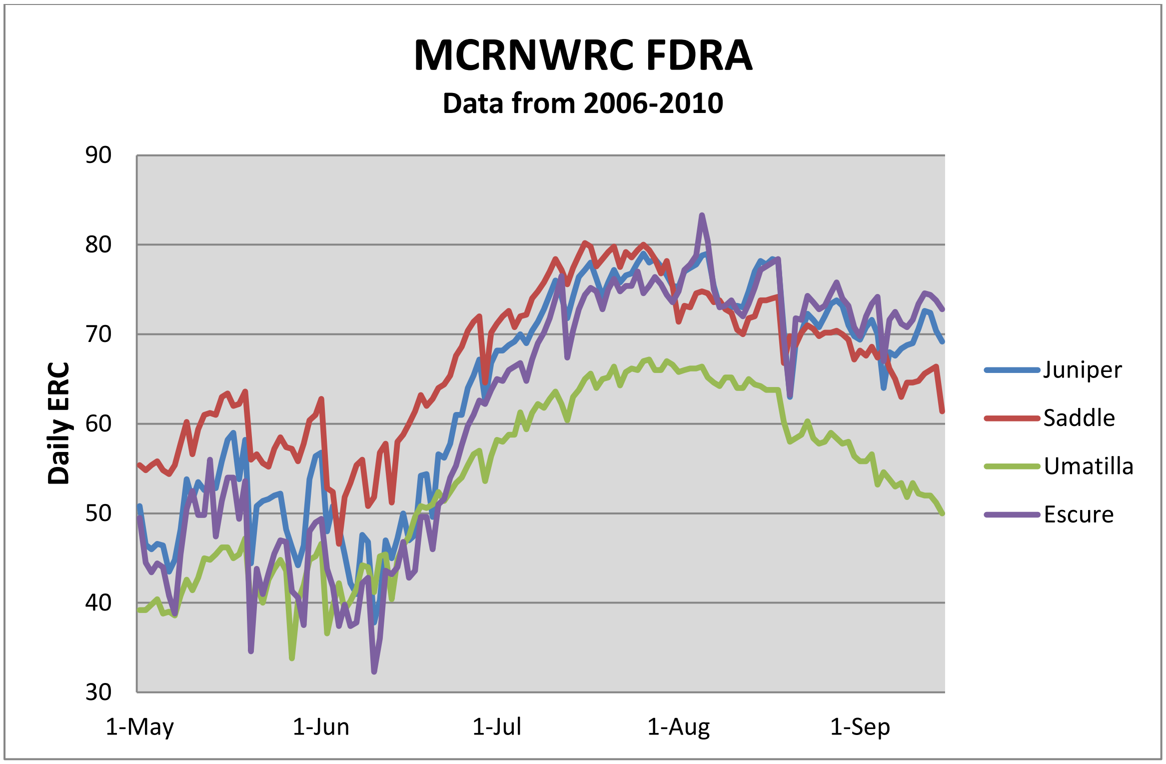
The Juniper Dunes, Saddle Mountain, Escure, and Umatilla RAWS have been combined with equal weight into a SIG to compute Fire Danger Indices for the Columbia Basin FDRA. The following graphs show the trend information for each station within the SIG group and illustrate the similarities between the stations. The trending and spatial locations are part of the reason these stations when combined into a SIG correlated so well with fire occurrence for the fire danger rating area.



a. 1 hour Timelag Fuel Moistures (Station Comparison)



b. Burning Index (Station Comparison)



c. Energy Release Component (Station Comparison)

10. Fire Danger Decision Levels

The National Fire Danger Rating System (NFDRS) utilizes the Weather Information Management System (WIMS) processor to manipulate weather data and forecasted data stored in the National Interagency Fire Management Integrated Database to produce fire danger ratings for corresponding weather stations (RAWS). 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 Fire Danger Rating system is designed to calculate worst-case scenario fire danger. Outputs from NFDRS will be utilized in three ways for the purpose of this plan. The **Preparedness Level** will assist fire managers with more long-term (or seasonal) decisions with respect to fire danger. The **Staffing Level** will be used for appropriate day-to-day suppression resource staffing. **Adjective Fire Danger** levels are intended to communicate fire danger to the public, such as fire danger signs. Although not used for making fire business decisions, **Climatological Percentiles** are discussed in this section.

Note: There is not enough historic fire occurrence at Conboy FDRA to do any statistical analysis, so the ERC fuel model G from the Greyback RAWS will be tracked, and when values trend above the 90^{th} percentile (70+). For the U.S. FWS administered lands, the local USFWS fire managers must monitor and assess the situation. They have the responsibility to take preparedness and staffing actions necessary as condition change.

11. Preparedness Level Analysis

Preparedness Levels are established to assist fire managers with weekly or monthly planning decisions based upon seasonal fire danger elements. The Fire Family Plus software has been used to establish the fire business thresholds. A statistical analysis of fire occurrence and historical weather has been completed for each Fire Danger Rating Area. The correlation of various combinations of NFDRS outputs with weather records is listed in the appendix. The final Preparedness Level determination will also incorporate fine fuel loading and the 7-day significant fire potential outlook forecast by the northwest GACC.

Preparedness Level: Fire Family Plus Analysis Factors and Determinations

Fire Danger Rating Area	RAWS	Data Years Used	Weight Factor	Fuel Model	NFDRS Index	Class	Range
Columbia Basin	Juniper Dunes Saddle Mtn Umatilla Escure	1996 – 2010 2002 – 2010 1999 – 2010 2001-2010	1.0 1.0 1.0 1.0	7G	ERC	1 2 3 4 5	0 – 44 45 –55 56 – 64 65 – 71 72 +
Conboy	Greyback	1996 – 2010	1.0	7G	ERC	5	70 +

12. Staffing Level Analysis

Staffing Levels are established to assist fire managers with daily staffing decisions. The Fire Family Plus software has been used to establish the Staffing Level thresholds. A statistical analysis of fire occurrence and historical weather has been completed for the Columbia Basin Fire Danger Rating Area. The correlation of various combinations of NFDRS outputs with weather records is listed in the appendix. The final Staffing Level determination will also incorporate the Columbia Basin FDRA preparedness level and the GACC preparedness level. Using the NFDRS fuel model 7R has a better statistical correlation to Burning Index (BI) and large fires then using fuel model 7G as in the case with ERC and Preparedness level (see appendix f).

Dispatch Level: Fire Family Plus Analysis Factors and Determinations

Fire Danger Rating Area	RAWS	Data Years Used	Weight Factor	Fuel Model	NFDRS Index	Class	Range
Columbia Basin	Juniper Dunes Saddle Mtn Umatilla Escure	1996 – 2010 2002 – 2010 1999 – 2010 2001-2010	1.0 1.0 1.0 1.0	7R	BI	1 2 3 4 5	0 – 13 14 – 17 18 – 20 21 – 23 24 +
Conboy	Greyback	1996 – 2010	1.0	7G	BI	5	72 +

13. Adjective Fire Danger Rating

The Adjective Fire Danger Rating will be used by agency personnel to inform the public of the current level of fire danger associated with a specific Fire Danger Rating Area. The amount of interaction will depend on the magnitude of the adjective fire danger. Although NFDRS processors (such as WIMS) will automatically calculate the adjective class rating, MCRNWRC will manually determine Adjective Fire Danger Rating based upon the Benton County Wildfire Protection Plan.

14. Climatological Percentiles

Climatological breakpoints are points on the cumulative distribution of one fire weather/danger index computed from climatology without regard for associated fire occurrence/business. For example, the value of the 90th percentile ERC is the climatological breakpoint at which only 10 percent of the ERC values are greater in value. The percentiles for climatological breakpoints predetermined by agency directive are shown below.

BLM - 80th and 95th percentiles
FWS - 90th and 97th percentiles
NPS - 90th and 97th percentiles
FS - 90th and 97th percentiles

It is equally important to identify the period or range of data analysis used to determine the agency percentiles. The percentile values for 12 months of data will be different from the percentile values for the fire season. Year round data should be evaluated for percentiles involving severity-type decisions.

Recognizing climatological break points is useful to provide situational awareness for fire managers.

IV. OPERATIONS AND APPLICATIONS

Worksheets (flowcharts) will be used to determine the daily Staffing and Preparedness Rating levels. Adjective rating levels will be determined in coordination is local cooperators (see section VI – 5). The resultant staffing levels for each FDRA will be broadcast in conjunction with the morning information report and documented by the Mid- Columbia fire Duty Officer on the daily resource status report (see appendix y). The preparedness and adjective fire danger rating levels will be broadcast and documented in the same manner.

Although fire danger ratings do not prevent human-caused fires, a strong effort should be made to communicate the fire danger as it changes throughout the fire season. The social, political, and financial impacts of wildfires on agency, public, and industrial entities can be far reaching. Loss of life, property, and financial resources can potentially be associated with any wildfire. As the fire danger fluctuates, agency personnel need to have pre-planned and appropriate responses. These actions should not only focus on appropriate fire suppression, but also mitigation/education.

1. WIMS Setup and Application

The Weather Information Management System (WIMS) is a comprehensive system that enables users to manage weather information.

WIMS can be accessed at *http://fam.nwcg.gov/fam-web/*.

The WIMS User Guide can be downloaded from the following web site:
http://www.fs.fed.us/fire/planning/nist/wims_web_ug/wims__ug_complete061803.pdf

See Appendix M for WIMS setup and application instructions.

2. Preparedness Level

The preparedness levels for this plan are intended to recognize one – week and seasonal fire danger conditions. The Preparedness Level is a five-tier (1-5) fire danger rating system that will be based on Energy Release Component (ERC) and indicators of the severity of the fire season. The fire business indicators used to calculate the preparedness level uses Fine Fuel Loading and the Pacific Northwest (PNW) Predictive Services 7-Day significant fire potential. Several procedures and guidelines are to be followed and/or considered once the preparedness level has been determined (See Resource allocation considerations and Appendix G). The thresholds for the preparedness level are set using an historical analysis (Fire Family Plus) of fire business and its relationship to 1300 RAWS observations. These threshold values are evaluated by fire managers after the daily observations are entered into the NIFMID database and processed by WIMS, which calculates the NFDRS index values (i.e. BI, IC, SC, ERC, etc).
Worksheet Instructions:

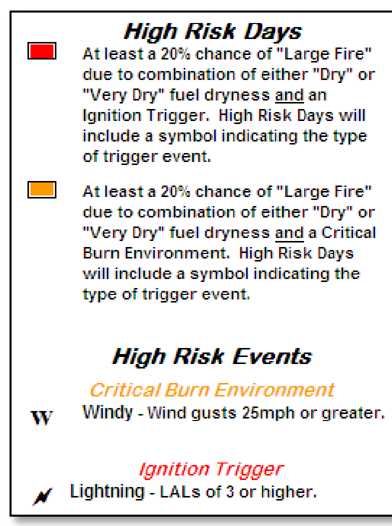
a. ERC Index Value

Place a checkmark in Row One indicating the appropriate index value (Energy Release Component, Fuel Model G). These indices are based on the 1300 (daily) RAWS observations from the FDOP SIG, which are input to the WIMS processor by Mid-Columbia NWRC fire personnel.

b. Fine Fuel Loading

Place a checkmark in Row Two indicating the appropriate Fine Fuel loading for the associated FDRA. Annually, after the primary growing season the fire fuels loading will be measured to determine the annual grass loading for a given year (see fine fuel sampling guide Appendix L).

http://www.blm.gov/nstc/library/pdf/samplveg.pdf



c. PNW 7-day Significant fire Potential Outlook

Place a checkmark in Row Three indicating if the PNW 7-Day Significant Fire Potential Outlook for Predictive Service Area (PSA) E3 is in a high risk category. Place the check mark in the "yes" column if PSA E3 is forecast for either an Orange or Red high risk category in any of the 7 following days. When North West Coordination Center will issue a high risk day for PSA E3 when forecasters expect conditions to exist that historically have resulted in approximately a 20% or greater chance for a large fire. These days will be indicated on the NW Coordination Center Predictive services 7-Day significant fire potential Chart in red (when the causal agent is an ignition trigger event) or orange (when the causal agent is a critical burn environment). A symbol will be included to indicate the reason for the high risk. http://www.nwccweb.us/index.aspx

Preparedness Level Worksheet

Mid-Columbia River National Wildlife Refuge Complex

ERC – Model 7G (Columbia Basin FDRS SIG)	0 - 44		45- 55		56 - 64		65 - 71		72 Plus	
(1) ✓ ⇨										
Fine Fuel Loading	< ½ ton/ac ⇩	> ½ ton/ac ⇩	< ½ ton/ac ⇩	> ½ ton/ac ⇩	< ½ ton/ac ⇩	> ½ ton/ac ⇩	< ½ ton/ac ⇩	> ½ ton/ac ⇩	Any Loading ⇩	
(2)✓ ⇨										
7-day Significant Fire Potential Outlook	No ⇩	Yes ⇩	No ⇩	Yes ⇩	No ⇩	Yes ⇩	No ⇩	Yes ⇩	No ⇩	Yes ⇩
(3)✓ ⇨										
Preparedness Level	I		II		III		IV		V	

Resource allocation considerations by Preparedness level

The tables below are used by U.S. Fish and Wildlife fire managers on the Mid-Columbia Wildlife Refuge Complex as a standard for unit capability by Preparedness Level. Funded response capability (FRC) is described in annual budget allocation. Managers must incorporate forecast conditions and adjust capability accordingly.

Preparedness Level	I	II	III	IV	V
Fire Management resource allocation	Funded response capability (FRC) at 25%. Off unit assignments available for 75% of the FRC.	Funded response capability (FRC) at 75%. Off unit assignments available for 25% of the FRC.	Funded response capability (FRC) at 100% All FRC are fire ready for Initial attack.	Funded response capability (FRC) at 100% All FRC are fire ready for Initial attack. Consider additional long term severity resources assigned to increase response to 125% of FRC	Funded response capability (FRC) at 100% All FRC are fire ready for Initial attack. Consider additional long term severity resources assigned to increase response to 150% of FRC

3. Staffing Level

The Staffing Level forms the basis for decisions regarding the "degree of readiness" of initial attack (IA) resources and support resources. The Staffing Level is based on an analysis of the value of Burning Index (BI) as they relate to a Local Preparedness Levels. 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. Staffing Level will be used to determine staffing which requires employee overtime associated with working people beyond their normal schedules (i.e., days off, after hours). In addition, the extended staffing of shared resources such as air tankers, helicopters, hotshot crews and other large fire support resources will be linked to the Staffing Level.

a. BI Value:

Place a checkmark in Row One indicating the appropriate index value (Burning Index, Fuel Model C). These indices are based on the 1300 observed for afternoon staffing or the 1600 forecast indices for next day staffing.

b. Mid-Columbia FDRA preparedness level

Place a checkmark in Row Two indicating the appropriate preparedness level from the Preparedness Level Worksheet above.

Staffing Level Worksheet

Mid-Columbia River National Wildlife Refuge Complex

<table>
<tr><td>BI – Model 7R (Columbia Basin FDRA SIG)</td><td colspan="2">0 - 13</td><td colspan="2">14 - 17</td><td colspan="2">18 - 20</td><td colspan="2">21 - 23</td><td colspan="2">24 Plus</td></tr>
<tr><td>(1) ✓ ⇨</td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Columbia Basin FDRA Preparedness Level</td><td>I-III ⇩</td><td>IV-V ⇩</td><td>I-III ⇩</td><td>IV-V ⇩</td><td>I-III ⇩</td><td>IV-V ⇩</td><td>I-III ⇩</td><td>IV-V ⇩</td><td>I-III ⇩</td><td>IV-V ⇩</td></tr>
<tr><td>(2)✓ ⇨</td><td colspan="3"></td><td colspan="2"></td><td colspan="2"></td><td colspan="2"></td><td></td></tr>
<tr><td>Staffing Level</td><td colspan="3">I</td><td colspan="2">II</td><td colspan="2">III</td><td colspan="2">IV</td><td>V</td></tr>
</table>

Resource staffing guidance by Staffing level

The tables below are used by U.S. Fish and Wildlife fire managers on the Mid-Columbia Wildlife Refuge Complex as a standard for unit capability by Staffing Level. Managers (Duty Officers) must incorporate and document local conditions/circumstances and adjust staffing accordingly.

Staffing Level	**I**	**II**	**III**	**IV**	**V**
Fire Management Staffing Guidance	Normal work periods	Normal work periods All resources fire ready	Normal work periods All resources fire ready Fire prevention patrols and contacts	Flexible work schedule - Shift to afternoon work periods (1000 – 1830) All resources fire ready Fire prevention patrols and documented contacts Funded response capability staffing on the 6 work day	Flexible work schedule - Shift to afternoon work periods (1000 – 1830) All resources fire ready Fire prevention patrols and documented contacts Funded response capability staffing on the 6 work day Extend daily staffing as conditions warrant to 2000

4. Adjective Fire Danger Rating

Adjective Fire Danger Rating Description

In 1974, the Forest Service, Bureau of Land Management and State Forestry organizations established a standard adjective description for five levels of fire danger for use in public information releases and fire prevention signing. For this purpose only, fire danger is expressed using the adjective levels and color codes described below.

Fire Danger Class and Color Code	Description
Low (L) (Green)	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) (Blue)	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. Short-distance spotting may occur, but is not persistent. Fires are not likely to become serious and control is relatively easy.
High (H) (Yellow)	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 hit hard and fast while small.
Very High (VH) (Orange)	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 in heavier fuels.
Extreme (E) (Red)	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.

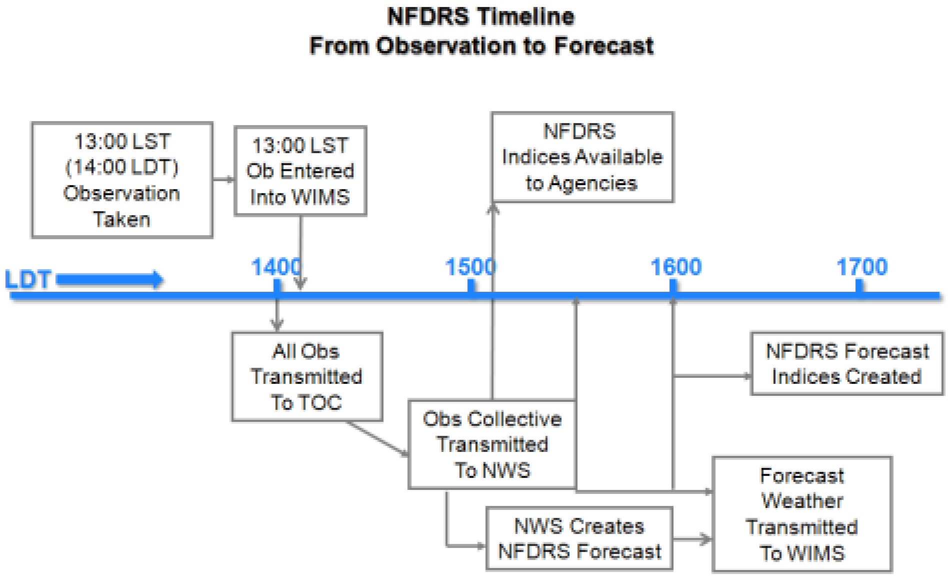
5. Adjective Fire Danger Rating Determination

Although NFDRS processors (i.e., WIMS) will automatically calculate the adjective class rating, MCRNWRC will use the Adjective Fire Danger Rating based upon the Benton County Wildfire Protection Plan. The actual determination of the weekly adjective rating is based on the past weeks average ERC and the fire weather forecast trend for the next week. A SIG of Saddle Mountain, Columbia NWR, and Juniper Dunes RAWS with fuel model T is used. Incorporating the Benton County Plan process will ensure a consistent fire danger message is put out to the public.

Contact Lieutenant Aaron Bibe, Benton County Fire District #1, for the weekly Fire Danger Rating Forecast. 509-734-9200.

Staffing Index (ERC-T)	MCRNWRC FDRA Adjective Fire Danger Rating
0 – 3	L
4 – 8	M
9 – 11	H
12 – 16	VH
17 +	E

6. Daily Timeline



Weather Information Management Application (WIMS) processing

Weather stations finish transmitting data by 14:30. Data are available for editing within five minutes of transmission. Mid-Columbia personnel publish raw data in WIMS by 15:00 (convert R to O). (Publication procedure for BLM stations is unknown at this time.) Obtain O (observed) and F (Forecasted) ERC and BI for FDOP SIG by 16:00. Enter data into matrix for Observed and Forecasted Preparedness and Staffing Levels.

Preparedness Level determination Process

Daily Preparedness Level — effective from 16:00 (today) to 15:59 (tomorrow)
Inputs will be taken from the following:

- *Observed **Energy Release Component*** (ERC-G) issued for that day and available in WIMS by 14:40.
- If fine fuel loading was above 0.5 tons/acre for the season ***Fine Fuel Loading*** is a “Y” input; otherwise, it is an “N” input.
- If a *High Risk Event* for wind or lightning is forecasted for any of the following 7 days, ***Significant Fire Potential*** is a “Y” input; otherwise, it is an “N” input

Staffing Level determination process for this afternoon

Daily Staffing Level — effective from 16:00 (today) to 06:00 (tomorrow)
Inputs will be taken from the following:

- *Observed **Burning Index (BI)*** for that day from the Columbia basin FDRA sig.
- If the Columbia Basin FDRA Preparedness Level is IV-V, **Columbia Basin FDRA Preparedness Level** is a “**Y**”; otherwise, it is an “**N**” input.

Predicted Staffing Level determination process for following day

Daily Staffing Level — effective from 06:00 (tomorrow) to 15:59 (tomorrow)
Inputs will be taken from the following:

- *Forecasted* ***Burning Index (BI)*** from the Columbia basin FDRA sig forecasted for the next day.
- If the observed Columbia Basin FDRA Preparedness Level is IV-V, **Columbia Basin FDRA Preparedness Level** is a "**Y**"; otherwise, it is an "**N**" input.

Adjective Rating Level determination Process

Weekly Adjective Rating Level — Issued by Benton County on Tuesday - effective from Tuesday - Monday
Inputs will be taken from the following in coordination with Benton County:

- Forecasted Energy Release Component for the following day – FM T, from a SIG of the following RAWs: Saddle Mountain, Columbia NWR, and Juniper Dunes. This data can be obtained from Benton County and must always be coordinated with them for consistent fire danger messaging.

7. Seasonal Risk Analysis

Seasonal risk analysis is a comparison of the historic weather/fuels records with current and forecasted weather/fuels information. Seasonal risk analysis is an on-going responsibility for fire program managers. The most reliable indicators of seasonal fire severity have been measurements of fine fuel loading, live fuel moisture, 1000-hour (dead) fuel moisture, and ERC. These levels will be graphically compared to historical maximum values and the average; these graphs will be routinely updated and distributed to fire suppression personnel and dispatch. Seasonal risk analysis information will be used as a basis for pre-positioning critical resources, dispatching resources, and requesting fire severity funding.

At minimum, a Fire Family Plus Energy Release Component Statistical Graph for the associated FDRA will be produced and posted at duty stations and ready rooms weekly. These graphs with current data should be used in reference to the published fire danger pocket card (see appendix h)

8. Thresholds (Extreme Fire Danger)

Seasonal risk escalation in fuel complexes of the Columbia Basin relies upon a combination of factors, which will ultimately trigger an extreme state of fuel volatility and a high potential for large fire growth or multiple ignition scenarios.

The occurrence of large/multiple fires is the reliable indicator of severity conditions and the potential for seasonal risk. Any one incident reaching type one or two complexity would be an indicator of severity. Two or more type three incidents within a two to four week period would also be a strong indicator. Three or more initial attack fires in the same day indicate a point where resources are limited. A progressive approach to assessing seasonal risk will prepare the local unit for these occurrences and the necessary resources will already be in place.

1. **Live Fuel Moisture:** Live herbaceous (sagebrush) fuel moisture plots would provide valuable data with a direct correlation between fire intensity (controllability) and live moisture levels. Fire severity can be determined by comparing current trends to historical averages.

Comparison of fuel moisture to historical conditions at various locations can be located on the National Fuel Moisture Database at: http://72.32.186.224/nfmd/public/index.php

2. **Cheat Grass and Fine Fuel Loading:** Fuel load determinations made on an annual basis and compared to historical averages can determine the potential intensity of wildfires. However, based on experiences from around the country, generally fine fuel loading over .5 tons/acre indicates a fire controllability problem. If plots exhibit significant amounts of carry-over fuel and/or matted grass, it will contribute to continuity and fuel bed density, resulting in control problems and increased fireline intensity.

3. **NFDRS Thresholds:** ERC and 1000-hr (3" – 8" diameter dead) fuel are used as the primary indicators to track seasonal trends of fire danger potential. NFDRS fuel model R has been chosen due to its good "fit" with the BI models. Other fuel models which might seem to be more appropriate due to their classification (grass/brush) do not correlate very well statistically with the NFDRS models. Consequently, fuel model **R** was chosen due to its ability to predict fire occurrence; specifically, a day when a large fire is likely to occur. The BI threshold for high fire potential is 41 (or higher) for the Columbia Basin FDRA. It has been statistically proven that large fire events will occur proportionally more often when this threshold is exceeded. The ERC threshold with fuel model G is 72 (or higher) for the Columbia Basin FDRA Early and late-season readings that trend above average may indicate an extension of the normal fire season. The Conboy FDRA has not had enough fires for a statistical analysis, so a 90th percentile value of NFDRS fuel model G was used for BI and ERC thresholds. The BI threshold for high fire potential is 72 and 70 for ERC.

4. **Weather Thresholds:** Seasonal weather assessments rely upon long-range (30-90 day) forecasts. This information is available in two formats: seasonal long-lead outlooks and 30-90 day outlooks. This information is provided by NOAA Climate Prediction Center. The observable weather factors that contribute to large fires and the potential for extreme fire behavior can be determined from the same percentiles determined from NFDRS thresholds. Any of these factors significantly increase the potential for extreme fire behavior and large fire growth. Combination of these factors will increase the risk. Managers must consider these weather thresholds along with NFDRS indices in Staffing and Preparedness levels.

5. **Drought Indicators:** The Keetch-Byrum Drought Index (KBDI) and Palmer Drought Index track soil moisture and have been tailored to meet the needs of fire risk assessment personnel. Current KBDI information is located on the Wildfire Assessment System (WFAS) Internet site (*http://www.wfas.us/*). Tracking and comparing 1000-hour fuel moisture is another method to assess drought conditions. Palmer Drought Index graphics display current drought conditions while KBDI values of 500-800 indicate the potential for rapid curing and drying of the fine fuels and potential for live fuel moisture to drop. The 1000-hour fuel moisture is also a good drought indicator. Values between six and ten percent indicate the potential risk for extreme burning conditions.

6. **Normalized Difference Vegetation Index (NDVI):** NDVI data is satellite imagery, which displays vegetative growth and curing rates of live fuels. The WFAS Internet site (http://www.wfas.us/) provides several different ways to analyze current and historical greenness imagery, which can be a significant contributor to seasonal risk assessments. An

analysis of this imagery will assist in the assessment of current fuel moisture conditions and provide historical as well as average greenness comparisons.

9. Season Ending Event
Utilizing the Term Module of the FIREFAMILY Plus software, the Weibull waiting-time distribution was developed from historical season-ending dates. The probability graphs along with the event locator parameters from the FireFamily Plus software dialog box are contained in Appendix J. From this analysis, it can be estimated that there is an equal probability of a season-ending event occurring before or after the 50^{th} percentile date. For the Columbia Basin FDRA, this occurs near September 8^{th} and for the Conboy Refuge FDRA, this occurs near September 21^{st}.
Historical fire records were examined for all FDRAs to determine the combination of weather parameters which would indicate the end of the fire season. The following season-ending events have been identified:
1. **Columbia Basin FDRA:** When the ERC for the Columbia Basin SIG falls below the 75^{th} percentile (≥ 68) and does not recover.
2. **Conboy Refuge FDRA:** When the ERC for the Greyback RAWS falls below the 75^{th} percentile (≥ 59) and does not recover.

10. Fire Danger Pocket Cards
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. Burning Index was the NFDRS output chosen as a measure of fire controllability (Deeming et al. 1978). NFDRS fuel model G was selected for all fire danger rating areas as it provides a good statistical correlation to large fire occurrence and responds quickly to changing weather and fuel conditions. Refer to Appendix H for an example. Visiting resources can use the pocket card to familiarize themselves with local fire danger conditions. The Mid-Columbia River Pocket Card meets NWCG guidelines and is posted on the interagency web site: *http://fam.nwcg.gov/fam-web/pocketcards/*

V. Roles Responsibilities

1. **Fire Danger Operating and Preparedness Plan:** The Mid-Columbia FMO will ensure that necessary amendments or updates to this plan are completed. Updates to this plan will be made at least every three years, reviewed by the USFWS Pacific Regional Office and approved by the local line officer.
2. **Suppression Resources:** During periods when local preparedness levels are IV and V, the Fire Management Officer will strive to achieve the most efficient and effective organization to meet Fire Management Plan objectives. This may require the pre-positioning of suppression resources. The FMO/AFMO will also determine the need to request/release off unit resources or support personnel throughout the fire season.
3. **Duty Officer:** The Mid-Columbia NWRC Duty Officer is a designated Mid-Columbia fire management staff member, who provides input and guidance regarding preparedness and staffing levels.
    a. It is the Duty Officer's role to interpret and modify the daily preparedness and Staff levels as required by factors of this plan. Modifications of the preparedness

and/or staffing levels must be coordinated with the Hanford Fire Dispatch Center Manager and local cooperators.

b. It is the Duty Officer's role to ensure that the daily fire weather forecast (including NFDRS indices) is retrieved and that the daily preparedness, staffing, and are calculated, distributed and stored.
c. It is the Duty Officers role to ensure the timely editing of daily 1300 weather observations of all stations. During periods when a Duty Officer is not assigned, that responsibility falls to the Mid-Columbia NWRC FMO.
d. The Duty Officer will keep NWRC fire and management staff updated (as needed).

4. **Fire Weather Forecasting:** Daily fire weather forecasts will be developed by the National Weather Service, Both Pendleton and Spokane Fire Weather Forecast Office and posted on the Internet and in WIMS for the Mid-Columbia NWRC Duty Officer to retrieve.
5. **Risk Analysis Information:** The risk analysis will include information such as live fuel moisture, 1000-hour fuel moisture, fuel loading, NFDRS (BI/IC/ERC) trends, NDVI imagery, and other pertinent data. This information will be distributed to agency staff as necessary. The Mid-Columbia NWRC fire management staff will ensure information is posted at all of the fire suppression duty station.
6. **Weather Station Maintenance:** The Remote Sensing Laboratory located at the National Interagency Fire Center (NIFC) calibrates the RAWS station sensors on an annual basis. The Mid-Columbia FMO is responsible for RAWS maintenance and compliance with RAWS station maintenance schedules. Support for RAWS stations maintenance is available at the Regional Fire Branch.
7. **WIMS Access, Daily Observations, and Station Catalog Editing:** The Mid-Columbia FMO is listed as the station owner for the FWS RAWS. The owner maintains the WIMS Access Control List (ACL). The station owner will ensure appropriate editing of the RAWS catalogs.
8. **Adjective Level Guidelines:** The FMO working with local cooperators will be responsible for establishing and reviewing the preparedness, staffing, and adjective level guidelines every three years (as a minimum).
9. **Public and Industrial Awareness:** The FMO or Duty Officer will implement Education and mitigation programs as directed by the agency Public Information Officers, Law Enforcement Officers, FMOs, AFMOs, and Fire Education/Mitigation Specialists based on Preparedness Level Guidelines and direction provided by the agency's the Mid-Columbia NWRC prevention and mitigation plan (***in development***).
10. **NFDRS and Adjective Fire Danger Break Points:** The FDOP team will review weather and fire data at least every three years (when the FDOP is re-analyzed). The team will ensure that the thresholds reflect the most accurate information with the concurrence of the FMOs.
11. **Fire Danger Pocket Cards:** The MCRNWRC FMO will ensure that pocket cards are prepared at least every two years and are in compliance with NWCG standards. The cards will be distributed to all interagency, local and incoming firefighters and Incident Management Teams (IMTs). The pocket cards will be posted on the National Wildfire Coordinating Group (NWCG) pocket card web site (*http://fam.nwcg.gov/fam-web/pocketcards/*). Fire suppression supervisors will utilize pockets cards to train and brief suppression personnel ensuring that they are posted at their respective fire stations.

PROGRAM IMPROVEMENTS

Training

- Train local responders in the appropriate use of NFDRS application
- Provide FDOP training to cooperators including county fire wardens, cooperating dispatch centers, and military fire departments.
- Provide refresher training on the FDOP each year, emphasizing the differences between BI, ERC, Staffing, Levels, Preparedness, and Adjective Rating Levels.
- Train more personnel as first responders to RAWS malfunctions.
- Establish local WIMS/NFDRS training courses for agency personnel.
- Inform agency fire suppression supervisors of FDOP applications by integrating the training in unit orientation and *Incident Qualification Card* meetings. At a minimum, this should include Fire Management Officers, Fire Operations Supervisors, Area Managers, and Fire Wardens.

Data

- Acquire complete cooperator fire occurrence data.

RAWS

- Analyze the effect of weighting RAWS within each SIG to better represent the potential fire danger for each FDRA.

Technology & Information Management

- Integrate preparedness level flow chart into a software package.
- Improve the Mid-Columbia Complex – Fire Management Internet Site where pertinent seasonal risk assessment information can be reviewed.

Appendix a. Fire Danger Operating Plan Development Team Members

Scott Tobler
Fire Planner
Forest Service, US Dept. of the Agriculture, Dixie and Fishlake National Forests, Cedar City Ut.

Brett Fay
Assistant Regional Fire Management Coordinator, US Dept. of the Interior, Fish and Wildlife Service – Pacific Region, Portland Or.

Cyndi Sidles
Fire Ecologist, US Dept. of the Interior, Fish and Wildlife Service - Pacific Region

John Saltenburger
Meteorologist, US Dept. of the Interior, Fish and Wildlife Service – Pacific Northwest Coordination Center, Portland Or.

Terry Marsh
Meteorologist, US Dept. of the Interior, Bureau of Land Management – Pacific Northwest Coordination Center, Portland Or.

Thomas Skinner
Fire Management Officer, US Dept. of the Interior, Fish and Wildlife - Mid-Columbia National Wildlife Refuge Complex, McNary Wa.

Jon Bonk
Journeyman Forecaster / IMET, National Weather Service, Portland Or.

Appendix b. Primary Distribution List for this Plan

Name	Title	Agency	E-mail
Dennis Strange	FMO	BLM	dstrange@blm.gov
Aaron Bibe	Lieutenant	Benton County Fire District	
John Saltenberger	Meteorologist	PNWCC predictive Service	Jsaltenb@blm.gov
Rachel Trimarco	Meteorologist	Pendleton NWS	rachel.trimarco@noaa.gov

The above list indicates key personnel associated with this plan. Copies of the FDOP will also be distributed to……, military airspace coordinators, military fire departments, and surrounding county cooperators.

Appendix c. Terminology

1-hour Timelag Fuels	The 1-hour fuel moisture content represents the modeled fuel moisture of dead fuels from herbaceous plants or roundwood that is less than one quarter inch in diameter. Also estimated is the uppermost layer of litter on the forest floor.
10-hour Timelag Fuels	Dead fuels consisting of roundwood in the size range of one quarter to 1 inch in diameter and, very roughly, the layer of litter extending from just below the surface to three-quarters of an inch below the surface.
100-hour Timelag Fuels	Dead fuels consisting of roundwood in the size range of 1 to 3 inches in diameter and, very roughly, the forest floor from three quarters of an inch to 4 inches below the surface.
1000-hour Timelag Fuels	Dead fuels consisting of roundwood 3 to 8 inches in diameter or the layer of the forest floor more than about 4 inches below the surface or both.
Adjective Rating	A public information description of the relative severity of the current fire danger situation.
Annual Plant	A plant that lives for one growing season, starting from a seed each year.
Burning Index (BI)	BI is a number related to the contribution of fire behavior to the effort of containing a fire. The BI (difficulty of control) is derived from a combination of Spread Component (how fast it will spread) and Energy Release Component (how much energy will be produced). In this way, it is related to flame length, which, in the Fire Behavior Prediction System, is based on rate of spread and heat per unit area. However, because of differences in the calculations for BI and flame length, they are not the same. The BI is an index that rates fire danger related to potential flame length over a fire danger rating area. The fire behavior prediction system produces flame length predictions for a specific location (Andrews, 1986). The BI is expressed as a numeric value related to potential flame length in feet multiplied by 10. The scale is open-ended which allows the range of numbers to adequately define fire problems, even during low to moderate fire danger.
Climatological Breakpoints	Points on the cumulative distribution of one fire weather/fire danger index without regard to associated fire occurrence/business. They are sometimes referred to as exceedence thresholds.
Duff	The partially decomposed organic material of the forest floor that lies beneath the freshly fallen twigs, needles and leaves. (The F and H layers of the forest soil profile.)
Energy Release Component (ERC)	ERC is a number related to the available energy (BTU) per unit area (square foot) within the flaming front at the head of a fire. Since this number represents the potential "heat release" per unit area in the flaming zone, it can provide guidance to several important fire activities. It may also be considered a composite fuel moisture value as it reflects the contribution that all live and dead fuels have to potential fire intensity. The ERC is a cumulative or "build- up" type of index. As live fuels cure and dead fuels dry, the ERC values get higher thus providing a good reflection of drought conditions. The scale is open-ended or unlimited and, as with other NFDRS components, is relative. Conditions producing an ERC value of 24 represent a potential heat release twice that of conditions resulting in an ERC value of 12.
Equilibrium Moisture Content	The moisture content that a fuel particle will attain if exposed for an infinite period in an environment of constant temperature and humidity. When a fuel particle has reached its equilibrium moisture content, the net exchange of moisture between it and its environment is zero.

Fire Business Thresholds	Values of one or more fire weather/fire danger indexes that have been statistically related to occurrence of fires (fire business). Generally, the threshold is a value or range of values where historical fire activity has significantly increased or decreased.
Fire Danger	The resultant descriptor of the combination of both constant and variable factors that affect the ignition, spread, and control difficulty of control of wildfires on an area.
Fire Danger Continuum	The range of possible values for a fire danger index or component, given a set of NFDRS parameters and inputs.
Fire Danger Rating	A system that integrates the effects of existing and expected states of selected fire danger factors into one or more qualitative or numeric indices that reflect an areas protection needs.
Fire Danger Rating Area	A geographic area relatively homogeneous in climate, fuels and topography, tens of thousands of acres in size, within which the fire danger can be assumed to be uniform. Its size and shape is primarily based on influences of fire danger, not political boundaries. It is the basic, on the ground unit for which unique fire danger decisions are made based on fire danger ratings. Weather is represented by one or more NFDRS weather (RAWS) stations.
Fire Weather Forecast Zone	A grouping of fire weather stations that experience the same weather change or trend. Zones are developed by the National Weather Service to assist NWS production of fire weather forecasts or trends for similar stations. Fire weather forecast zones are best thought of as a list of similar-weather stations, rather than an area on a map.
Forb	A non- grass-like herbaceous plant.
Fuel Class	A group of fuels possessing common characteristics. In the NFDRS, dead fuels are grouped according to their timelag (1, 10, 100, and 1000 hr) and live fuels are grouped by whether they are herbaceous (annual or perennial) or woody.
Fuel Model	A simulated fuel complex for which all the fuel descriptors required by the mathematical fire spread model have been supplied.
Fuel Moisture Content	The water content of a fuel particle expressed as a percent of the oven-dry weight of the particle. Can be expressed for either live or dead fuels.
Fuels	Non-decomposed material, living or dead, derived from herbaceous plants.
Green-up	Green-up within the NFDRS model is defined as the beginning of a new cycle of plant growth. Green- up occurs once a year, except in desert areas where rainy periods can produce a flush of new growth more than once a year. Green- up may be signaled at different dates for different fuel models. Green-up should not be started when the first flush of green occurs in the area. Instead, the vegetation that will be the fire problem (represented by the NFDRS fuel model associated with the weather station) when it matures and cures should be identified. Green- up should start when the majority of this vegetation starts to grow.
Herb	A plant that does not develop woody, persistent tissue but is relatively soft or succulent and sprouts from the base (perennials) or develops from seed (annuals) each year. Included are grasses, forbs, and ferns.
Herbaceous Vegetation Moisture Content	The water content of a live herbaceous plant expressed as a percent of the oven-dry weight of the plant.
Ignition Component (IC)	IC is a rating of the probability that a firebrand will cause a fire requiring suppression action. Since it is expressed as a probability, it ranges on a scale of 0 to 100. An IC of 100 means that every firebrand will cause a fire requiring action if it contacts a receptive fuel.
Keetch-Byram	KBDI is a stand-alone index that can be used to measure the effects of seasonal drought

Drought Index (KBDI)	on fire potential. The actual numeric value of the index is an estimate of the amount of precipitation (in 100ths of inches) needed to bring the soil back to saturation (a value of 0 is complete saturation of the soil). Since the index only deals with the top 8 inches of the soil profile, the maximum KBDI value is 800 or 8.00 inches of precipitation would be needed to bring the soil back to saturation. The Keetch-Byram Drought Index's relationship to fire danger is that as the index value increases, the vegetation is subjected to increased stress due to moisture deficiency. At higher values, desiccation occurs and live plant material is added to the dead fuel loading on the site. Also, an increasing portion of the duff/litter layer becomes available fuel at higher index values.
Litter	The top layer of the forest floor, typically composed of loose debris such as branches, twigs, and recently fallen leaves or needles; little altered in structure by decomposition. (The layer of the forest soil profile.)
Live Fuels	Naturally occurring fuels whose moisture content is controlled by the physiological processes within the plant. The National Fire Danger Rating System considers only herbaceous plants and woody material small enough (leaves, needles and twigs) to be consumed in the flaming front of a fire.
Moisture of Extinction	The theoretical dead fuel moisture content above which a fire will not spread.
Perennial Plant	A plant that lives for more than two growing seasons. For fire danger rating purposes, biennial plants are classed with perennials.
Roundwood	Boles, stems, or limbs of woody material; that portion of the dead wildland fuel which is roughly cylindrical in shape.
Shrub	A woody perennial plant differing from a perennial herb by its persistent and woody stem; and from a tree by its low stature and habit of branching from the base.
Slash	Branches, bark, tops, cull logs, uprooted stumps, and broken or uprooted trees left on the ground after logging; also debris resulting from thinning or wind storms.
Slope	The rise or fall in terrain measured in feet per 100 feet of horizontal distance measurement, expressed as a percentage.
Spread Component (SC)	SC is a rating of the forward rate of spread of aheadfire. Deeming, et al., (1977), states that "the spread component is numerically equal to the theoretical ideal rate of spread expressed in feet-per-minute". This carefully worded statement indicates both guidelines (it's theoretical) and cautions (it's ideal) that must be used when applying the Spread Component. Wind speed, slope and fine fuel moisture are key inputs in the calculation of the spread component, thus accounting for a high variability from day-to-day. The Spread Component is expressed on an open-ended scale; thus it has no upper limit.
Staffing Index	Adjective rating calculations are keyed off the first priority fuel model listed in your station record in the processor. It uses the staffing index (such as ERC or BI) the user associates with the first fuel model/slope/grass type/climate class combination.
Staffing Level	The basis for decision support for daily staffing of initial attack resources and other activities; a level of readiness and an indicator of daily preparedness.
Surface-Area-to-Volume Ratio	The ratio of the surface area of a fuel particle (in square- ft) to its volume (in cubic-ft). The "finer" the fuel particle, the higher the ratio; for example, for grass this ratio ranges above 2,000; while for a ½ inch diameter stick it is 109.
Timelag	The time necessary for a fuel particle to lose approximately 63 percent of the difference between its initial moisture content and its equilibrium moisture content.
Timelag Fuel Moisture Content	The dead fuel moisture content corresponding to the various timelag fuel classes.

X-1000 Hr Fuel Moisture	X-1000 is the live fuel moisture recovery value derived from the 1000-hr fuel moisture value. It is an independent variable used in the calculation of the herbaceous fuel moisture. The X-1000 is a function of the daily change in the 1000-hour timelag fuel moisture, and the average temperature. Its purpose is to better relate the response of the live herbaceous fuel moisture model to the 1000-hour timelag fuel moisture value. The X-1000 value is designed to decrease at the same rate as the 1000-hour timelag fuel moisture, but to have a slower rate of increase than the 1000-hour timelag fuel moisture during periods of precipitation, hence limiting excessive herbaceous fuel moisture recovery.

Appendix d. WIMS User ID List

Name	WIMS User ID
Fay, Brett	FS7088
Sidles, Cyndi	FWS0238
Skinner, Thomas	FWS0042

For assistance with passwords you may contact the WIMS help desk at 1-800-253-5559 or 208-387-5290, fax 208-387-5292, email: **fire_help@fs.fed.us**.

Appendix e. Weather Station Catalogs (Active RAWS Only)

Station	Priority	Model	Slope	Herb Grass Type	Climate Class	Staffing Index	Decision Classes	Staffing Index Breakpoints Low SI%	Low VAL	High SI%	High VAL
Umatilla NWR (351316)	1	7T	1	A	1	BI	5	90	54	97	72
	2	7A	1	A	1	BI	5	90	38	97	45
	3	7G	1	A	1	KB	5	90	608	97	648
	4	7C	1	A	1	BI	5	90	10	97	20
Douglas (452601)	1	7L	1	A	1	BI	5	90	32	97	41
	2	7T	1	A	1	BI	5	90	34	97	52
	3	7A	1	A	1	BI	5	90	33	97	40
	4	7G	1	A	1	BI	5	90	71	97	81
Saddle Mountain (452701)	1	7T	1	A	1	BI	5	90	65	97	74
	2	7A	1	A	1	BI	5	90	46	97	52
	3	7G	1	A	1	ERC	5	90	84	97	88
	4	7C	1	A	1	BI	5	90	10	97	20
Columbia NWR (453102)	1	7T	1	A	1	BI	5	90	59	97	72
	2	7A	1	A	1	BI	5	90	43	97	50
	3	7G	1	A	1	ERC	5	90	77	97	81
	4										
Juniper Dunes (453201)	1	7T	1	A	1	BI	5	80	47	95	67
	2	7A	1	A	1	BI	5	80	37	95	45
	3	7C	1	A	1	ERC	5	80	19	95	21
	4	7G	1	A	1	ERC	5	80	73	95	80
Escure (453601)	1	7A	1	A	1	BI	5	80	30	95	38
	2	7T	1	A	1	BI	5	80	33	95	50
	3	7G	1	A	1	BI	5	80	71	95	81
	4										
Greyback (452404)	1	7C	2	P	2	ERC	6	90	16	97	20
	2	7G	2	P	2	ERC	6	90	65	97	70
	3										
	4										

Appendix f. Weather Station Data Analysis

SIG	Variable	Model	FIRE DAY R^2	Chi²	P-Val	P-Range	LARGE FIRE DAY Acres	R^2	Chi²	P-Val	P-Range	MULTIPLE FIRE DAY Fires	R^2	Chi²	P-Val	P-Range
SIG -Columbia Basin	BI	7R	0.87	7.71	0.4624	0.07 - 0.57	100 (C)	0.89	1.92	0.9834	0.03 - 0.52	2 (C)	0.53	4.45	0.8146	0.10 - 0.43
SIG - Jun_Sad_Uma	BI	7R	0.84	9.91	0.2711	0.07 - 0.58	100 (C)	0.87	2.19	0.9745	0.03 - 0.52	2 (C)	0.48	7.15	0.5202	0.09 - 0.45

SIG	Variable	Model	FIRE DAY R^2	Chi^2	P-Val	P-Range	LARGE FIRE DAY Acres	R^2	Chi^2	P-Val	P-Range	MULTIPLE FIRE DAY Fires	R^2	Chi^2	P-Val	P-Range
SIG - Columbia Basin	BI	7H	0.8	13.01	0.1115	0.08 - 0.59	100 (C)	0.85	2.66	0.9539	0.04 - 0.52	2 (C)	0.34	10.5	0.2317	0.11 - 0.44
SIG - C_J_S_U_E	BI	7E	0.84	8.93	0.3483	0.07 - 0.56	100 (C)	0.71	5.22	0.7343	0.06 - 0.54	2 (C)	0.17	17.04	0.0297	0.14 - 0.44
SIG - Col_Jun_Doug	BI	7L	0.89	5.56	0.6967	0.09 - 0.53	100 (C)	0.73	5.6	0.6925	0.04 - 0.52	2 (C)	0.34	17.38	0.0264	0.09 - 0.50
SIG - Jun_Uma_Esc	BI	7P	0.82	9.17	0.3282	0.08 - 0.55	100 (C)	0.86	2.83	0.9448	0.03 - 0.51	2 (C)	0.37	8.29	0.4053	0.11 - 0.41
SIG - Columbia Basin	BI	7P	0.8	13.18	0.1057	0.07 - 0.58	100 (C)	0.72	5.51	0.7024	0.03 - 0.51	2 (C)	0.37	8.22	0.4125	0.10 - 0.42
SIG - Jun_Sad_Uma	BI	7H	0.83	10.57	0.2275	0.08 - 0.59	100 (C)	0.78	4	0.8573	0.04 - 0.51	2 (C)	0.47	8.35	0.4004	0.10 - 0.46
SIG - Columbia Basin	BI	7N	0.82	7.54	0.4797	0.09 - 0.50	100 (C)	0.75	4.23	0.8357	0.04 - 0.51	2 (C)	0.34	9.88	0.2739	0.11 - 0.42
SIG - Uma_Sad_Col	BI	7P	0.84	9	0.342	0.07 - 0.58	100 (C)	0.74	4.32	0.8268	0.06 - 0.53	2 (C)	0.21	12.45	0.1321	0.15 - 0.41
SIG - Columbia Basin	BI	7S	0.81	10.95	0.2045	0.08 - 0.57	100 (C)	0.74	4.97	0.7613	0.04 - 0.51	2 (C)	0.43	5.99	0.6489	0.12 - 0.41
SIG - Jun_Sad_Uma	BI	7S	0.87	7.69	0.4641	0.08 - 0.57	100 (C)	0.73	5.23	0.7331	0.04 - 0.51	2 (C)	0.56	4.57	0.8023	0.11 - 0.43
SIG - Jun_Uma_Esc	BI	7H	0.84	7.95	0.4383	0.09 - 0.56	100 (C)	0.73	5.33	0.7221	0.04 - 0.51	2 (C)	0.28	14.73	0.0645	0.11 - 0.43
SIG - Jun_Uma_Esc	BI	7E	0.83	8.18	0.4163	0.09 - 0.57	100 (C)	0.72	5.86	0.6631	0.04 - 0.51	2 (C)	0.21	16.02	0.0422	0.12 - 0.41
SIG - Jun_Sad_Uma	BI	7Q	0.9	4.93	0.7645	0.07 - 0.54	100 (C)	0.83	2.82	0.9451	0.03 - 0.50	2 (C)	0.39	10.74	0.2168	0.09 - 0.45
SIG - Columbia Basin	BI	7D	0.76	13.3	0.1021	0.08 - 0.53	100 (C)	0.78	3.57	0.8933	0.03 - 0.50	2 (C)	0.31	9.7	0.2868	0.11 - 0.40
SIG - Columbia Basin	BI	7Q	0.87	6.45	0.5974	0.08 - 0.54	100 (C)	0.76	4.44	0.8154	0.03 - 0.50	2 (C)	0.32	11.49	0.1755	0.10 - 0.42
SIG - Columbia Basin	BI	7U	0.76	16.28	0.0386	0.07 - 0.59	100 (C)	0.9	1.62	0.9905	0.04 - 0.50	2 (C)	0.3	12.39	0.1348	0.10 - 0.44
SIG - Columbia Basin	BI	7E	0.84	8.89	0.3516	0.08 - 0.60	100 (C)	0.89	1.8	0.9866	0.04 - 0.50	2 (C)	0.35	10.48	0.2331	0.11 - 0.42
SIG - Jun_Sad_Uma	BI	7U	0.81	12.22	0.1416	0.07 - 0.58	100 (C)	0.82	2.7	0.9517	0.04 - 0.50	2 (C)	0.34	14.36	0.0729	0.09 - 0.46
SIG - Col_Jun_Sad_Um	BI	7E	0.83	9.6	0.2941	0.07 - 0.56	100 (C)	0.8	2.81	0.9455	0.06 - 0.52	2 (C)	0.2	22.09	0.0047	0.14 - 0.45
SIG - Uma_Sad_Col_Ju	BI	7E	0.83	9.6	0.2941	0.07 - 0.56	100 (C)	0.8	2.81	0.9455	0.06 - 0.52	2 (C)	0.2	22.09	0.0047	0.14 - 0.45
SIG - Jun_Uma_Esc	BI	7Q	0.76	12.43	0.1329	0.09 - 0.51	100 (C)	0.8	3.56	0.8946	0.04 - 0.50	2 (C)	0.26	13.66	0.0911	0.11 - 0.41
SIG - Jun_Sad_Uma	BI	7C	0.92	4.83	0.7756	0.08 - 0.58	100 (C)	0.76	4.17	0.8413	0.04 - 0.50	2 (C)	0.51	7.15	0.5203	0.11 - 0.44
SIG - Jun_Uma_Esc	BI	7G	0.74	10.52	0.2304	0.09 - 0.53	100 (C)	0.75	4.57	0.802	0.04 - 0.50	2 (C)	0.21	15	0.0592	0.12 - 0.41
SIG - Col_Uma	BI	7D	0.9	4.4	0.8191	0.08 - 0.52	100 (C)	0.73	5.04	0.7536	0.05 - 0.51	2 (C)	0.38	4.92	0.7664	0.15 - 0.38

SIG	Variable	Model	FIRE DAY R²	Chi²	P-Val	P-Range	LARGE FIRE DAY Acres	R²	Chi²	P-Val	P-Range	MULTIPLE FIRE DAY Fires	R²	Chi²	P-Val	P-Range
SIG - Col_Jun_Sad_Um	BI	7P	0.84	10.26	0.2473	0.06 - 0.56	100 (C)	0.72	5.06	0.7511	0.06 - 0.52	2 (C)	0.18	26.12	0.001	0.13 - 0.44
SIG - Uma_Sad_Col_Ju	BI	7P	0.84	10.26	0.2473	0.06 - 0.56	100 (C)	0.72	5.06	0.7511	0.06 - 0.52	2 (C)	0.18	26.12	0.001	0.13 - 0.44
SIG - Doug_Juni	BI	7L	0.9	3.71	0.8827	0.10 - 0.51	100 (C)	0.89	1.44	0.9937	0.06 - 0.51	2 (C)	0.28	19.32	0.0132	0.09 - 0.53
SIG - Col_Jun_Sad_Um	BI	7D	0.87	7.16	0.5196	0.06 - 0.54	100 (C)	0.82	3.05	0.9313	0.06 - 0.51	2 (C)	0.28	15.02	0.0588	0.14 - 0.43
SIG - Uma_Sad_Col_Ju	BI	7D	0.87	7.16	0.5196	0.06 - 0.54	100 (C)	0.82	3.05	0.9313	0.06 - 0.51	2 (C)	0.28	15.02	0.0588	0.14 - 0.43
SIG - Uma_Sad_Col	BI	7G	0.78	12.22	0.1418	0.08 - 0.57	100 (C)	0.79	3.33	0.9121	0.07 - 0.52	2 (C)	0.28	11.06	0.1981	0.16 - 0.41
SIG - Jun_Uma_Esc	BI	7U	0.83	9.44	0.3065	0.08 - 0.57	100 (C)	0.82	3.45	0.9033	0.04 - 0.49	2 (C)	0.27	14.15	0.078	0.10 - 0.43
SIG - Jun_Uma	BI	7S	0.82	9.05	0.3385	0.09 - 0.52	100 (C)	0.8	3.72	0.8812	0.04 - 0.49	2 (C)	0.44	6.76	0.5625	0.12 - 0.41
SIG - Jun_Sad_Uma	BI	7E	0.78	12.56	0.128	0.08 - 0.59	100 (C)	0.77	4.02	0.8555	0.04 - 0.49	2 (C)	0.37	10.77	0.2153	0.10 - 0.43
SIG - Jun_Uma	BI	7U	0.83	9.36	0.3129	0.08 - 0.55	100 (C)	0.72	4.29	0.83	0.04 - 0.49	2 (C)	0.33	11.69	0.1654	0.10 - 0.44
SIG - Jun_Sad_Uma_Dg	BI	7C	0.84	8.98	0.3438	0.08 - 0.52	100 (C)	0.78	4.72	0.7868	0.05 - 0.50	2 (C)	0.32	13.27	0.1028	0.12 - 0.44
SIG - Jun_Uma_Esc	BI	7D	0.85	6.17	0.6287	0.09 - 0.50	100 (C)	0.71	4.76	0.7827	0.04 - 0.49	2 (C)	0.2	18.25	0.0194	0.12 - 0.40
SIG - PSA E3	BI	7G	0.73	8.22	0.4123	0.10 - 0.45	100 (C)	0.64	9.37	0.3124	0.04 - 0.49	2 (C)	0.2	19.63	0.0118	0.10 - 0.44
SIG - Columbia Basin	ERC	7G	0.62	21.75	0.0054	0.07 - 0.38	100 (C)	0.26	8.64	0.374	0.09 - 0.27	2 (C)	0.3	7.74	0.459	0.11 - 0.35
Umatilla	ERC	7H1AE1	0.7	16.38	0.0372	0.08 - 0.45	100 (C)	0.66	2.18	0.9752	0.05 - 0.33	2 (C)	0.41	7.79	0.4546	0.07 - 0.43
Douglas	ERC	7G1AE1	0.62	13.61	0.0926	0.09 - 0.32	100 (C)	0.62	4.41	0.8183	0.05 - 0.30	2 (C)	0.32	9.24	0.3221	0.09 - 0.35
Douglas	ERC	7U1AE1	0.73	9.99	0.2657	0.11 - 0.34	100 (C)	0.7	2.41	0.9659	0.05 - 0.29	2 (C)	0.48	7.87	0.4461	0.08 - 0.34
SIG - Jun_Uma_Doug	ERC	7G	0.57	23.02	0.0033	0.08 - 0.37	100 (C)	0.65	3.58	0.893	0.07 - 0.31	2 (C)	0.25	15.72	0.0465	0.10 - 0.37
SIG - Uma_Doug_Esc	ERC	7G	0.5	24.94	0.0016	0.09 - 0.34	100 (C)	0.61	4.48	0.8112	0.06 - 0.30	2 (C)	0.16	15.6	0.0485	0.13 - 0.32
SIG - Doug_Sad	ERC	7U	0.83	7.01	0.5353	0.08 - 0.35	100 (C)	0.6	3.48	0.9006	0.05 - 0.28	2 (C)	0.36	9.22	0.324	0.08 - 0.35
SIG - Sad_Doug_Esc	ERC	7U	0.74	11.83	0.159	0.09 - 0.34	100 (C)	0.67	1.92	0.9833	0.06 - 0.27	2 (C)	0.37	6.88	0.5495	0.10 - 0.32
SIG - Col_Doug	ERC	7U	0.81	9.77	0.2816	0.07 - 0.38	100 (C)	0.67	2.13	0.9769	0.06 - 0.27	2 (C)	0.21	22.12	0.0047	0.08 - 0.35
SIG - PSA E3	ERC	7G	0.6	16.	0.03	0.09 -	100	0.3	13.	0.08	0.06 -	2	0.4	4.7	0.78	0.10 -

SIG	Variable	Model	FIRE DAY R^2	Chi^2	P-Val	P-Range	LARGE FIRE DAY Acres	R^2	Chi^2	P-Val	P-Range	MULTIPLE FIRE DAY Fires	R^2	Chi^2	P-Val	P-Range
			4	22	93	0.35	(C)	2	73	91	0.29	(C)	3	7	19	0.34
SIG - PSA E3	BI	7G	0.73	8.22	0.4123	0.10 - 0.45	100 (C)	0.64	9.37	0.3124	0.04 - 0.49	2 (C)	0.2	19.63	0.0118	0.10 - 0.44
SIG - Columbia Basin	ERC	7G	0.62	21.75	0.0054	0.07 - 0.38	100 (C)	0.26	8.64	0.374	0.09 - 0.27	2 (C)	0.3	7.74	0.459	0.11 - 0.35
Umatilla	ERC	7H1AE1	0.7	16.38	0.0372	0.08 - 0.45	100 (C)	0.66	2.18	0.9752	0.05 - 0.33	2 (C)	0.41	7.79	0.4546	0.07 - 0.43
Douglas	ERC	7G1AE1	0.62	13.61	0.0926	0.09 - 0.32	100 (C)	0.62	4.41	0.8183	0.05 - 0.30	2 (C)	0.32	9.24	0.3221	0.09 - 0.35
Douglas	ERC	7U1AE1	0.73	9.99	0.2657	0.11 - 0.34	100 (C)	0.7	2.41	0.9659	0.05 - 0.29	2 (C)	0.48	7.87	0.4461	0.08 - 0.34
SIG - Jun_Uma_Doug	ERC	7G	0.57	23.02	0.0033	0.08 - 0.37	100 (C)	0.65	3.58	0.893	0.07 - 0.31	2 (C)	0.25	15.72	0.0465	0.10 - 0.37
SIG - Uma_Doug_Esc	ERC	7G	0.5	24.94	0.0016	0.09 - 0.34	100 (C)	0.61	4.48	0.8112	0.06 - 0.30	2 (C)	0.16	15.66	0.0485	0.13 - 0.32
SIG - Doug_Sad	ERC	7U	0.83	7.01	0.5353	0.08 - 0.35	100 (C)	0.6	3.48	0.9006	0.05 - 0.28	2 (C)	0.36	9.22	0.324	0.08 - 0.35
SIG - Sad_Doug_Esc	ERC	7U	0.74	11.83	0.159	0.09 - 0.34	100 (C)	0.67	1.92	0.9833	0.06 - 0.27	2 (C)	0.37	6.88	0.5495	0.10 - 0.32
SIG - Col_Doug	ERC	7U	0.81	9.77	0.2816	0.07 - 0.38	100 (C)	0.67	2.13	0.9769	0.06 - 0.27	2 (C)	0.21	22.12	0.0047	0.08 - 0.35
SIG - PSA E3	ERC	7G	0.64	16.22	0.0393	0.09 - 0.35	100 (C)	0.32	13.73	0.0891	0.06 - 0.29	2 (C)	0.43	4.77	0.7819	0.10 - 0.34

Appendix g. Preparedness Level Actions by Responsible Party

The following Preparedness Level actions are guidelines for agency personnel. They are discretionary in nature and usually will require a consensus between agency personnel prior to implementation.

Responsible Party	Suggested Action	PL 1	PL 2	PL 3	PL 4	PL 5	Affected Entity
Agency Administrator	Ensure supervisors approve fire availability of staff and notify Duty Officer.	●	●	●	●	●	Agency
	Ensure resource advisors are designated and available for fire assignments.	●	●	●	●	●	Agency
	Evaluate work/rest needs of fire staff.		●	●	●	●	Agency
	Consider need for fire restriction or closures.				●	●	Public Industry
	Provide appropriate political support to fire staff regarding the implementation of preparedness level actions.			●	●	●	Agency Public Industry
	Review and transmit severity requests to the appropriate level.				●	●	Agency
	Issue guidance to respective agency staff indicating severity of the season and increased need and availability for fire support personnel.				●	●	Agency
FMO	Evaluate season severity data (BI and ERC trends for season, fuel loadings, live FM, drought indices, and long term forecasts).	●	●	●	●	●	Agency
	Evaluate fire staff work/rest requirements.		●	●	●	●	Agency
	Brief agency administrator on burning conditions and fire activity.			●	●	●	Agency
	Review geographical and national preparedness levels and evaluate need to suspend local prescribe fire activities.			●	●	●	Agency
	Ensure Education/Mitigation personnel have initiated media contacts and public notification.				●	●	Public Industry
	Ensure agency staff is briefed on increasing fire activity.				●	●	Agency
	Brief next higher level of fire management on increasing/decreasing fire activity.				●	●	Agency
	Consider fire severity request and pre-positioning of resources including: suppression resources, aerial support, aerial supervision, command positions, dispatch, logistical support, and prevention.				●	●	Agency

	Coordinate with interagency partners the need for fire restrictions or closures.					●	Public Industry
	Request that the Agency Administrator issue guidance to respective agency staff regarding the need for increased fire availability in support positions.				●	●	Agency
	Pre-position a Type 3 organization/Type 2 Team.					●	Agency
Duty Officer	Confirm (or adjust) the Preparedness and Staffing Levels with Dispatch.	●	●	●	●	●	Agency
	If preparedness level is decreasing, consider releasing pre-positioned and detailed resources.	●	●	●			Agency
	Evaluate work/rest needs of IA crews, dispatchers, & aviation bases.			●	●	●	Agency
	Evaluate need to change or shift duty hours of IA resources.				●	●	Agency
	Evaluate draw-down levels for suppression, command, and oversight positions.				●	●	Agency
	Consider extending staffing beyond normal shift length.				●	●	Agency
	Brief FMO on severity of conditions and consider severity request.				●	●	Agency
	Consider pre-positioning and/or detailing of additional IA resources.				●	●	Agency
	Consider bringing in local IA resources from scheduled days off.				●	●	Agency
	Consider patrols and pre-positioning of local IA resources in high risk areas.				●	●	Agency
	Consider automatic dispatch of helicopter, SEAT and/or heavy air tankers for IA				●	●	Agency
Dispatch	Determine and broadcast the morning and afternoon preparedness, dispatch, and adjective fire danger levels to interagency fire personnel.	●	●	●	●	●	Agency
	Evaluate work/rest needs of center staff.			●	●	●	Agency
	If preparedness level is decreasing, consider release of pre-positioned or detailed dispatchers and logistical support personnel.	●	●	●			Agency
	Consult with Duty Officer concerning potential for extended staffing beyond normal shift length.				●	●	Agency
	Contact local fire chiefs to make them aware of fire danger.				●	●	Agency
	Consider pre-positioning or detail of off-unit IA dispatchers and logistical support personnel.				●	●	Agency
	Consider discussing activation of local area MAC Group.					●	Agency

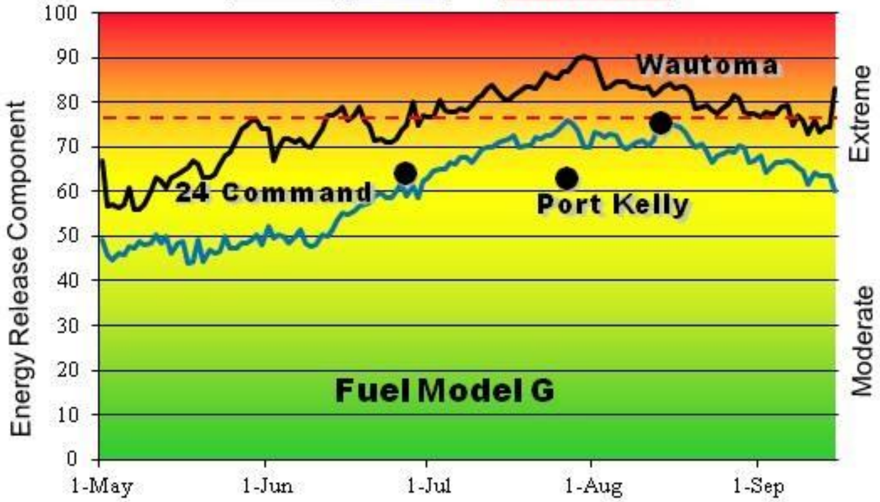
	Consider ordering a Fire Behavior Analyst.					●	Agency
	Consult with duty officer and FMO regarding potential need for severity request.				●	●	Agency
	Consider bringing additional dispatch personnel in from scheduled days off.					●	Agency
	Consult with Pacific Northwest Coordination Center (EGBCC) regarding availability of resources at the geographical and national levels.			●	●	●	Agency
AFMO	Ensure that roadside fire danger signs reflect the current adjective fire danger rating.	●	●	●	●	●	Public
	Ensure IA crews are briefed on local preparedness level, burning conditions, and availability of IA resources and air support.	●	●	●	●	●	Agency
	Ensure incoming pre-position or detailed personnel are briefed on local conditions.	●	●	●	●	●	Agency
	Evaluate work/rest needs of crews.			●	●	●	Agency
	Increase patrols in camping and recreation areas.				●	●	Public
	Coordinate fire prevention patrol and enforcement with Agency LEO				●	●	Agency
	Consider suspension of project work away from station.					●	Agency
	Provide duty officer with feedback regarding unique/unexpected fire behavior and severity conditions and the need to increase IA capabilities.				●	●	Agency
Engine Captains and Engine Crew	Ensure that roadside fire danger signs reflect the current adjective fire danger rating.	●	●	●	●	●	Public
	Initiate press release to inform public/industry of the potential fire danger.				●	●	Public Industry
	Ensure the public and industrial entities are aware of the policy regarding fire trespass investigations for human-caused fires and cost recovery for suppression action.				●	●	Public Industry
	Consider need for increased prevention patrols.				●	●	Public Industry
	Consider door to door contacts in rural communities or ranch areas.					●	Public Industry
	Post signs and warnings in camp and recreation areas.				●	●	Public
	Consult with FMO regarding severity request and potential need for additional prevention personnel.				●	●	Public Industry

	Consult with AFMO and FMO regarding need for fire restrictions, closures and the need to order a Fire Prevention Team.				•	•	Agency Public Industry

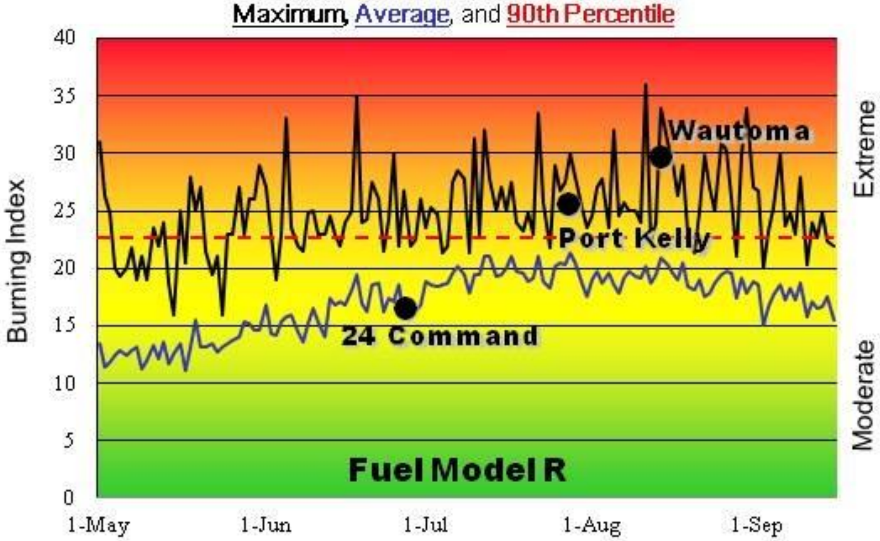
Appendix h. Columbia Basin FDRA Pocket Card

FIRE DANGER – Mid Columbia River NWRC

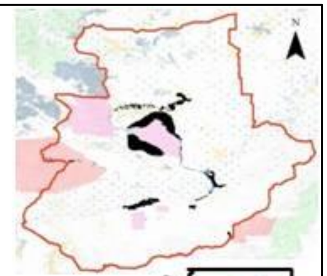
Maximum, Average, and 90th Percentile



Maximum, Average, and 90th Percentile

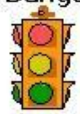


Fire Danger Area: Mid Columbia River NWRC



- Columbia Basin – OR, WA
- Fire Wx Forecast Zones WA 673, OR 631, OR 675
- Umatilla* (351316), Saddle Mtn (452701), Juniper Dunes* (453201), and Escure* (453601) RAWS
  *Meets NWCG Weather Station Standards

Fire Danger Graph Interpretation:



EXTREME – Use extreme caution
CAUTION – Watch for change
MODERATE – Lower potential, but always be aware

MAXIMUM – Highest ERC / BI by day for 1996 - 2010
AVERAGE – Average daily ERC / BI value for 1996 – 2010
90th Percentile ERC – Only 10% of the days from 1996 – 2010 were over **77**
90th Percentile BI – Only 10% of the days from 1996 – 2010 were over **23**

Local Thresholds – Watch Out:

A combination of any of these factors can greatly increase fire behavior: 20' Wind Speed over 7 mph, Relative Humidity below 20%, Temperature over 90 degrees

Remember what Fire Danger tells you:

- ✓ Energy Release Component gives seasonal trends calculated from 13:00 temperature and RH, daily temperature & RH ranges, and precipitation duration
- ✓ Burning Index gives day to day fluctuations calculated from 13:00 temperature, wind, and RH, daily temperature & RH ranges, and precipitation duration
- ✓ Listen to weather forecasts – especially wind

Past Fire Experience:

24 Command June 27, 2000. (ERC 65, BI 16), 163,884 acres. Columbia NWR RAWS Temp. 93, RH 10, Windspeed 8 mph.

Port Kelly July 28, 2001. (ERC 63, BI 26), 9,929 acres. Umatilla RAWS Temp. 80, RH 21, Windspeed 22 mph.

Wautoma August 16, 2007. (ERC 76, BI 29), 72,641 acres. Saddle Mtn RAWS Temp. 91, RH 13, Windspeed 12 mph.

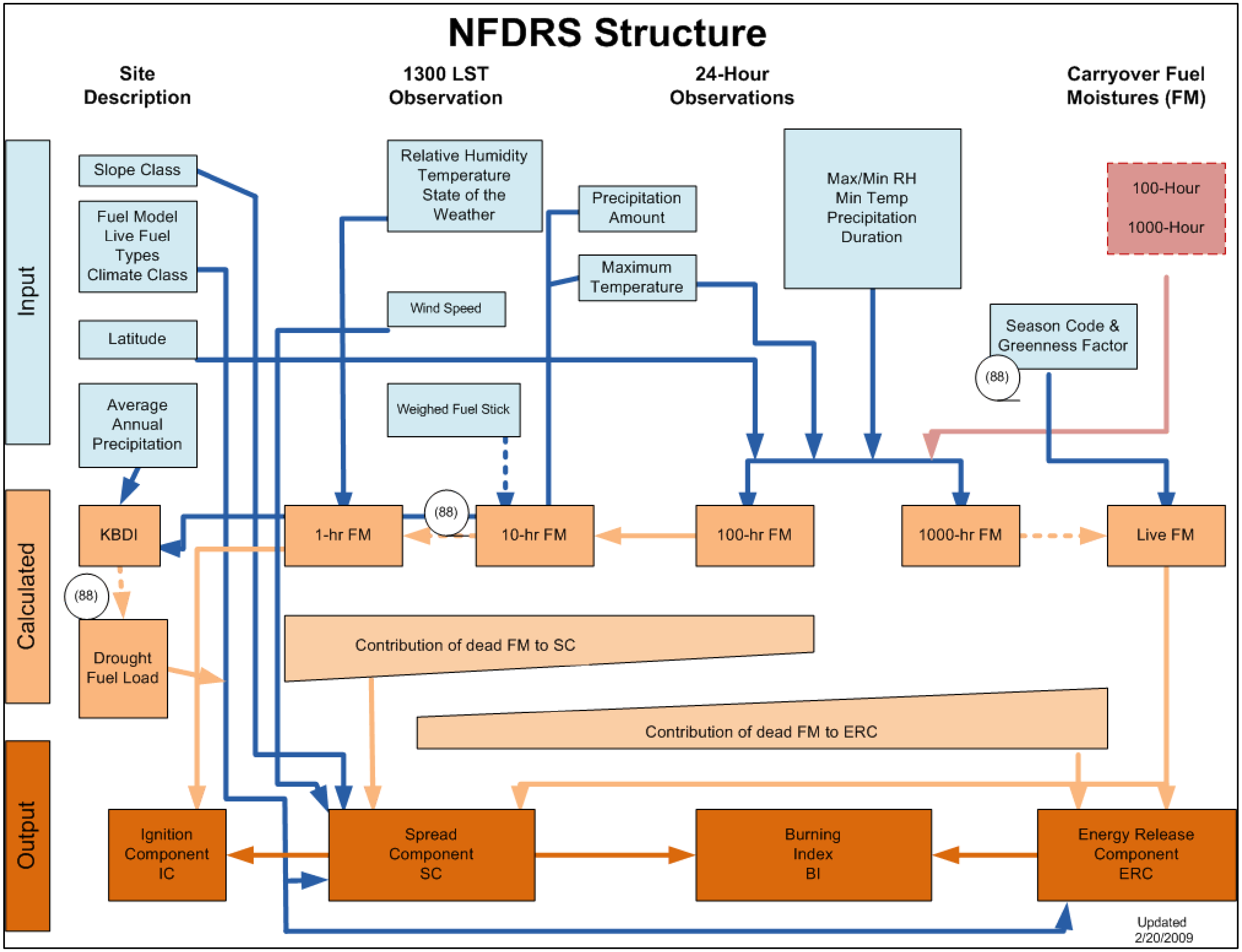
Poor access often contributes to large fires more than wind or low fuel moisture.

Check with local personnel about cheatgrass fuel loading. Large fires can occur at low ERC if annual grasses and fine fuels are continuous enough to carry fire.

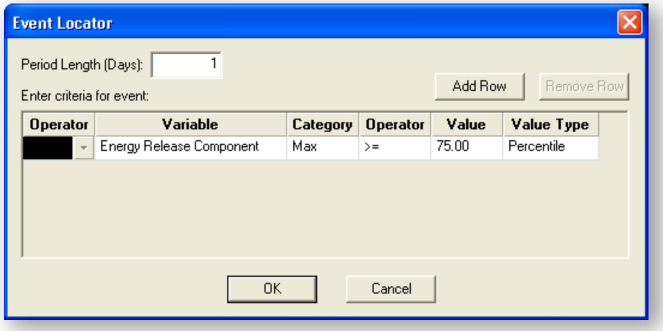
Produced April 13, 2012 using FireFamily+ v4.0.2 (Current_Mid-Columbia_2_794.mdb)

Responsible Agency : USFWS

Appendix i. NFDRS Structure Chart



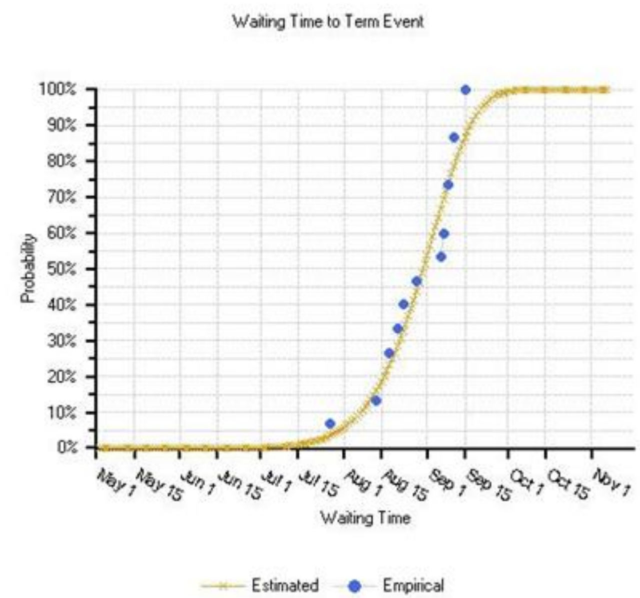
Appendix j. Fire Term Analysis (Season-Ending Event Probabilities) Columbia Basin FDRA



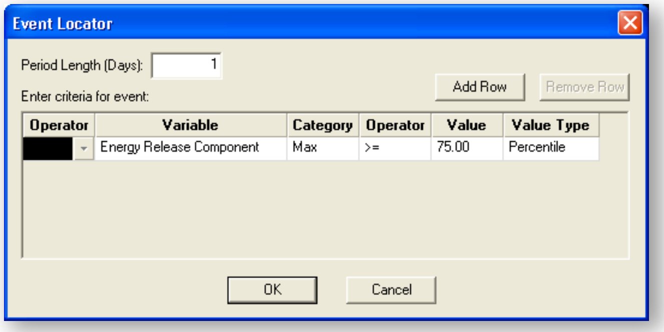
Term Report

Season Start Date:	5/1
Alpha Value:	8.9
Beta Value:	0.0079
R Squared:	
File name:	columbiabasinSIG.trm

Date	# days
9/11/1996	133
8/23/1997	114
9/6/1998	128
9/11/1999	133
8/13/2000	104
9/15/2001	137
9/15/2002	137
9/7/2003	129
8/21/2004	112
9/9/2005	131
9/9/2006	131
8/18/2007	109
8/18/2008	109
8/28/2009	119
7/27/2010	87



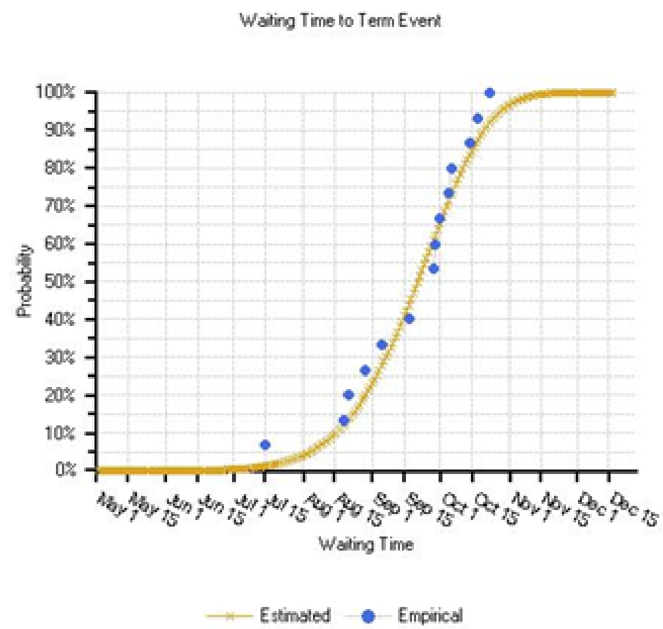
Appendix k. Fire Term Analysis (Season-Ending Event Probabilities) Conboy Refuge FDRA



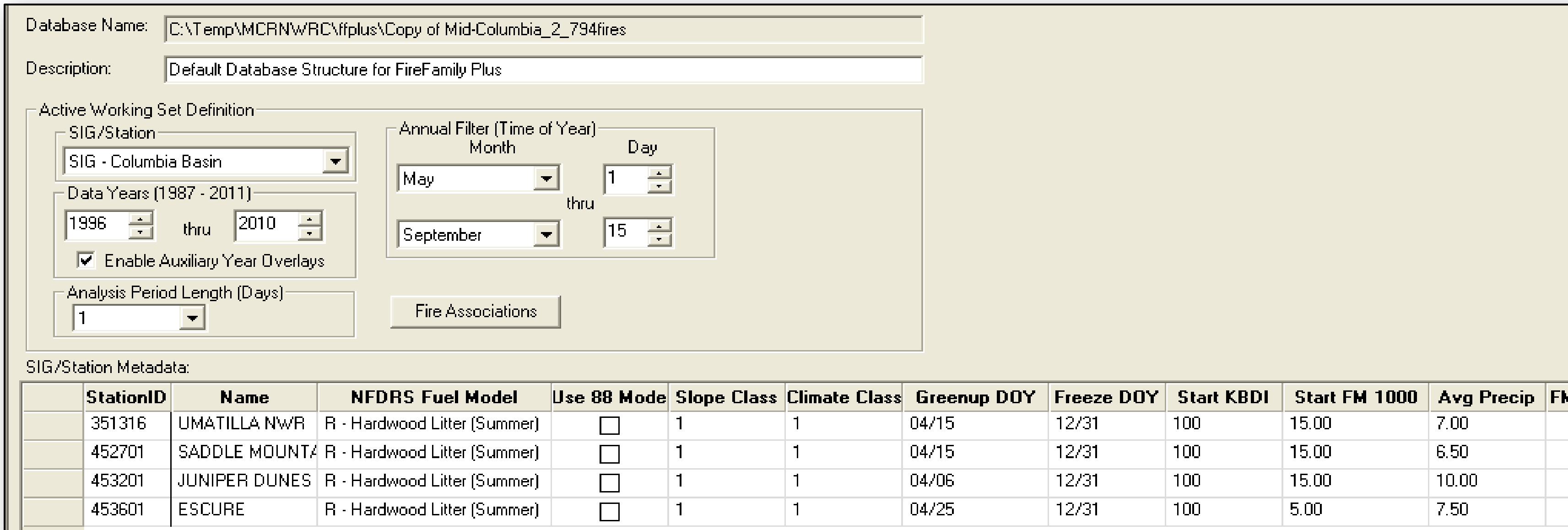
Term Report

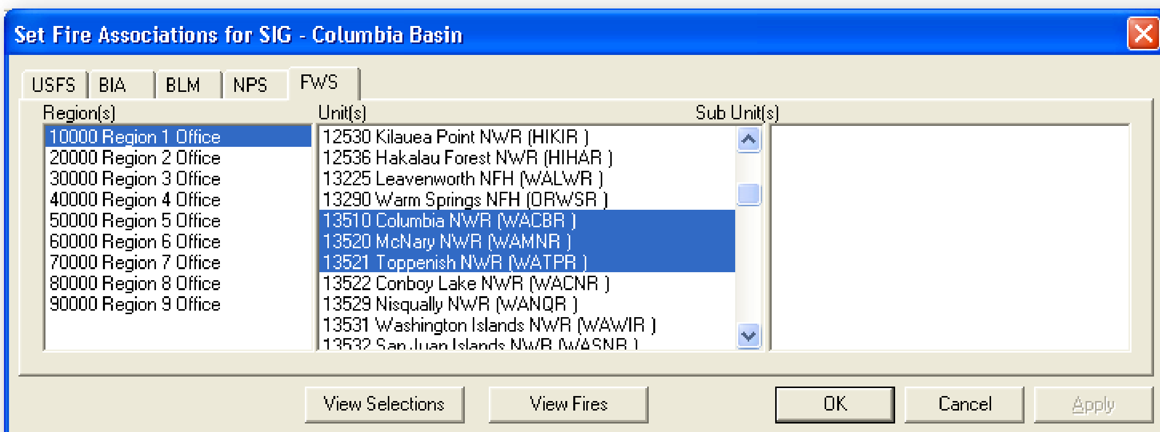
Season Start Date:	5/1
Alpha Value:	6.4
Beta Value:	0.0066
R Squared:	
File name:	greyback.trm

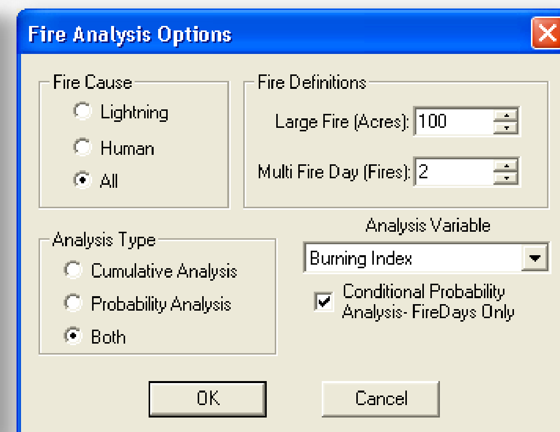
Date	# days
8/29/1996	120
8/19/1997	110
9/17/1998	139
10/23/1999	175
9/28/2000	150
10/5/2001	157
10/18/2002	170
10/6/2003	158
8/21/2004	112
9/29/2005	151
10/14/2006	166
7/15/2007	75
10/1/2008	153
9/28/2009	150
9/5/2010	127



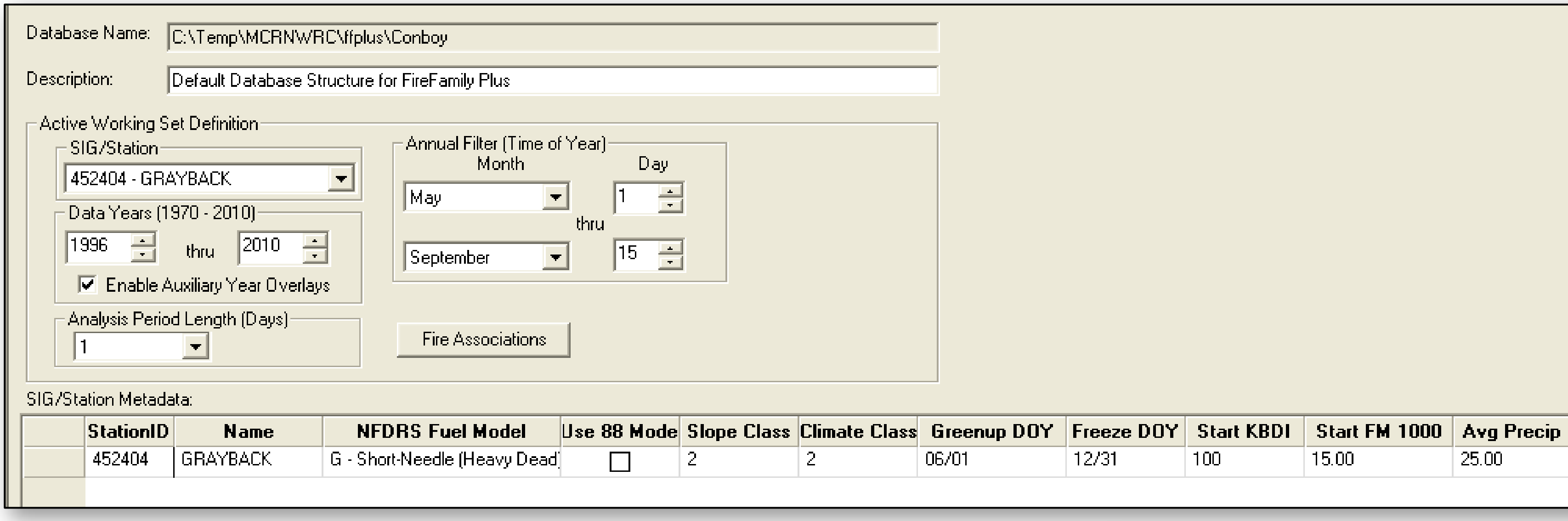
Appendix l. FireFamily Plus Analysis Working Set (Columbia Basin FDRA)

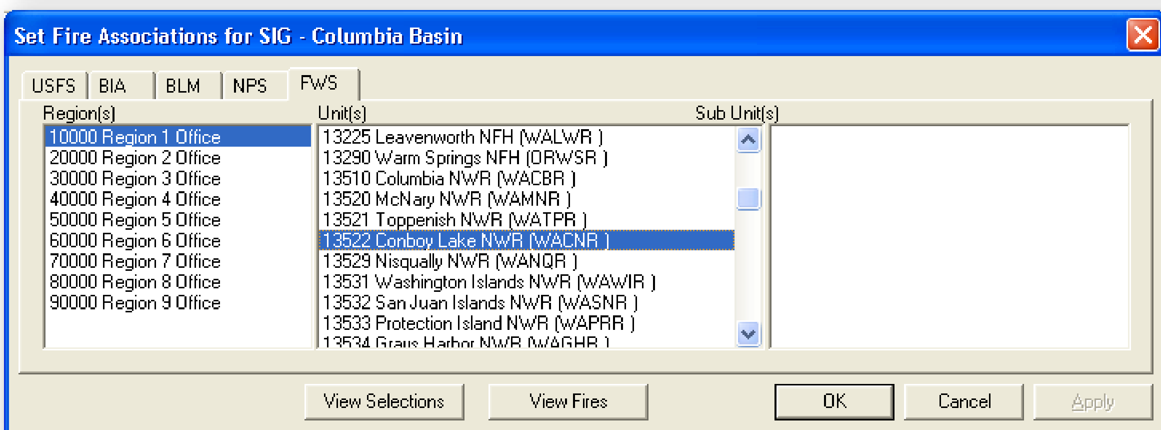


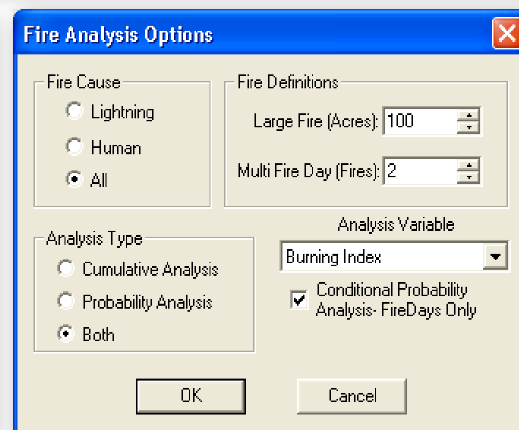




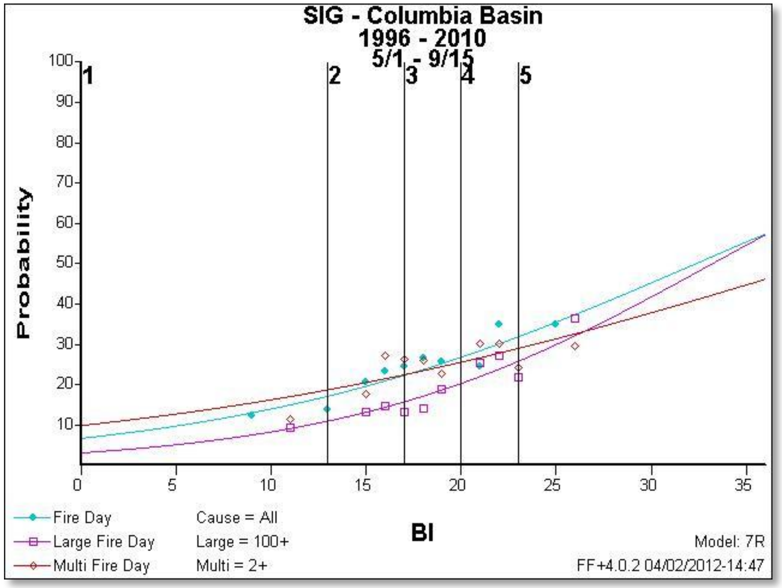
Appendix m. Working Set (Conboy Refuge FDRA)

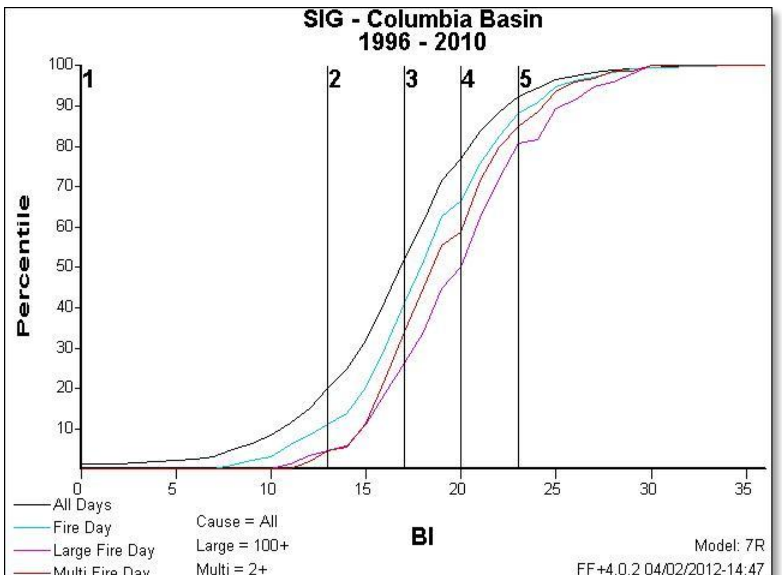


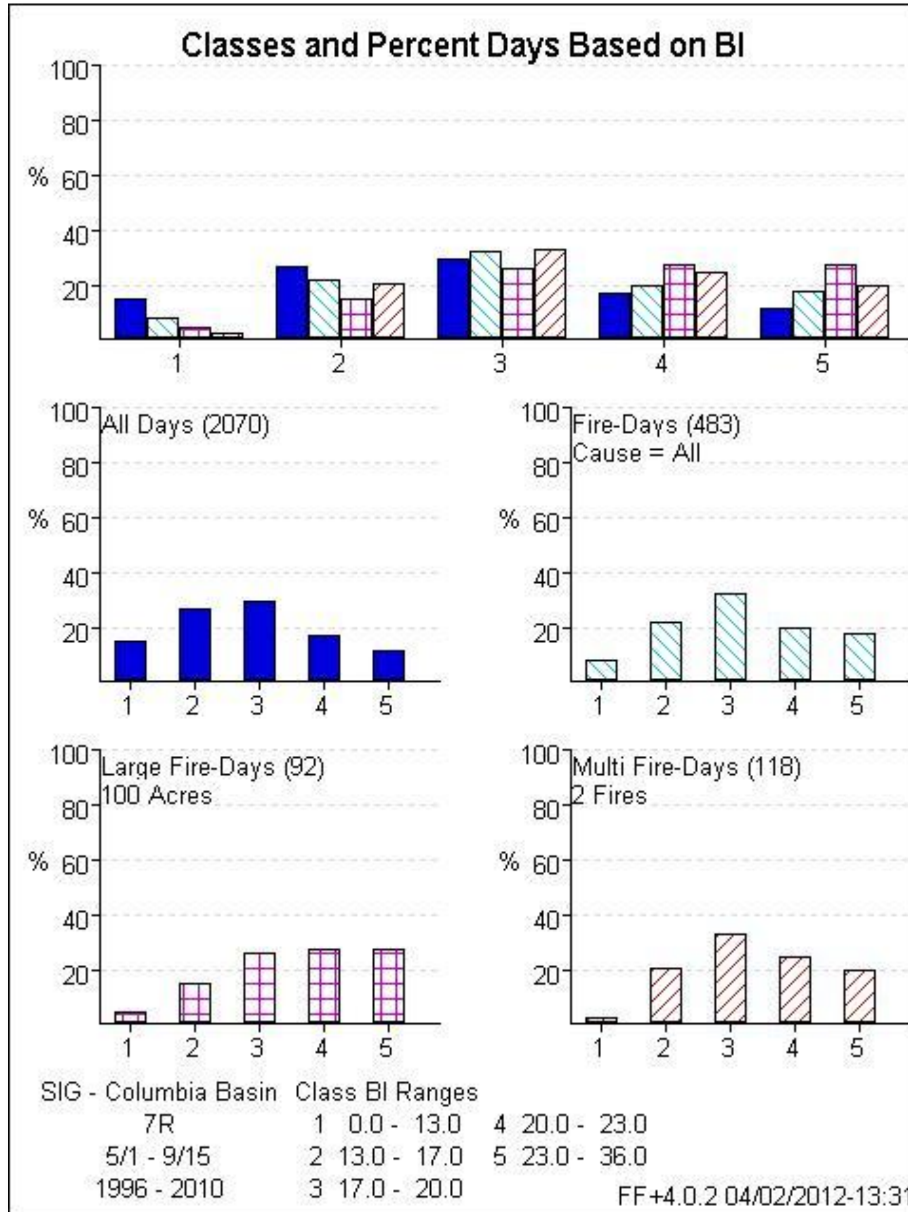




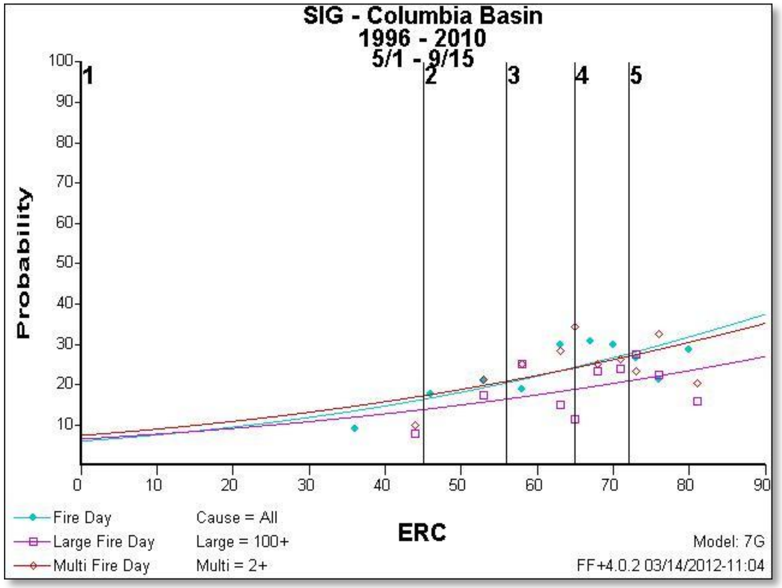
Appendix n. Staffing Level Decision Points (Columbia Basin FDRA)

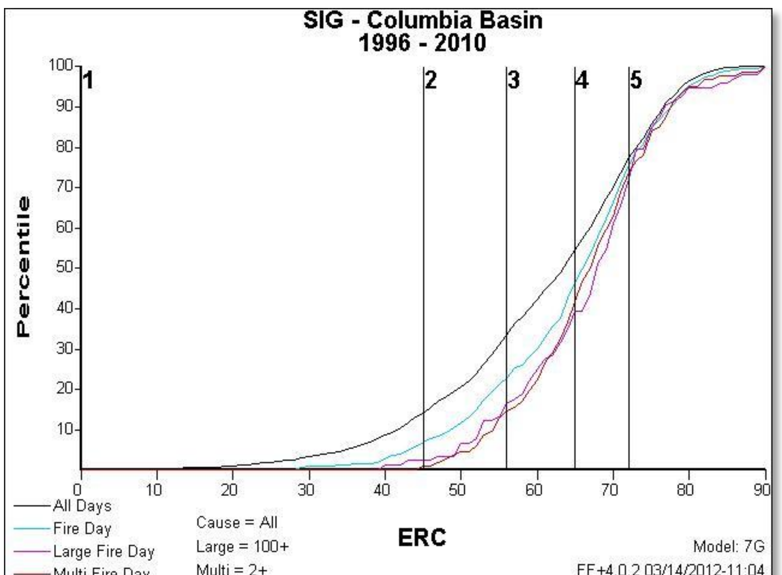


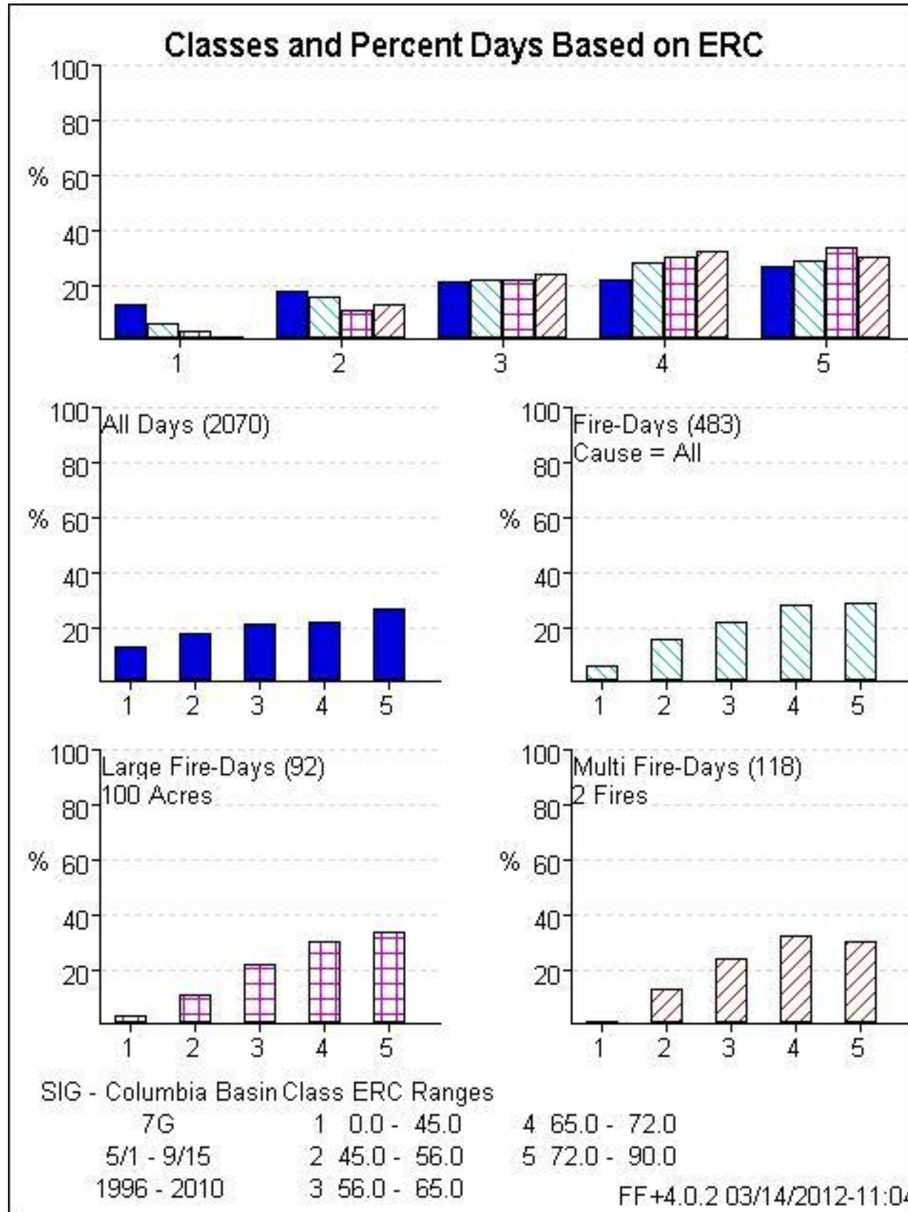




Appendix o. Preparedness Level Decision Points (Columbia Basin FDRA)







Take Pre-clipping Photograph

Use digital cameras and software to develop a permanent record of clipped plots for refreshing your memory of the vegetation and corresponding carrying capacity calculated from the air-dry herbage.

1. Pre-clipping photographs of quadrats should include the clipping frame and a 3 to 6-foot graduated staff next to the frame.
2. The staff should be slightly taller than the tallest grass and forb species. Use 1" to 1-1/2" PVC pipe or wooden dowel.
3. Staves should be painted with alternating 6-inch black and white increments for the first 2 feet and 12-inch increments for the remaining height.
4. Attach a sharpened metal rod to the bottom to anchor the staff.
5. Focal distance and angle should be the same for all photographs. Early and late daylight are best with the sun at your back. Use a long enough focal distance to keep your shadow out of the picture.

- Build clipping frame

1. To estimate standing herbage, build a square frame using 3/4" PVC pipe with inside measurements of 37 3/16" x 37 3/16".
2. With schedule-40 PVC, cut four pieces at 37 1/8". This will account for the lack of closure inside the elbows.
3. Glue PVC elbows at the ends of 2 sections of pipe.
4. Temporarily insert the 2 free sections into the non-glued ends of elbows and use a large flat work surface to properly align elbows when gluing. The frame can then be disassembled for easy transport and storage.
5. Snugly assemble the frame and place it flat on the ground.

Dimensions of this quadrat will allow you to easily convert from grams of air-dry herbage inside the plot to pounds/acre. Simply multiply the grams by 10.

- Measure Standing Herbage

1. Slide herbage of plants not rooted inside to the outside.
2. Place a graduated staff at the left rear corner and take 1 or 2 pictures.
3. Review the pictures on the camera monitor.

4. Clip all herbage at the **ground level** from plants rooted inside the frame. Discard previous year(s) herbage.
5. Place the current-year herbage in a paper bag. Label the bag with a level of production (high, intermediate, or low), sample number, and a date. It is helpful to clip several sample plots for each level of herbage production.
6. Place the open bags in an outside vehicle with closed windows for several days.
7. Use a 100 or 250-gram spring scale to weigh dried samples. Samples may have to be divided into several bags for drying and weighing. Subtract the weight of the bag from the total weight.
   - Calculate Carrying Capacity

Calculate the stocking rate (AUM/ac) and note this number on the digital photograph for each clipped plot.

Moderate stocking rates are based on use of about 25% of peak standing herbage. This accounts for the fact that half of total forage should be left for plant and soil health, and that cattle will only fully utilize about half of available forage (the other half will be trampled, bedded in, and urinated on).

1. Convert grams of dried forage to lbs/acre by multiply by 10 (as long as you used the size of frame outlined above).
2. Divide this number by 4 (to account for proper production and utilization factors as described above).
3. Divide this number by 780 lbs of forage per AUM (feed needs of one AU for one month) to get carrying capacity.

Example:

1. Convert grams to lb/ac: 164 grams x 10 = 1,640 lb/ac
2. Determine the amount of herbage to be used: 1,640 lb / 4 = 410 lb
3. Calculate carrying capacity: 410 lb / 780 lb/AUM = 0.53 AUM/ac

http://drought.unl.edu/ranchplan/InventoryMonitor/ForageRange/RangeMonitoringMethods/ClipandWeighMethod.aspx



Sampling Vegetation Attributes
Interagency Technical Reference
Cooperative Extension Service
U.S. Department of Agriculture
— Forest Service —
Natural Resource Conservation Service,
Grazing Land Technology Institute
U.S. Department of the Interior
— Bureau of Land Management —
1996
Revised in 1997, and 1999
http://www.blm.gov/nstc/library/pdf/samplveg.pdf

Location of Study Sites Proper selection of study sites is critical to the success of a monitoring program. Errors in making these selections can result in irrelevant data and inappropriate management decisions. The site selection process used should be documented. Documentation should include the management objectives, the criteria used for selecting the sites, and the kinds of comparisons or interpretations expected to be made from them. Common locations for studies include critical areas and key areas. Some of the site characteristics and other information that may be considered in the selection of study sites are:

- Soil
- Vegetation (kinds and distribution of plants)
- Ecological sites
- Seral stage
- Topography
- Location of water, fences, and natural barriers
- Size of pasture
- Kind and/or class of forage animals—livestock, wildlife, wild horses, and wild burros
- Habits of the animals, including foraging
- Areas of animal concentration
- Location and extent of critical areas
- Erosion conditions
- Threatened, endangered, and sensitive species—both plant and animal
- Periods of animal use
- Grazing history
- Location of salt, mineral, and protein supplements
- Location of livestock, wildlife, wild horse, and/or wild burro trails

1. **Critical Area** Critical areas are areas that should be evaluated separately from the remainder of a management unit because they contain special or unique values. Critical areas could include fragile watersheds, sage grouse nesting grounds, riparian areas, areas of critical environmental concern, etc.
2. **Key Areas** Key areas are indicator areas that are able to reflect what is happening on a larger area as a result of on-the-ground management actions. A key area should be a representative sample of a large stratum, such as a pasture, grazing allotment, wildlife habitat area, herd management area, watershed area, etc., depending on the management objectives being addressed by the study. Key areas represent the "pulse" of the rangeland. Proper selection of key areas requires appropriate stratification. Statistical inference can only be applied to the stratification unit.

   a) **Selecting Key Areas** The most important factors to consider when selecting key areas are the management objectives found in land use plans, coordinated resource management plans, and/or activity plans. An interdisciplinary team should be used to select these areas. In addition, permittees, lessees, and other interested publics should be invited to participate, as appropriate, in selecting key areas. Poor information resulting from improper selection of key areas leads to misguided decisions and improper management.

b) Criteria for Selecting Key Areas The following are some criteria that should be considered in selecting key areas. A key area:

- Should be representative of the stratum in which it is located.
- Should be located within a single ecological site and plant community.
- Should contain the key species where the key species concept is used.
- Should be capable of and likely to show a response to management actions. This response should be indicative of the response that is occurring on the stratum.

c) Number of Key Areas The number of key areas selected to represent a stratum ideally depends on the size of the stratum and on data needs. However, the number of areas may ultimately be limited by funding and personnel constraints.

d) Objectives Objectives should be developed so that they are specific to the key area. Monitoring studies can then be designed to determine if these objectives are being met.

e) Mapping Key Areas Key areas should be accurately delineated on aerial photos and/or maps. Mapping of key areas will provide a permanent record of their location.

Appendix q. Weather Information Management Application (WIMS)

WIMS Setup and Application

The Weather Information Management System (WIMS) is a comprehensive system that enables users to manage weather information.

WIMS can be accessed at *http://fam.nwcg.gov/fam-web/*.

The WIMS User Guide can be downloaded from the following web site:
http://www.fs.fed.us/fire/planning/nist/wims_web_ug/wims__ug_complete061803.pdf

1. NSIG: Create a Special Interest Groups (SIG)

Enter SIG name (i.e., “FDOP”) and select Setup

Enter the associated station numbers for the SIG. . . . then select Save

Station Id
351316
452701
453201

EAVG: Assign NFDRS Weighted Avg.

Enter the SIG name and select Display

By default, each station is weighted equally for the first priority fuel model. Keep the default value by selecting Save

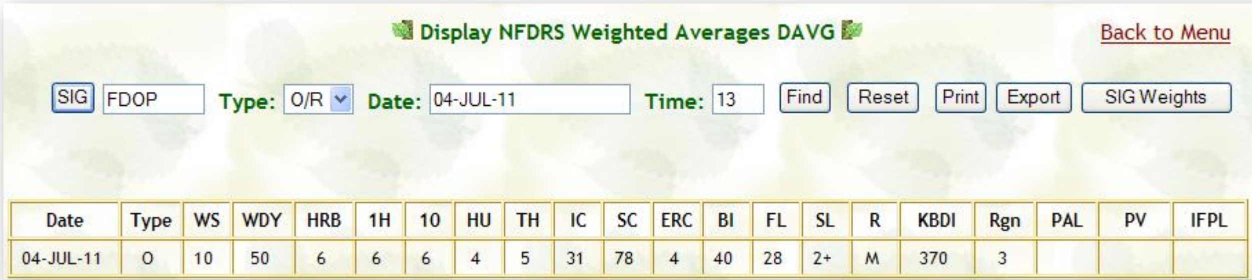
If successful, the following message will be displayed: Weighted average for SIG 'XXXXX' has been successfully updated.

Repeat these steps for each SIG.

X	Station ID	Priority	Model Info	Weight Factor %
	351316	1		33
	452701	1		33
	453201	1		34

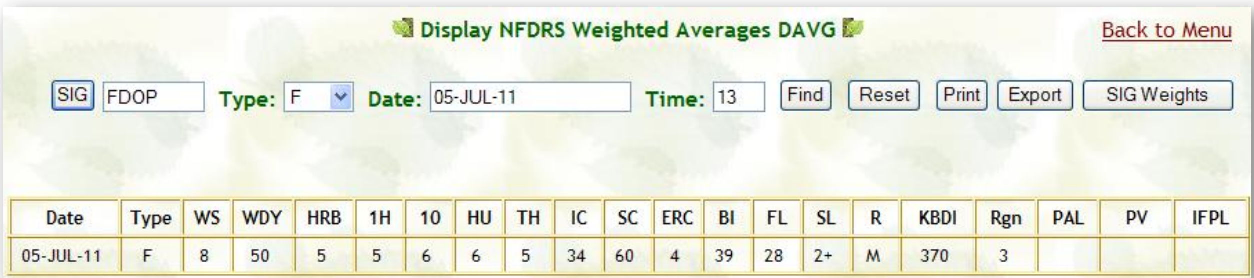
2. DAVG: Display NFDRS Weighted Averages

Enter the SIG name, Type “O”, and current date for daily indices, then select Find



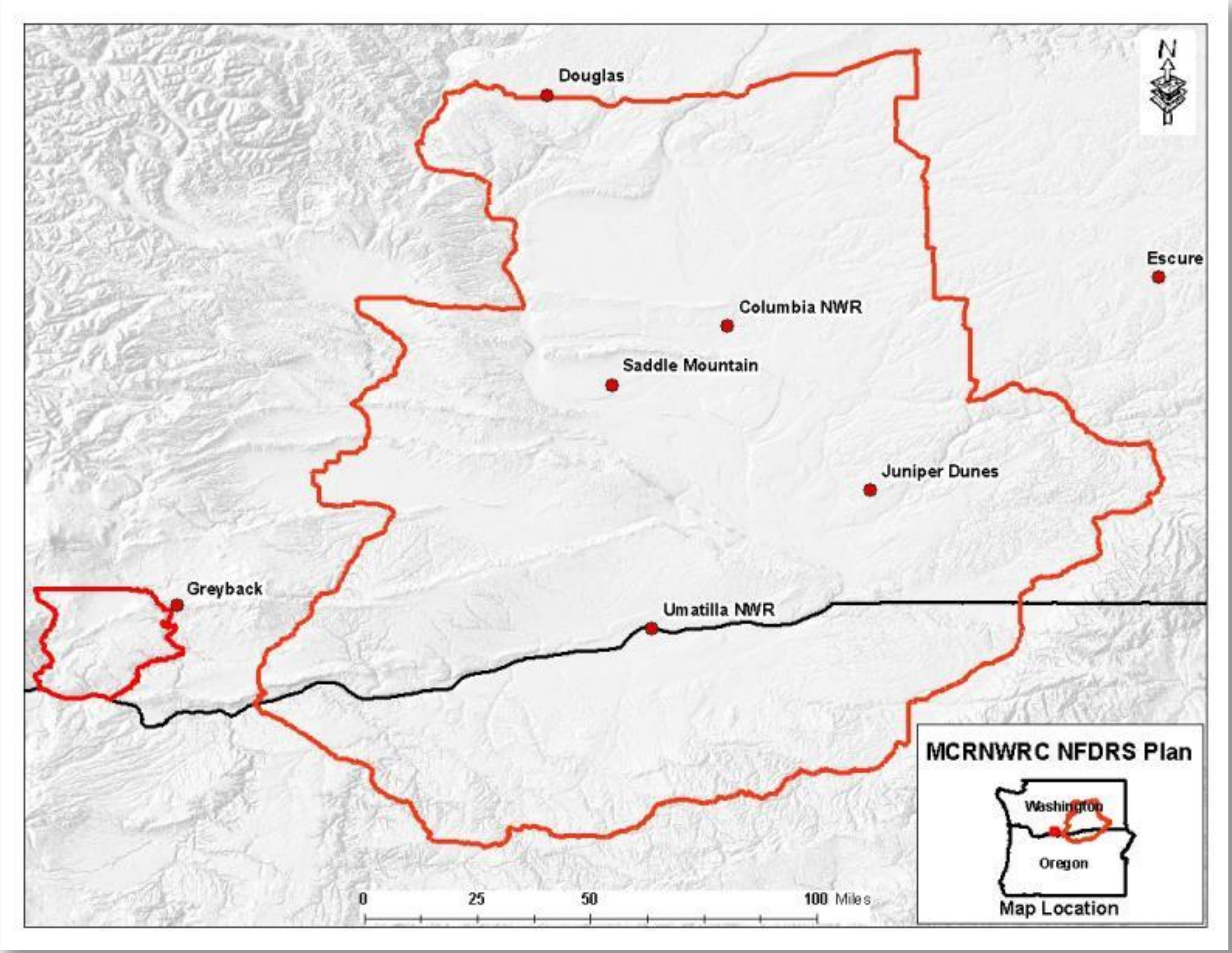
Date	Type	WS	WDY	HRB	1H	10	HU	TH	IC	SC	ERC	BI	FL	SL	R	KBDI	Rgn	PAL	PV	IFPL
04-JUL-11	O	10	50	6	6	6	4	5	31	78	4	40	28	2+	M	370	3			

Enter the SIG name, Type "F", and date of forecasted indices, then select Find

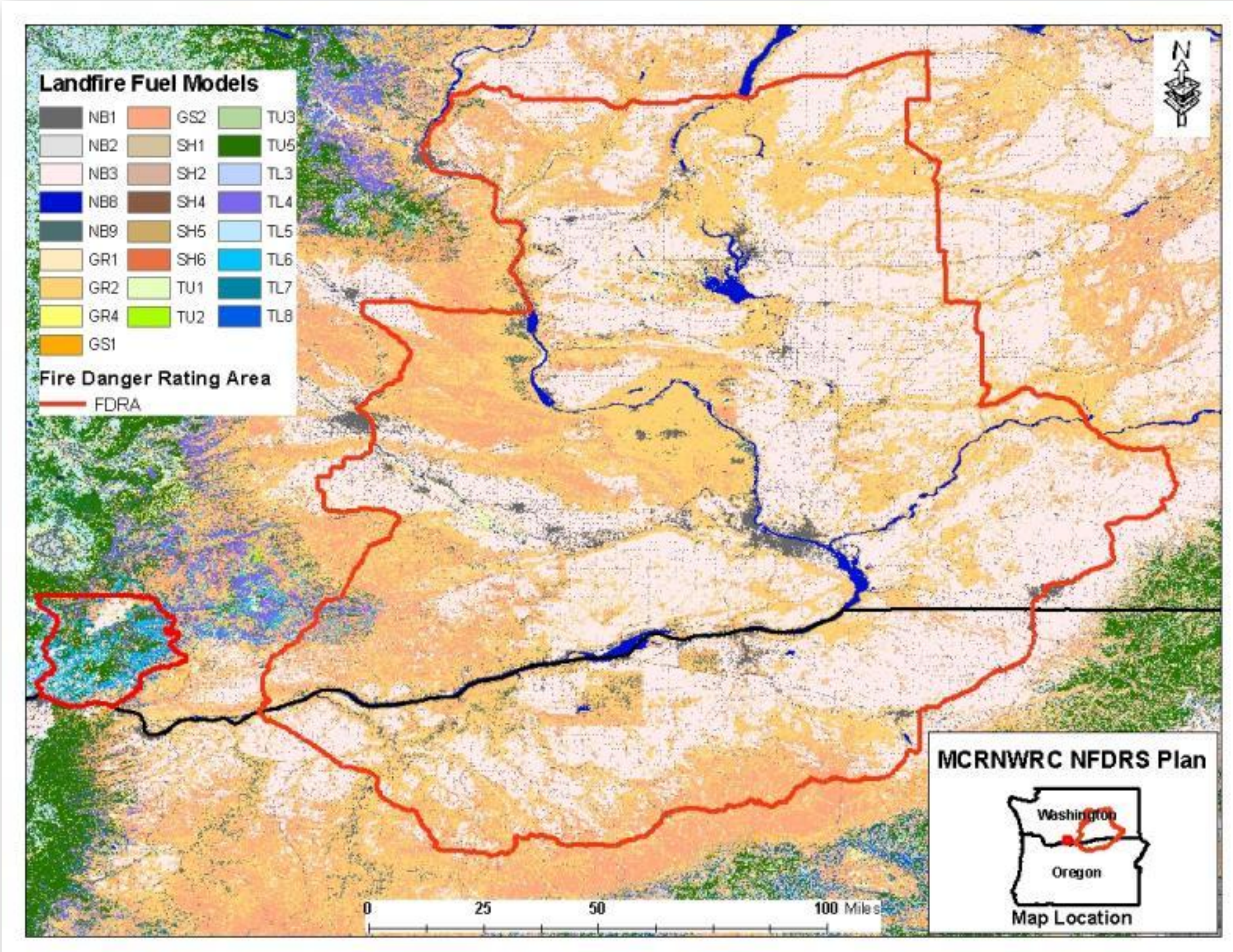


Date	Type	WS	WDY	HRB	1H	10	HU	TH	IC	SC	ERC	BI	FL	SL	R	KBDI	Rgn	PAL	PV	IFPL
05-JUL-11	F	8	50	5	5	6	6	5	34	60	4	39	28	2+	M	370	3			

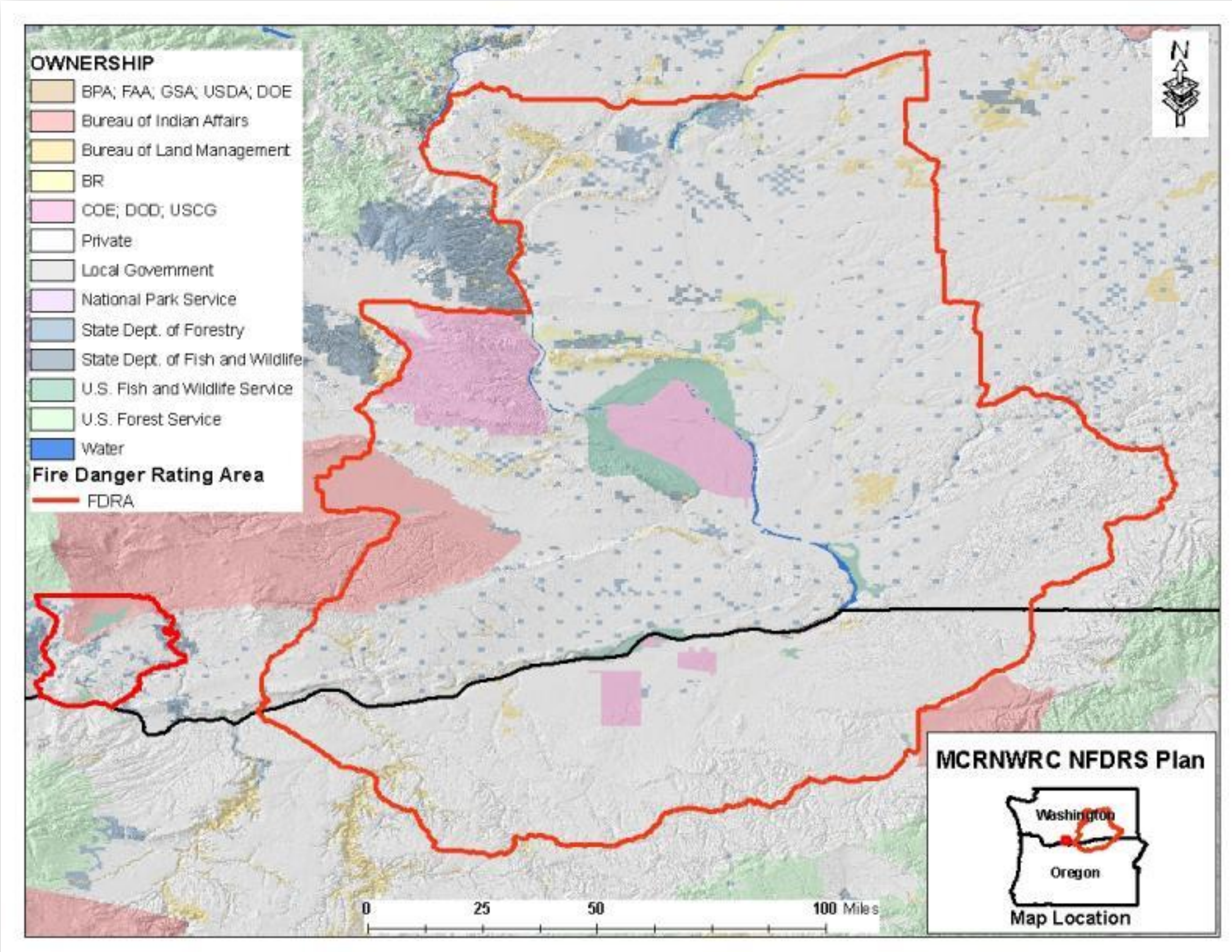
Appendix r. Map - Fire Danger Rating Areas Remote Automated Weather Stations (RAWS)



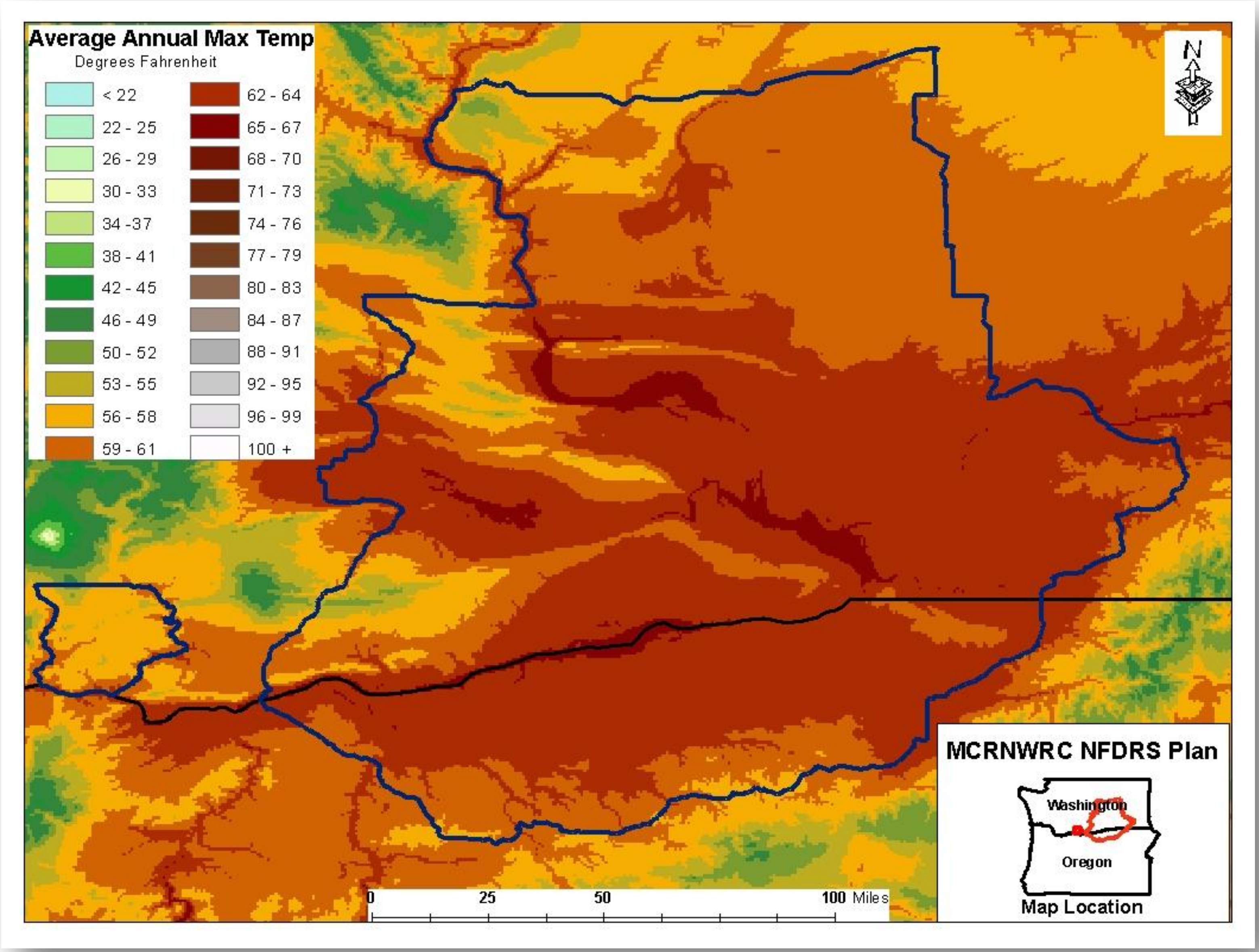
Appendix s. Map - Fuel Models (Landfire)



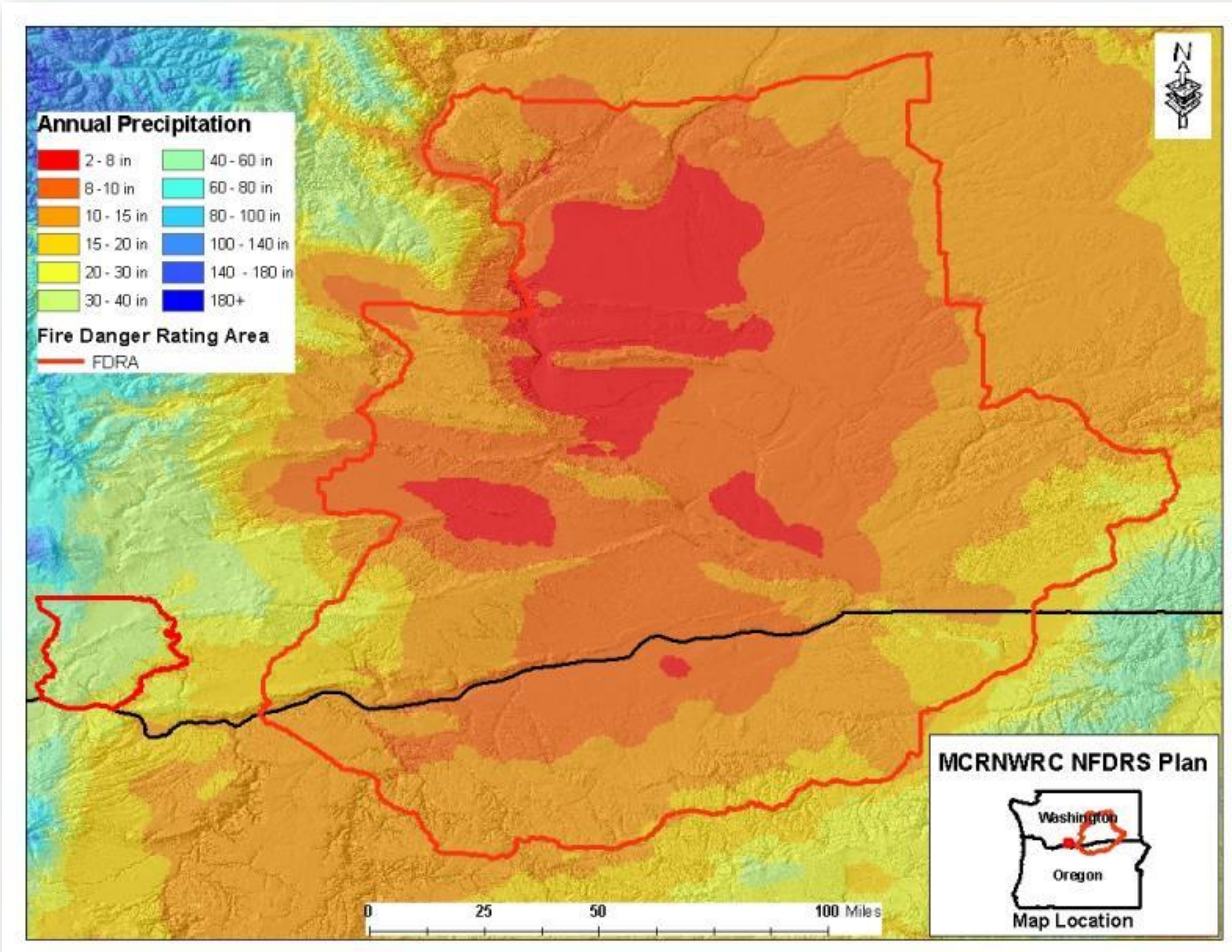
Appendix t. Map - Ownership



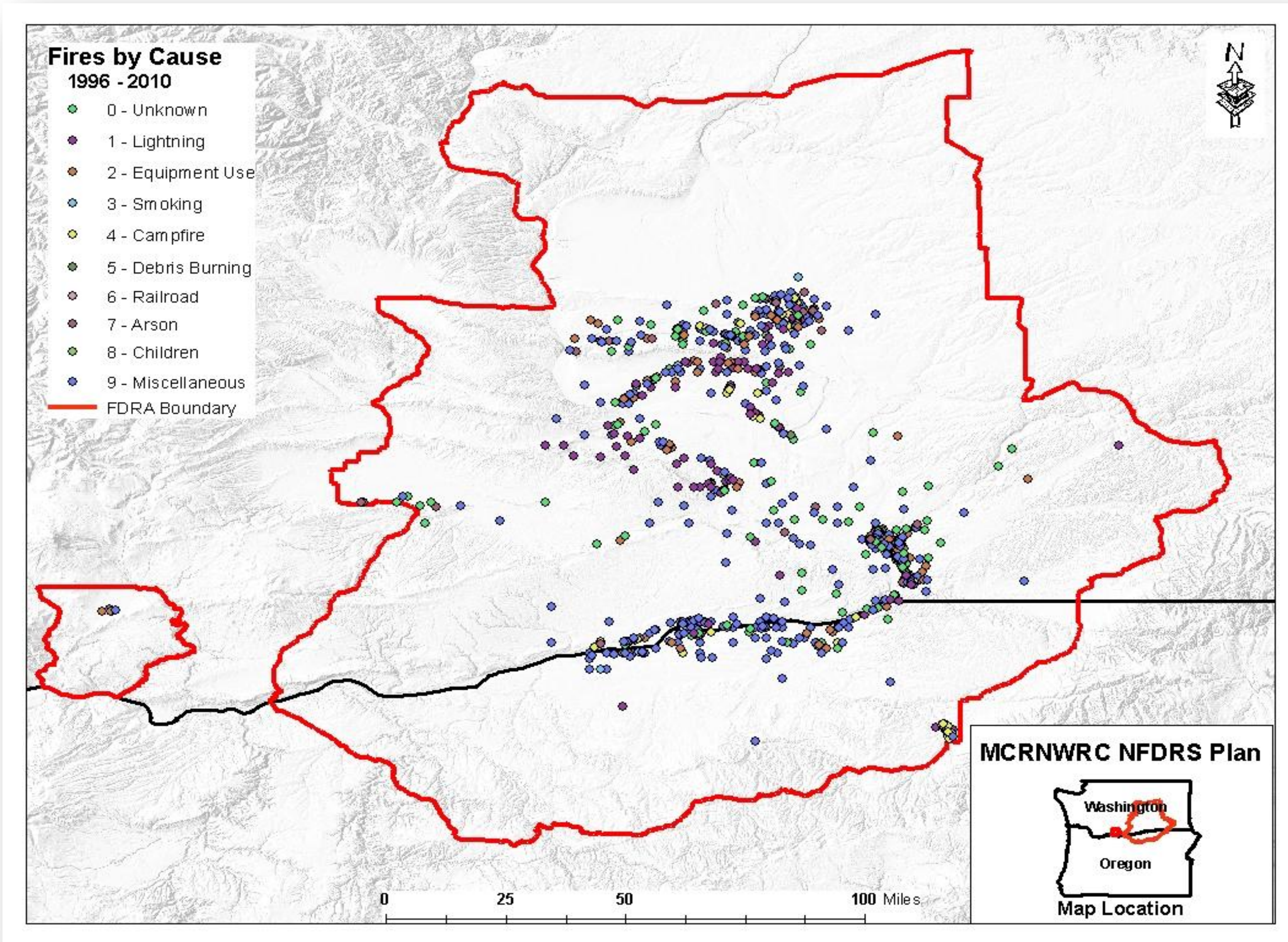
Appendix u. Map - Climate (Annual Average Temperature)



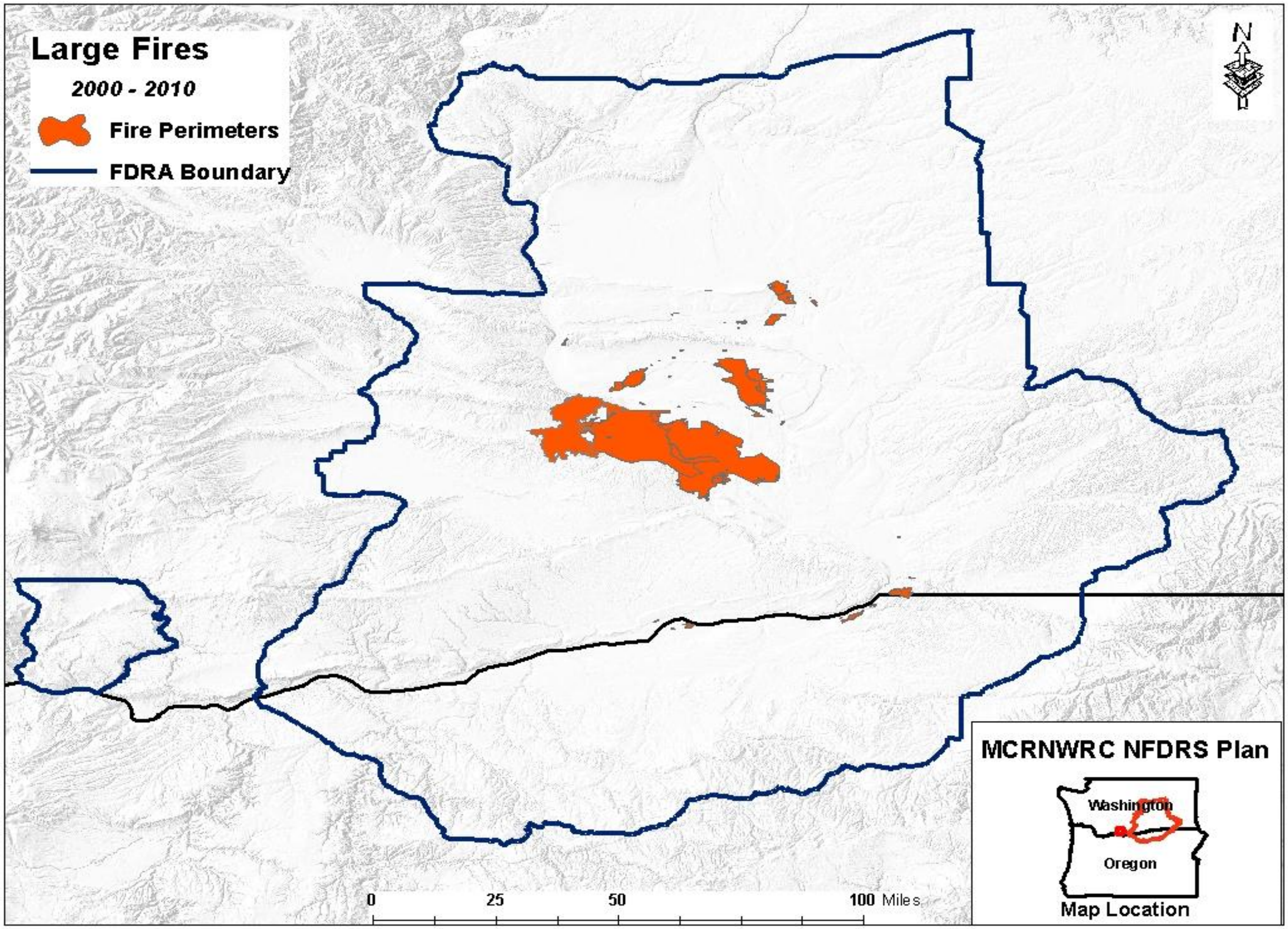
Appendix v. Map -Climate (Annual Average Precipitation)



Appendix w. Map -Fire Occurrence (Point Location by Cause)



Appendix x. Map -Fire Occurrence (Large Fire Perimeters)



Appendix y. Fire Resource Status report

Mid-Columbia Basin FDRA

Date	
Staffing Level	
Preparedness Level	
Duty Officer	

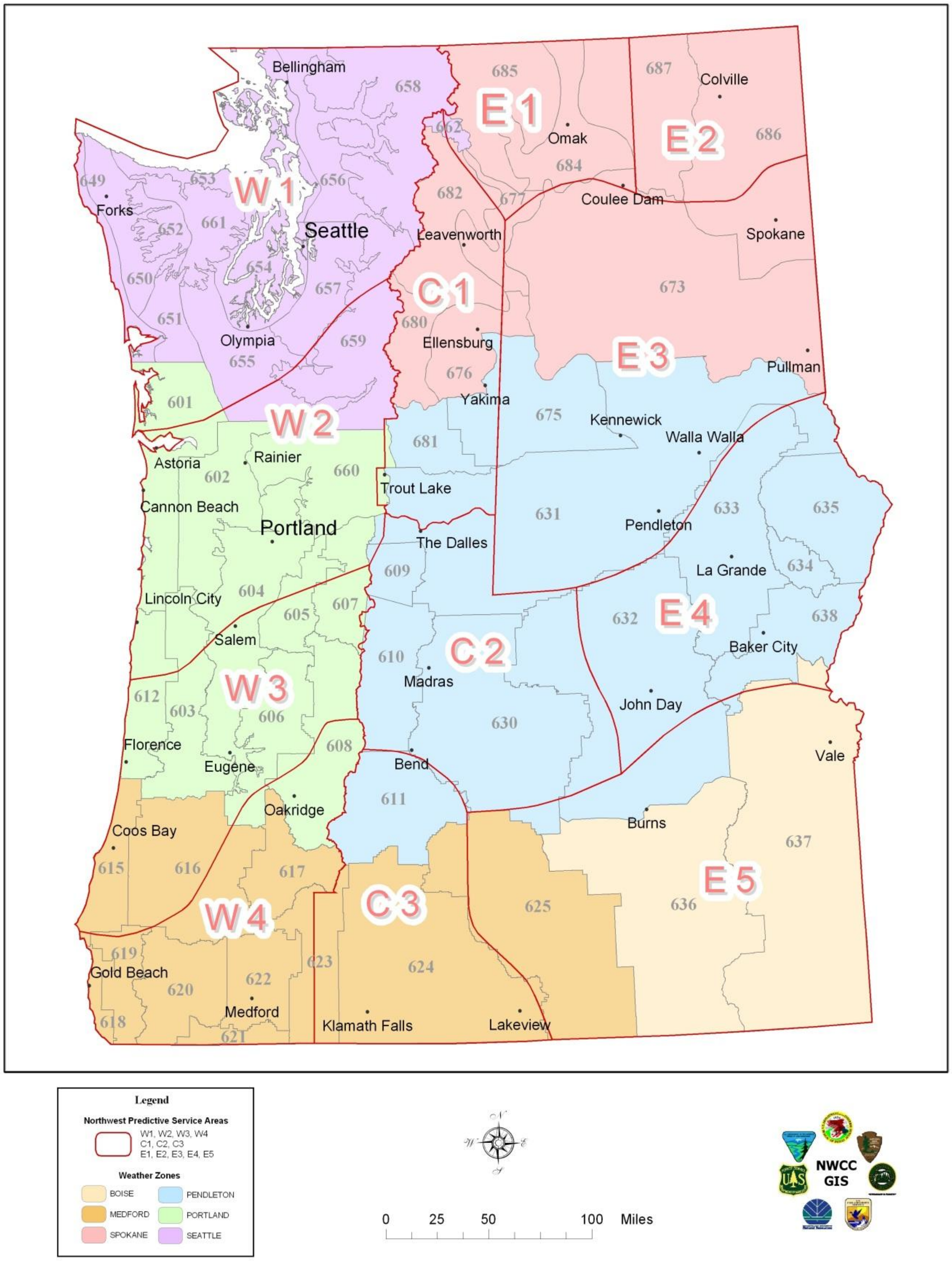
Month XX, Year

Station	351316	452701	453201	453601	Average	GACC Risk/P.L.	Preparedness/ Staffing Class
ERC-G							
BI-R							
Forecasted BI-R							

Resource	McNary Heavy	McNary Light	Columbia Heavy	Columbia Light
Unit Leader				Unstaffed
Unit Strength				0

Appendix z. Map - Fire Weather Zones and Predictive Service Areas

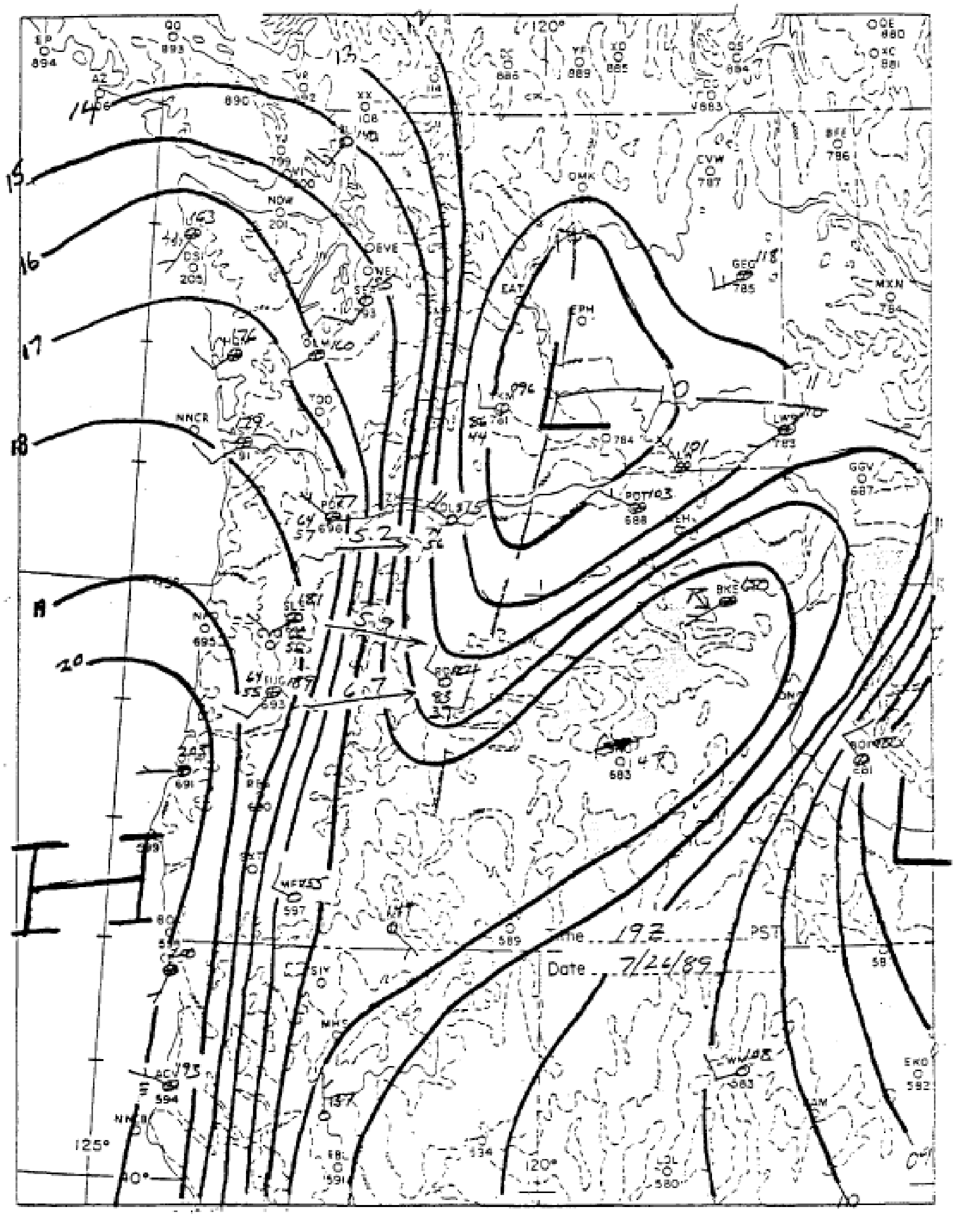
Northwest Predictive Service Areas and Fire Weather Zones



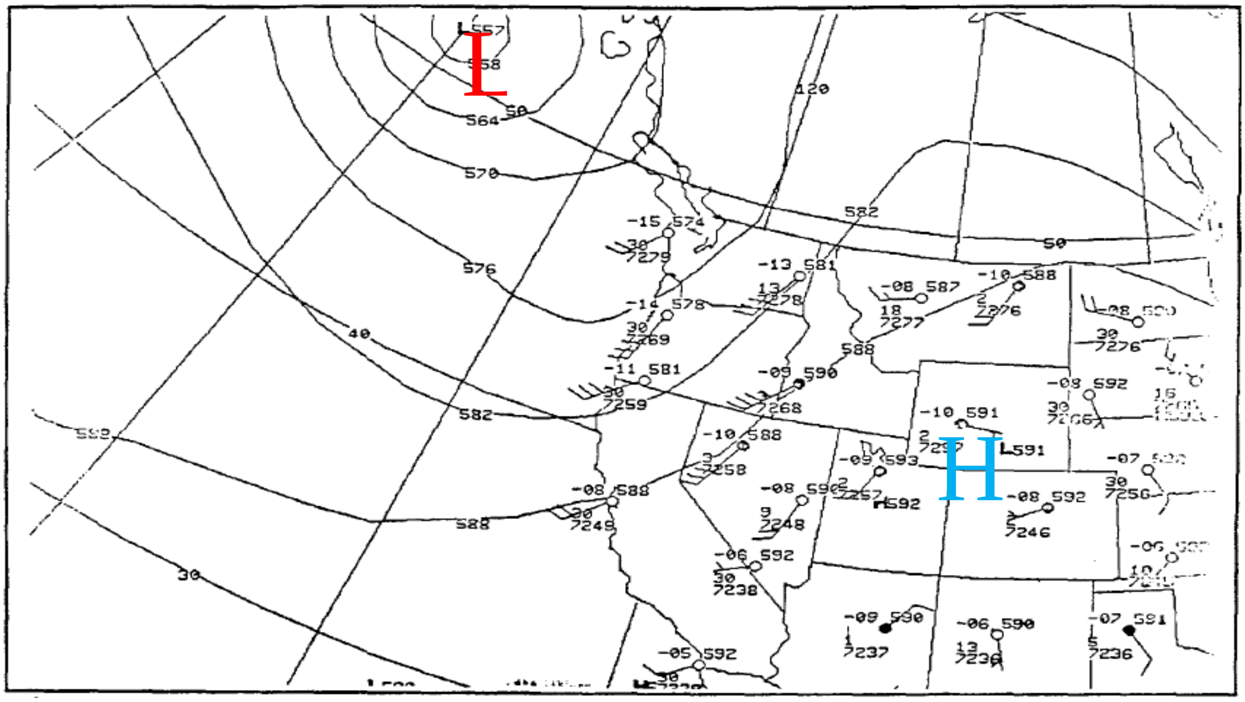
Appendix aa. Weather Patterns that Influence Fire Growth across the Columbia Basin

Jon Bonk, National Weather Service
Figures taken from the "Critical Fire Weather Patterns of the United States" document presented at the National Weather Service's (NWS) Fire Weather Forecasters Course, Boise, March 30 – April 2, 1999

Large fire growth across the Columbia Basin is largely determined by winds. This should not be surprising to area fire managers as a few events like those described here minimally occur each fire season. Typical wind events result from surface low pressure located east of the Cascades ideally centered over, but not limited to, Columbia Basin combined with high pressure building west of the Cascades. The figure below provides an example of a typical surface pressure configuration. The surface low over the Columbia Basin will continue to move east drawing the gusty winds across the Basin.



The most critical wind pattern is associated with the breakdown of an upper ridge. In this scenario, an upper-level high pressure ridge remains situated over the Pacific Northwest for several days during mid to late summer. This typically results in very hot and dry weather with afternoon relative humidity commonly in the teens and upper single digits along with significant instability. A thermally driven surface "heat" low pressure area, similar to the pattern above, commonly develops as well. An upper-level low pressure trough then displaces the ridge and heat low eastward thus increasing pressure differences across the Cascades. The faster this breakdown occurs and/or the greater the difference in pressures, the faster the wind speeds tend to be. The figure below illustrates this breakdown with strong high pressure aloft having moved east of the Pacific Northwest and strong low pressure aloft approaching from off the British Columbia coast.



The result is very gusty winds through the Cascade gaps and across the Columbia Basin. The winds can come in the form of either a non-precipitating (dry) cold front or as a “marine push”. The marine push is a surge of cool, moist, and stable marine air that is forced through and over the Cascades resulting in a prolonged surge of wind. Both cases typically produce sustained wind speeds of 15 to 30 mph with gusts up to 45 mph not uncommon. Depending on location, wind directions are largely from the west or southwest except for regions downwind of the central Washington gaps where winds typically will be from the west to northwest.

The refuges most susceptible to these winds in no particular order are the Toppenish, Hanford Reach, Columbia, McNary, Umatilla, and Cold Springs. McKay Creek is believed to receive lower magnitudes of wind, though still significant, during these events due to its depressed elevation location within the Foothills of the Blue Mountains. The Conboy Lake area tends to quickly receive significantly higher humidity from westerly wind due to proximity near the Cascade crest.