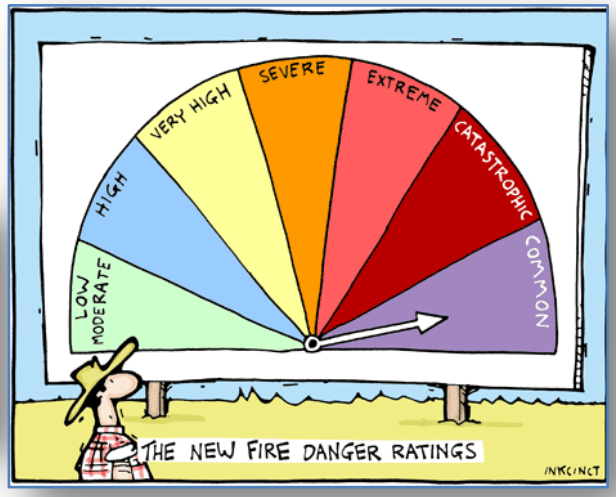

Southeast Zone Interagency National Fire Danger Operating Plan

2015

Coronado National Forest

Arizona BLM Gila District

U.S. Fish and Wildlife Service

National Park Service - Southern Arizona Group

Bureau of Indian Affairs – TON

Arizona State Forestry Division

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Signature Page

Forest Fire Staff Officer - Coronado National Forest — Date: 2/24/15

Fire Management Officer - AZ BLM Gila District — Date: 2-24-15

Fire Management Officer - Buenos Aires National Wildlife Refuge — Date: 2/24/15

Fire Management Officer - Saguaro National Park — Date: 2-24-2015

Fire Management Officer – Tohono O'odham Nation — Date: 2-24-15

Fire Management Officer – Arizona State Forestry Div. — Date: 2-24-15

Edits/Changes for 2015

Page 23, *Table 18. Primary Weather Stations for the Southeast Zone*: Added Canelo RAWS (021303).

Page 29, *Table 21. Fire Season Dispatch Level Analysis based on the IC Index*: Corrected the IC-G breakpoints for the three Dispatch Levels for each FDRA.

Page 35, Tables 26 – 28. *Adjective Fire Danger Ratings* for each FDRA (Sonoran, Basin & Range Low, Basin & Range High): Corrected the IC-G breakpoints in each table.

Page 37, Added text to clarify the use of Pocket Cards as a fire awareness situation tool:

The Fire Danger Pocket Card is a tool based on the National Fire Danger Rating System (NFDRS) to help the firefighter develop an awareness of the current fire situation that you are about to step into. The prime objective of the NFDRS is to provide a measure of the seriousness of local burning conditions. The Pocket Card provides a visual reference of those conditions and how they compare to previous fire seasons.

- *What is Fire Danger Rating?*
  - A decision *aid* that describes the factors - fuels, weather and topography - which affect the initiation, spread and difficulty of control of wildfires on an area.
  - We emphasize *aid* because fire danger rating information is not the answer by itself; it must be considered along with local knowledge of an area.
- *What will the Fire Danger Pocket Card do?*
  - The Fire Danger Pocket Card is useful in initial fire size up, initial attack and extended attack.
  - The Fire Danger Pocket Card gives firefighters a general indicator of the potential for the fuels to support extreme fire behavior and of the difficulty of control.
- *What won't the Fire Danger Pocket Card do?*
  - The Fire Danger Pocket Card will not provide site specific fire behavior predictions.
- *How Do Firefighters use the Fire Danger Pocket Cards?*
  - Compare current and predicted local fire danger to historical local fire danger in order to enhance situational awareness.
  - Use this information to be aware of indicators that predict the potential for extreme fire behavior.

Pages 38-39, Updated all three Pocket Cards (edited information on each card).

Page 40, Redefined "*Season Ending/Season Slowing Events*" parameters for each FDRA.

Page 41, Edit: "Recommend that the FDTG develop a schedule to meet on a regular basis to review weather and fire history data." Deleted: "and begin incorporating 2012 weather and fire history data into the FFP database."

Page 41, Add: "Recommend that weather and fire history data for this plan will be updated every five (5) years and incorporated into the FFP database. Further recommend that a 20-year period be used for analyses."

Pages 42-49, (Appendix A – G): Removed graphs showing decision points for the NFDRS indices (ERC, IC) in each FDRA. Graphs were not useful.

Pages 52-55, (Appendix J): Reviewed and edited *Preparedness Levels and Recommended Action Guides* for: Agency Administrators, FMO's, TDC & DutyOfficers, Prevention/Mitigation.

Page 55, (Appendix J – Duty Officer): Added below the table: “December 2014: USFS policy for Duty Officer Responsibilities is currently in DRAFT format and will be incorporated into this planning document after final review and approval.”

Pages 56-58 (Appendix K1 – K3): Created new Weibull distribution graphs for each FDRA using redefined event definition parameters (see page 40).

Table of Contents

Introduction

The National Fire Danger Rating System (NFDRS) is being used to support the fire management decision making process within the Southeast Arizona Zone - SEZ (USFS Coronado National Forest [CNF], Bureau of Land Management [BLM], National Park Service [NPS], Tohono O'odham Nation [TON], Arizona State Forestry Division [AZSFD], US Fish and Wildlife Service [FWS]). Fire-danger ratings are guides for initiating preparedness activities and selecting the appropriate level of initial response to a reported fire. The purpose of this Interagency Fire Danger Operating Plan is to analyze and develop danger rating areas to manage the NFDRS for all participating agencies. Just as agency administrative boundaries are not delineated on the basis of climate, fuels, or topography, neither is fire occurrence and fire danger. A combined NFDRS operating plan will maximize the efficiency and effectiveness of the agencies respective fire management organizations. The plan was developed to assist with planning and operational decisions relative to fire danger, preparedness, resource needs, personnel briefing, situational awareness, and implementing fire restrictions.

This operating plan is a tool that will assist fire managers in understanding and utilizing fire-danger information in the day-to-day management decisions and in long term fire preparedness planning. It is a framework for a consistent thought process to apply fire-danger rating within the jurisdictions of the Southeast Zone.

This plan was developed through analysis of fuels, weather, historical fire occurrence, and topography. A working group (Table 1, SEZ Fire Danger Technical Group [FDTG]) was formed to identify and analyze wildland fire danger related problems, the target groups that will be impacted, and the fire danger rating component or index that could be used to assist in making decisions to reduce the problems. The analysis does not take into account other factors such as resource drawdown, training levels, political factors, overriding budget constraints and other external factors.

Fire Danger Rating Areas (FDRA) were developed by evaluating topography, vegetation, historical fire occurrence, and weather/climate data layers in ArcGIS. The SEZ FDTG identified three FDRAs within the SEZ: (1) Sonoran FDRA, (2) Basin and Range Low Elevation FDRA (<5,500'), and (3) Basin and Range High Elevation FDRA (>5,500').

The Level IV Ecoregion vegetation layer works well in determining where to draw the boundaries between the FDRAs. The Level IV Ecoregions denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources. They are designed to serve as a spatial framework for the research, assessment, management, and monitoring of ecosystems and ecosystem components. These general purpose regions are critical for structuring and implementing ecosystem management strategies across federal agencies, state agencies, and nongovernment organizations that are responsible for different types of resources within the same geographical areas.

C.W. Thornthwaite's "The Climates of North America According to a New Classification" publication was also used to aid in determining the boundaries and climate class for each FDRA. This climate classification system divides climates into groups according to their vegetation characteristics, the vegetation being determined by precipitation effectiveness (*P/E*, where *P* is the total monthly precipitation and *E* is the total monthly evaporation). The sum of the monthly *P/E* values gives the *P/E* index, which is used to define five humidity provinces, with associated vegetation. A *P/E* index of more than 127 (wet) indicates rain forest; 64–127 (humid) indicates forest; 32–63 (sub-humid) indicates grassland; 16–31 (semi-arid) indicates steppe; less than 16 (arid) indicates desert.

The purpose of understanding climate is to allow the processor to select the proper seasonal response of live fuel moisture predictions. Seasonal response of live fuels is dependent on latitude, elevation, and time of the year which are all a factor of climate. Adjustments of climate class are allowed during the course of the fire season if the observed live fuel characteristics deviate from the model but are not advised. Using actual measured values to manually adjust in Weather Information Management System (WIMS) is the preferred alternative. Only measured live fuel moisture values can be edited. All other values are to be left as calculated.

The topographical differences between the Sonoran FDRA in the western half of the SEZ and the unique topography of the southeastern Arizona Basin and Range country in the eastern half of the SEZ also aided the SEZ FDTG in determining the FDRA boundaries. The Basin and Range region of southeastern Arizona is characterized by abrupt changes in elevation, alternating between narrow faulted mountain chains and flat arid valleys or basins.

The role of the fire danger rating operating plan is to guide the application of the NFDRS at the unit level. It:

- Identifies the fire problems within the Southeast Zone.
- Defines which NFDRS indices and components best fit the fire management decision needs among the agencies.
- Defines fire-danger rating areas to which NFDRS outputs apply.
- Defines which NFDRS fuel model, slope class, and climate class that represent each fire-danger rating area.
- Designs a fire weather station network to collect the meteorological data necessary to support fire-danger rating and fire management decisions.
- Relates fire-danger and fire business to determine staffing levels, preparedness levels, preplanned dispatch levels, and fire prevention activities within the planning area.

In order to use this plan effectively, fire managers must understand the basic principles of the NFDRS:

1. NFDRS is not intended to predict how every fire will behave but to provide for short range planning. This system will determine the average worst case burning conditions across the landscape understanding that some risk is involved because the agencies cannot afford to staff for the absolute worst case conditions.
2. The NFDRS outputs are relative values (indices) of fire spread (i.e. spread component), flame length (i.e. burning index), and available fuel energy (i.e. energy release component).
3. The system only relates to the potential of an initiating fire that spreads without spotting through continuous ground fuels.
4. The system only addresses those aspects of fire control strategy affected by fire occurrence and fire behavior. The system is based on the concept of containment, not extinguishment. This allows limiting the scope of the rating to the behavior potential of the head fire.
5. The ratings are relative not absolute.
6. Fire-danger is rated on a worst case basis. This important principle must be understood to properly interpret fire-danger rating.

FireFamily Plus version 4.1 is a valuable analysis tool utilized for this planning effort. FireFamily Plus (FFP) is a software system used to summarize and analyze historical daily fire weather observations and to compute fire danger indices on the basis of the National Fire Danger Rating System (NFDRS) or the Canadian Fire Danger Rating System (CAN). Fire occurrence data can also be analyzed and cross-referenced with weather data to help determine critical levels for staffing and to establish fire danger for an area. FireFamily Plus allows for the performance of cumulative probability and logistic regression analysis of fire occurrence versus any weather variable or fire index.

The “Cumulative Fires Analysis” option generates frequency distribution of four groups of "weather days" in two ways: (1) frequencies as histograms and (2) cumulative distributions. Both contain the same information, but it is displayed differently. Weather groups shown are: all weather days regardless of fire activity, only weather days with a reported fire, only weather days with a large fire or only weather days with multiple fires. A Cumulative Analysis can be useful for displaying a graph of the frequency of fire days and cause.

The “Fires Probability Analysis” takes every historical weather day (date and index value) and assigns, from the “Fire Associations”, each day as a fire day, large fire-day, or multiple fire-days. The analysis performs a logistic regression for each fire-day type, and provides charts and Goodness of Fit statistics. Probability Analysis can be used for finding an index that gives meaningful information about fire business in the analysis area (Fire Danger Rating Area).

The goal is to rate models (indices) by reviewing the following:

Goodness of Fit:

- Chi-Square (Lower is better) - <13 is excellent, <20 is good, > 26 is not so good.
- Logistic Regression (RL^2) - (the closer the value is to "1" the better the model fits the data).

1. **Range of Probabilities over the range of the Predictor Variable** (i.e. Temperature, RH, ERC, BI, etc.).
   - A larger probability range is better; i.e. 0.1 to 0.9 is very good (see Example 1).
2. **Distribution of predictor variables.**
   - A wider range allows more flexibility in setting levels for fire business.
   - We do not want 90% of all observations in one or two classes.

```
Fire-Day:
    P(Fire-Day) = 1 / (1 + exp(-1 * -2.5374 + (-1 * 0.0182) * BI))
      Number of Weather-Days: 8160
      Number of Fire-Days: 1359
Chi-Squared Goodness of Fit Tests for Fire-Day
                                        FD        FD          No-FD
 Prob. Range     BI Range    Days  Pct   Obs     Exp     Obs     Exp   Chi-Square
-------------------------------------------------------------------------------
 0.07 - 0.11      0 -    24    853   10     86      81     767     772        0.4
 0.11 - 0.12     25 -    31    800   11     91      93     709     707        0.1
 0.12 - 0.13     32 -    37    910   12    111     117     799     793        0.4
 0.14 - 0.15     38 -    42    856   15    129     121     727     735        0.7
 0.15 - 0.15     43 -    46    692   16    108     104     584     588        0.2
 0.16 - 0.17     47 -    52    897   15    139     146     758     751        0.4
 0.17 - 0.18     53 -    58    811   15    120     145     691     666        5.1
 0.19 - 0.20     59 -    65    745   21    154     146     591     599        0.6
 0.21 - 0.24     66 -    77    837   24    203     187     634     650        1.7
 0.25 - 0.49     78 -   137    759   29    218     219     541     540        0.0
-------------------------------------------------------------------------------
                           8160   17   1359    1359    6801    6801        9.5
-------------------------------------------------------------------------------
Chi Square     DF    P-Value     R(L)-Sq.
      9.5       8     0.3028     0.94
```

Example 1. FireFamily Plus analysis showing Range of Probabilities (0.07 – 0.49)

Objectives

A. Provide a tool for agency administrators, fire managers, dispatchers, agency cooperators, and firefighters to gauge fire danger within fire suppression areas.
B. Define fire danger rating areas with similar weather, fuels, topography, and fire occurrence within the Southeast Zone (SEZ) dispatch area
C. Describe the current fire weather monitoring network within the SEZ made up of Remote Automated Weather Stations (RAWS).
D. Determine fire business and adjective fire danger rating breakpoints using the Weather Information Management System (WIMS), the National Fire Danger Rating System (NFDRS), FireFamily Plus software, and by analyzing historical climatological data and fire history.
E. Define roles and responsibilities to assist in making fire planning and management decisions, manage weather information, provided weather forecasts, and brief fire suppression personnel.
F. Ensure that agency administrators, fire managers, and cooperating agencies, private industry (ranchers, land owners, utility companies, etc.), and the public are notified of the adjective fire danger rating and local preparedness levels.
G. Make recommendations to personnel outlining specific daily actions to take at each planning level.

H. Develop and distribute fire danger pocket cards to all personnel involved with fire suppression activities.
I. Develop a fundamentally solid Fire Danger Operating Plan that also provides opportunities for improvements and updates.

Roles and Responsibilities

Southeast Zone Fire Danger Technical Group

Each Participating agency will be responsible for providing an NFDRS technical specialist to participate in the maintenance, review, and update of the plan. They will provide oversight to insure coordination between the agencies is occurring. The technical group consists of the following agencies and individuals (Table 1):

Agency	Technical Specialist
SEZ Tucson Interagency Dispatch	Mike Wilke
Coronado National Forest	Chris Stetson
AZ BLM Gila District	Mark Pater
NPS	Perry Grissom
USFWS	Rod Lopez
Tohono O'odham Nation	Guy Acuña
Arizona State Forestry Division	Gene Beaudoin

Table 1. SEZ Fire Danger Technical Group

Tucson Interagency Dispatch Center

Personnel at SEZ Tucson Interagency Dispatch Center are responsible for WIMS program implementation, station catalog maintenance and the dissemination of the daily fire-danger outputs to the field. The dispatch center will communicate daily, by radio and internet these outputs.

WIMS: NFDRS components and indices are calculated using the NFDRS processor within the Weather Information Management System (WIMS). Fire danger calculations are made daily based on a single observation taken at 1300 hours Local Standard Time (LST). The Tucson Dispatch Center (TDC) is responsible for the daily monitoring and editing of inputs.

Station Catalog Maintenance: The TDC designated personnel is responsible for assuring that station catalog information is reviewed on a yearly basis. Only designated personnel will have edit access to all catalogs and will adjust inputs as necessary after station analysis has been performed by the agency technical specialist.

Communication of Outputs: The afternoon forecast package will consist of the fire weather forecast, today's fire-danger indices and the next day forecasted indices for the SEZ. They will include the following:

1. ERC – today's value and tomorrow's forecasted value.
2. Adjective Rating - today's value and tomorrow's forecasted value.

Duty Officer (FMO's, AFMO's, FOS's)

For the purpose of this plan, a Duty Officer is defined at an FMO, AFMO, FOS, or whoever the local unit designates who can provide input and guidance regarding planning and dispatch levels. Duty Officers are responsible for the implementation of this plan; ensuring decisions made are consistent with the intent of the plan. Duty Officers will assure that their personnel understand NFDRS outputs and how to apply them to daily operations. These indices and their implications to the day's operations can be in discussions each morning by all field going personnel as a part of their daily briefings.

Fuel Moisture Monitoring: Each unit conducting fuel moisture monitoring activities within the SEZ is responsible for following the "*2007 Utah Fuel Moisture Sampling Guide*

[http://www.wfas.net/nfmd/references/fmg.pdf]" when collecting fuel moisture samples. Each unit is also responsible for following the National Fuel Moisture Database (NFMD) User's Guide when providing data input into the National Fuel Moisture Database. Fuel moisture information can be used in conjunction with current Energy Release Component (ERC) indices to determine adjective fire danger rating levels and provide a basis for severity funding requests.

Unit Fire Program Managers
Unit Fire Program Managers for each cooperating agency in the SEZ will utilize this Fire Danger Operating Plan and NFDRS outputs as a tool in developing appropriate decision matrices to establish appropriate fire related actions. It is the responsibility of the Unit Fire Program Manager to ensure this plan is utilized, maintained, and communicated.

Fire Danger Rating Inventory and Analysis

Involved Parties and Cooperators
This plan will affect a broad range of agency partners, cooperators, industrial companies, and general public groups and individuals. These entities have been grouped into three primary categories:

1. **Agency:** There are six agencies cooperating in the administrative unit of the analysis area. They include:
    - **National Park Service:** Saguaro NM; Chiricahua NM; Fort Bowie NM; Coronado NM; Fort Bowie National Historic Site; Organ Pipe Cactus NM; Tumacacori Nat Historic Park
    - **Coronado National Forest :** Douglas Ranger District; Nogales Ranger District; Safford Ranger District; Sierra Vista Ranger District; Santa Catalina Ranger District
    - **BLM Gila District:** Tucson Field Office; Safford Field Office
    - **US Fish and Wildlife Service:** Buenos Aires NWR; San Bernardino NWR
    - **Tohono O'odham Nation**
    - **Arizona State Forestry Division**
2. **Industry:** Organizations or businesses that either utilize the natural resources or have permits to conduct activities on federal, state, or private lands for commercial purposes. These entities include, but are not limited to, utility companies (power, communications), ranchers, railroads, timber harvesting, ski resorts, construction, etc.
3. **Public:** Individuals or groups who use the land for recreational purposes such as off-highway vehicle (OHV) activities, camping, hiking, hunting, fishing, skiing, firewood gathering, mountain biking, trail riding, etc. This group also includes those living within the wildland-urban interface.

Fire Problem Analysis
Table 2 displays the differences between the three target groups (Agency, Industry, and Public). The ability to regulate, educate or control the activities of a particular user group will be based on the interface method and how quickly the target audience can respond to the action being implemented. In addition, each action will result in either positive and/or negative impacts to the target audience. Accordingly, the decision tool that will be most appropriate will depend on the sensitivity of the target audience to the enactment of the selected action. When selecting a component and/or index, several factors must be considered:

Problem/Issue: This is an issue specific to the area of concern and includes ignition sources. The issue is framed to focus on a wildland fire management concern, such as the point when fire activity begins to exceed the capabilities of the local suppression resources.

Management Action (Application): The management actions are those which will affect agency personnel, industry, or the public. This includes fire management applications which can be used to formulate decisions regarding potential issues which have been identified for a specific area. Management actions represent a means 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, Restrictions, Closures, etc.).

Target Group: A group of people commonly associated with a fire management issue (Agency, Industry or Public).

Degree of Control: A general description relating how much control an agency can implement (Low, Moderate, High) and how quickly a target group can act in response to the implementation of management actions.

Communication: Types of communication used to inform user groups (i.e. face-to-face, radio, telephone, e-mail, media outlets, signing/posting, internet, etc.).

Potential Impacts: The potential impacts on the target group and the likely consequences of the decision (positive or negative).

Component/Index: Sensitivity of the NFDRS outputs should be consistent with the ability to communicate effectively to the target group. Memory and variability of the selected component or index must be understood to appropriately match the management action and the user group. If a situation where control and the ability to communicate with the target group is high, the component and/or index which is chosen to be the most appropriate should also be highly reactive to changing conditions (i.e. Ignition Component, Burning Index). If the chosen 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).

Fire Problem Analysis Chart

Problem / Issue	Management Action (Control Mechanism)	Target Group			Degree of Control	Communication	Potential Impacts	NFDRS Index / Component
		Agency	Industry	Public				
Miscellaneous Fires (Human-caused unknown origin)	Consider Fire Restrictions based on **Preparedness Level** Increased Prevention Patrols Prevention signs based on **Adjective Rating Level** Increased LEO Patrols	USFS BLM AZ State BIA NPS USFWS,		Recreation groups, campers, hikers, tourists, motorists	Moderate	Communicate via Dispatch daily to agency personnel for implementation. Communicate via various media outlets. Post appropriate signage	Public displeasure Increased agency workload Increased agency costs Increased suppression costs	Energy Release Component Ignition Component
Escaped Campfires	Consider Fire Restrictions based on **Preparedness Level** Increased Prevention Patrols Prevention signs based on **Adjective Rating Level** Increased LEO Patrols	USFS BLM AZ State BIA NPS USFWS,		Recreation groups, campers, hikers, tourists	Moderate	Communicate via Dispatch daily to agency personnel for implementation. Communicate via various media outlets. Post appropriate signage	Public dissatisfaction Increased agency workload Prevention/Mitigation Workload	Energy Release Component Ignition Component
Equipment Use	Consider Industrial restrictions based on **Preparedness Level** Consider Fire Restrictions based on **Preparedness Level** Prevention signs based on **Adjective Rating Level**	USFS BLM AZ State	Contractors, ADOT, Power Companies	OHV groups, campers, woodcutters	High	Contract pre-work meetings; Contract/Permit stipulations. IFPL implementation Post adjective fire danger level via media outlets and signs.	Potential for Industrial economic impacts Potential for social impacts (i.e. firewood cutting) Public dissatisfaction	Energy Release Component Ignition Component
Debris Burning	Consider Fire Restrictions Increased Prevention Patrols Prevention signs based on **Adjective Rating Level** Consider increased LEO Patrols	BIA AZ State	Highway construction crews	Private individuals	Moderate	Communicate via Dispatch daily to agency personnel for implementation. Communicate via various media outlets. Post adjective fire danger levels via signs and media outlets.	Public dissatisfaction Increased agency workload	Energy Release Component Ignition Component
Suppression Resources limited or committed to multiple fires	Preposition suppression resources based on **Staffing Level**.	USFS BLM AZ State BIA NPS USFWS,			High	Dispatch Center retrieves actual and forecasted fire danger indices from WIMS and communicates this information to Duty Officers.	Agency costs Suppression costs	Energy Release Component Ignition Component
Suppression Resources unavailable after work hours and/or on scheduled days off.	Extended or Supplemental staffing based on **Staffing Level**.	USFS BLM AZ State BIA NPS USFWS,			High	Dispatch Center retrieves actual and forecasted fire danger indices from WIMS and communicates this information to Duty Officers. Duty Officer notifies respective agency personnel through appropriate channels.	Agency costs Suppression costs	Energy Release Component Ignition Component
Arson	Consider increased Prevention and LEO patrols Post prevention signs based on **Adjective Rating Level**.	USFS BLM BIA USFWS AZ State		Individuals	Low	Communicate via various media outlets. Post adjective fire danger levels via signs and media outlets.	Increased agency workload Increased agency costs Increased suppression costs	Energy Release Component Ignition Component

Table 2. Fire Problem Analysis.

Fire Danger Rating Areas

The Southeast Zone Interagency Fire Danger Planning Area is comprised of three Fire Danger Rating Areas (FDRAs). They are identified as the Sonoran Fire Danger Rating Area, the Basin and Range Low Elevation (<5,500') Fire Danger Rating Area and the Basin and Range High Elevation (>5,500') Fire Danger Rating Area. These zones were identified primarily due to their vegetative, climatic and topographical characteristics.

Sonoran Fire Danger Rating Area

Sonoran FDRA Location

The Sonoran FDRA is located in southern Arizona and comprises the western half of the Southeast Zone (see Map, Appendix K-1). Cooperating agencies within this FDRA include Tribal lands, U.S. Fish and Wildlife Service, National Park Service, USFS Coronado National Forest, BLM, Bureau of Reclamation, Military lands, Arizona State and county and private lands (see Chart 1).

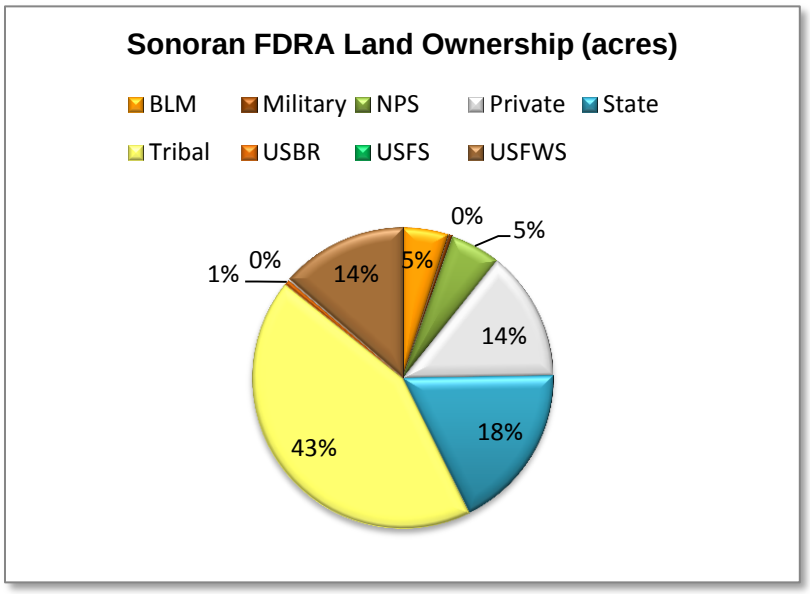


Chart 1. Sonoran FDRA ownership and acres.

Sonoran FDRA Vegetation and Fuels

The Sonoran FDRA supports desert shrub vegetation (see Map, Appendix K-2). The giant saguaro cactus is a widely recognizable species that characterizes the area. Various desert shrub and cactus species indicative of this ecosystem include bursage, desert wolfberry, desert saltbush, desert broom, creosote bush, mesquite, burroweed, ocotillo, cholla, and prickly pear. Bush muhly, Arizona cottontop, threeawns, and fluffgrass are the main understory plants. Winter annuals can grow in some areas, depending on the amount of winter precipitation. Joshua-tree and little-leaf palo verde mixed with some honey mesquite are on stony or rocky sites. These sites have an understory of Mormon tea, prickly pear, cholla, ocotillo, desert saltbush, and grasses. At the lower elevations, creosote bush, ironwood, mesquite, burroweed, and catclaw are associated with an understory of threeawns and annual grasses and forbs.

Although NFDRS Fuel Model A ("Western Annual Grass") represents the predominant fuel within this FDRA, it does not associate as well as Fuel Model G with the historical fire occurrence. In

this FDRA, NFDRS Fuel Model G correlates well for both Energy Release Component (ERC) and Ignition Component (IC).

Sonoran FDRA Climate

FireFamily Plus was used to determine the average dry bulb temperature and average monthly precipitation totals for the Sonoran FDRA. The Sonoran SIG (Special Interest Group: Saguaro RAWS, Sasabe RAWS, Sells RAWS) was used to compile and analyze these weather variables over a 20-year timeframe (1991 - 2011).

Analyzing weather data from the Sonoran SIG, the average annual precipitation is 9.72 inches for most of this area (Table 3). Typically, most of the rainfall occurs as high-intensity, convective thunderstorms, mainly from July to September, and as Pacific frontal storms from December to March. The average annual air temperature ranges from 64 to 97 ºF (18 to 36 ºC) (Table 4). The freeze-free period averages 285 days and ranges from 205 to 365 days, decreasing in length with increasing elevation.

Sonoran FDRA			
Month	**Mean Monthly Precipitation (in)**	**Average High Monthly Precipitation (in)**	**Average Low Monthly Precipitation (in)**
January	0.96	3.98	0.00
February	1.02	4.81	0.00
March	0.52	1.19	0.02
April	0.24	0.99	0.00
May	0.11	0.59	0.00
June	0.14	1.20	0.00
July	2.21	6.21	0.05
August	2.02	4.61	0.29
September	0.89	2.61	0.02
October	0.45	4.19	0.00
November	0.38	0.94	0.00
December	0.79	3.05	0.00
Total	9.72		

Table 3. Monthly precipitation averages for the Sonoran FDRA – Full Year. Data source: Sonoran SIG, FireFamily Plus.

Sonoran FDRA			
Month	**Mean Dry Bulb Temp (°F)**	**Average High Dry Bulb Temp (°F)**	**Average Low Dry Bulb Temp (°F)**
January	65	73	58
February	67	72	58
March	72	79	64
April	79	84	72
May	89	93	83
June	97	102	93
July	96	101	91
August	95	100	92
September	93	97	87
October	85	90	78
November	74	82	65
December	64	70	59

Table 4. Monthly Dry Bulb temperature averages for the Sonoran FDRA – Full Year. Data source: Sonoran SIG, FireFamily Plus.

The monthly dry bulb temperature averages for the identified fire season (April 1st – August 31st) in the Sonoran FDRA are shown in Table 5. Average temperatures range from 79 ºF in April to a high of 97 ºF in June. Average temperatures tend to decline slightly after the onset of the summer rains in July.

Sonoran FDRA			
Month	Mean Dry Bulb Temp (°F)	Average High Dry Bulb Temp (°F)	Average Low Dry Bulb Temp (°F)
April	79	84	72
May	89	93	83
June	97	102	93
July	96	101	91
August	95	100	92

Table 5. Monthly Dry Bulb temperature averages for the Sonoran FDRA – Fire Season. Data source: Sonoran SIG, FireFamily Plus.

The monthly total precipitation averages for the identified fire season (April 1st – August 31st) in the Sonoran FDRA are shown in Table 6. The months of May and June typically have the lowest total monthly averages with 0.11 inches and 0.14 inches respectively. The onset of the summer rain season usually begins in July and continues through August into September.

Sonoran FDRA			
Month	Mean Monthly Precipitation (in)	Average High Monthly Precipitation (in)	Average Low Monthly Precipitation (in)
April	0.24	0.99	0.00
May	0.11	0.59	0.00
June	0.14	1.20	0.00
July	2.21	6.21	0.05
August	2.02	4.61	0.29
Total	4.72		

Table 6. Monthly precipitation averages for the Sonoran FDRA – Fire Season. Data source: Sonoran SIG, FireFamily Plus.

C.W. Thornthwaite's "The Climates of North America According to a New Classification" publication was used to determine the climate class for each fire-danger rating area. The climate classes for the Sonoran FDRA includes the arid (climate class 1) for the western half of the Sonoran FDRA and semi-arid desert (climate class 2) for the eastern half of the Sonoran FDRA.

Sonoran FDRA Topography

The Sonoran FDRA is located in the Sonoran Desert Section of the Basin and Range Province of the Intermontane Plateaus. This FDRA has a number of short, fault-block mountain ranges trending southeast to northwest that rise abruptly from the smooth or gently sloping desert valley floors.

The basic consideration for selecting the slope class is the topography in the base area where initial attack is commonly taken. Precision in estimating slope class is subjective and absolute precision is not necessary. Slope classes within this FDRA are variable. The majority of fire activity (97%) occurs in Slope Class 1 (0-25). Slope Class analysis results for the Sonoran FDRA are displayed in Table 7.

Sonoran FDRA Slope Classes	
Slope Class	Fire Occurrence (%)
1 (0-25%)	97%
2 (26-40%)	1%
3 (41-55%)	1%
4 (56-75%)	1%
5 (>75%)	0%

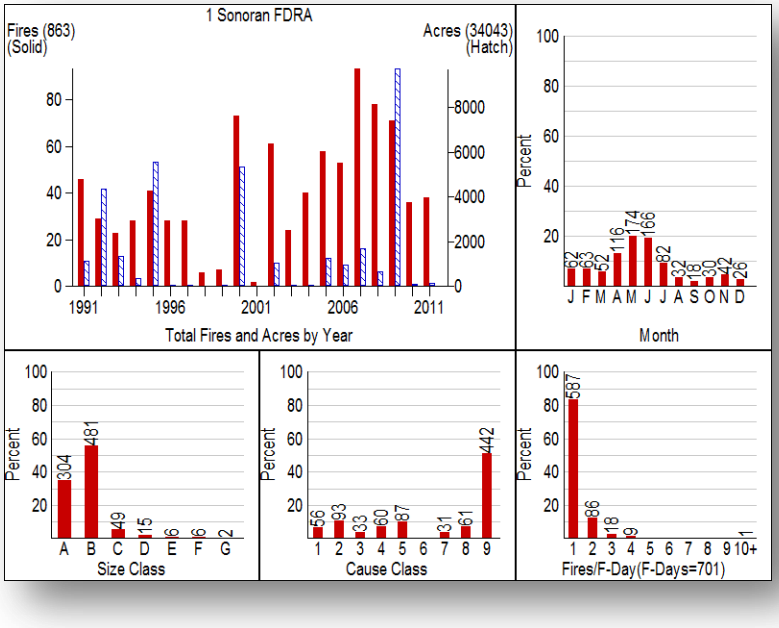
Table 7. Sonoran FDRA Slope Classes and Fire Occurrence per Slope Class category.

Sonoran FDRA Fire Occurrence

FireFamily Plus version 4.1 (FFP) was used to compile and analyze fire history data for the Sonoran FDRA. Evaluating the FFP fire summary data for the Sonoran FDRA, the FDTG determined the "Large Fire Size" to be nine (9) acres in size and the number of fires on a "Multi-Fire Days" to be two (2). The majority of fires within this FDRA are human-caused and the majority of all fires are Class A (≤ 0.25 acres) or B (0.26 – 9.9 acres) in size. For all cumulative and probability analyses the FDTG chose to use "Human" only as the cause class. For the 20-year analysis period (1991 -2011) only 6% of all fires recorded for a full year were caused by lightning (see Map, Appendix K-3).

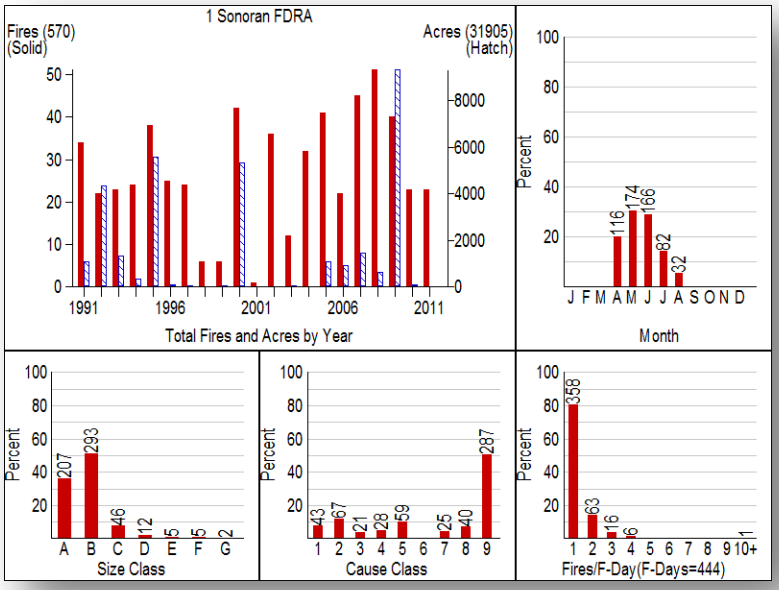
Lightning is not a primary fire problem within this FDRA. The FDTG decided that by removing the lightning-caused fires from the analysis process, the preferred predictor variables for this FDRA (ERC, IC, etc.) will provide acceptable analysis results regardless of the actual ignition source and result in more accurate development of fire business thresholds.

FFP fire history analyses show that during a full year (January 1st – December 31st) analysis period, from 1991 through 2011, the Sonoran FDRA recorded a total of 863 fires which burned a total of 34,043 acres (see Graph 1). The number of human-caused fires recorded for a full year within the Sonoran FDRA comprises 94% of all fires recorded.



Graph 1. Sonoran FDRA Fire History Summary, 1991-2011, January 1st – December 31st.

Fire history analyses for the Sonoran FDRA defined "fire season" to begin on April 1 and end on August 31. For fire seasons from 1991 through 2011, the Sonoran FDRA recorded 570 fires which burned a total of 31,905 acres. Forty three (8%) of these fires were caused by lightning (Cause Class 1); 240 fires (42%) were human-caused (Cause Classes 2-8); 287 fires (50%) were categorized in Cause Class 9 (Unknown) (see Graph 2).



Graph 2. Sonoran FDRA Fire History Summary, 1991-2011, April 1st – August 31st

Basin and Range Low Elevation Fire Danger Rating Area (<5,500')

Basin and Range Low Elevation FDRA Location

The Basin and Range Low Elevation FDRA is located in southern Arizona and comprises areas equal to or less than 5,500 feet in elevation within the eastern half of the SEZ (see Map, Appendix K-1). Land ownership within this FDRA includes Tribal lands, U.S. Fish and Wildlife Service, National Park Service, USFS Coronado National Forest, BLM, Bureau of Reclamation, Military lands, Arizona State, county and private lands (see Chart 2).

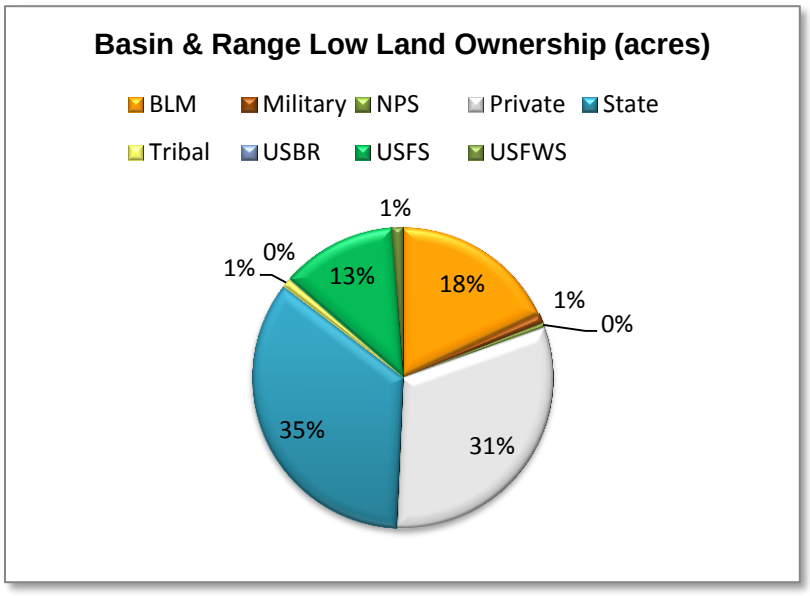


Chart 2. Basin and Range Low Elevation FDRA ownership and acres.

Basin and Range Low Elevation FDRA Vegetation and Fuels

The Basin and Range FDRA is comprised of a wide variety of low to mid-elevation (<5,500') vegetative communities (see Map, Appendix K-2). Based on the Level IV Ecoregion vegetation layer the predominant vegetation types include: Apacherian Valleys and Low Hills, Arizona Upland Eastern Sonoran Basins and Mountains, and Madrean Basin Grasslands. The upper elevation limits within this FDRA (5,500') includes some of the Lower Madrean Woodlands as they transition to the Basin and Range High Elevation FDRA.

This FDRA includes the Apacherian Valleys and Low Hills, Arizona Upland Eastern Sonoran Basins and Mountains, and the Madrean Basin Grasslands ecological systems which includes diverse semi-desert grassland and steppe vegetation. The vegetation in the Basin and Range Low Elevation FDRA is best described as upland shrub lands that are concentrated in the extensive grassland-shrub land transition in the foothills and piedmont in the Chihuahuan Desert. Mesquite species and other deep-rooted shrubs exploit deep soil moisture that is unavailable to grasses and cacti. Vegetation is typically dominated by honey mesquite or velvet mesquite and numerous succulents. These ecosystems begin on the valley bottoms and transition to gently sloping alluvial fans and plains below isolated desert mountains and on mesas and steeper piedmont and foothill slopes that have supported frequent fire.

Although NFDRS Fuel Model L ("Western Perennial Grass") represents the predominant fuel model within this FDRA, it does not associate as well as Fuel Model G with the historical fire occurrence. In this FDRA, NFDRS Fuel Model G correlates well for both Energy Release Component (ERC) and Ignition Component (IC).

Basin and Range Low Elevation FDRA Climate

FireFamily Plus was used to determine the average dry bulb temperature and average monthly precipitation totals for the Basin and Range Low Elevation FDRA. The Basin and Range Low Elevation SIG (Special Interest Group: Muleshoe RAWS, Empire RAWS, Rucker RAWS) was used to compile and analyze these weather variables over a 20-year timeframe (1991 – 2011).

Analyzing weather data from the Basin and Range Low Elevation SIG, the average annual precipitation is 12.83 inches for most of this area (Table 8). Typically, more than half of the precipitation occurs as high-intensity, convective thunderstorms during July, August, and September. Because of Pacific frontal storms, a second rainy season may occur from December to March. The average annual air temperature ranges from 57 to 89 ºF (14 to 32 ºC) (Table 9). The freeze-free period averages 245 days and ranges from 160 to 335 days, decreasing in length with elevation.

Basin and Range Low Elevation FDRA			
Month	**Mean Monthly Precipitation (in)**	**Average High Monthly Precipitation (in)**	**Average Low Monthly Precipitation (in)**
January	1.13	6.37	0.00
February	1.08	3.31	0.00
March	0.62	1.67	0.01
April	0.28	1.69	0.00
May	0.30	1.59	0.00
June	0.45	4.06	0.00
July	2.82	7.42	0.43
August	2.78	6.73	1.04
September	1.16	3.23	0.16
October	0.77	6.48	0.00
November	0.52	1.70	0.00
December	0.92	2.70	0.00
Total	12.83		

Table 8. Monthly precipitation averages for the Basin and Range Low Elevation FDRA – Full Year. Data source: BR Low SIG, FireFamily Plus.

Basin and Range Low Elevation FDRA			
Month	**Mean Dry Bulb Temp (°F)**	**Average High Dry Bulb Temp (°F)**	**Average Low Dry Bulb Temp (°F)**
January	58	65	50
February	60	66	53
March	64	70	59
April	72	78	66
May	81	87	76
June	89	93	84
July	87	92	82
August	86	90	80
September	84	88	78
October	76	80	70
November	66	74	57
December	57	63	51

Table 9. Monthly Dry Bulb temperature averages for the Basin and Range Low Elevation FDRA – Full Year. Data source: BR Low SIG, FireFamily Plus.

The monthly dry bulb temperature averages for the identified fire season (April 1st – August 31st) in the Basin and Range Low Elevation FDRA are shown in Table 10. Average temperatures during fire season range from 72 ºF in April to a high of 89 ºF in June. Average temperatures tend to decline slightly after the onset of the summer rains in July.

Basin and Range Low Elevation FDRA			
Month	**Mean Dry Bulb Temp (°F)**	**Average High Dry Bulb Temp (°F)**	**Average Low Dry Bulb Temp (°F)**
April	72	78	66
May	81	87	76
June	89	93	84
July	87	92	82
August	86	90	80

Table 10. Monthly Dry Bulb Temperature averages for the Basin and Range Low Elevation FDRA – Fire Season. Data source: BR Low SIG, FireFamily Plus.

The monthly total precipitation averages for the identified fire season (April 1st – August 31st) in the Basin and Range Low Elevation FDRA are shown in Table 11. The months of April and May typically have the lowest total monthly averages during this timeframe with 0.28 inches and 0.30 inches respectively. The onset of the summer rain season usually begins in July and continues through August into September.

Basin and Range Low Elevation FDRA			
Month	**Mean Monthly Precipitation (in)**	**Average High Monthly Precipitation (in)**	**Average Low Monthly Precipitation (in)**
April	0.28	1.69	0.00
May	0.30	1.59	0.00
June	0.45	4.06	0.00
July	2.82	7.42	0.43
August	2.78	6.73	1.04
Total	6.63		

Table 11. Monthly precipitation averages for the Basin and Range Low Elevation FDRA – Fire Season. Data source: BR Low SIG, FireFamily Plus.

C.W. Thornthwaite's "The Climates of North America According to a New Classification" publication was used to determine the climate class for each fire-danger rating area. The climate classes for the Basin and Range Low Elevation FDRA predominantly includes the semi-arid climate class (climate class 2), transitioning to the sub-humid climate class (climate class 3) as elevation increases towards the upper limits (5,500') of this FDRA.

Basin and Range Low Elevation FDRA Topography

This FDRA is characterized in the Mexican Highland Section of the Basin and Range Province of the Intermontane Plateaus. The Basin and Range Low Elevation FDRA encompasses elevations below 5,500' along several mountain ranges that trend southeast to northwest and the relatively smooth valleys located between the mountains. Examples of these mountain ranges are the Chiricahua, Dragoon, Swisshelm, and Pedregosa Mountains.

The basic consideration for selecting the slope class is the topography in the base area where initial attack is commonly taken. Precision in estimating slope class is subjective and absolute precision is not necessary. Slope classes within this FDRA are variable. The majority of fire activity (77%) occurs in Slope Class 1 and declines as the slope class increases. Slope Class analysis results for the Basin and Range Low Elevation FDRA are displayed in Table 12.

Basin and Range Low Elevation FDRA Slope Classes	
Slope Class	**Fire Occurrence (%)**
1 (0-25%)	77%
2 (26-40%)	14%
3 (41-55%)	6%
4 (56-75%)	3%
5 (>75%)	1%

Table 12. Basin and Range Low Elevation FDRA Slope Classes and Fire Occurrence per Slope Class category.

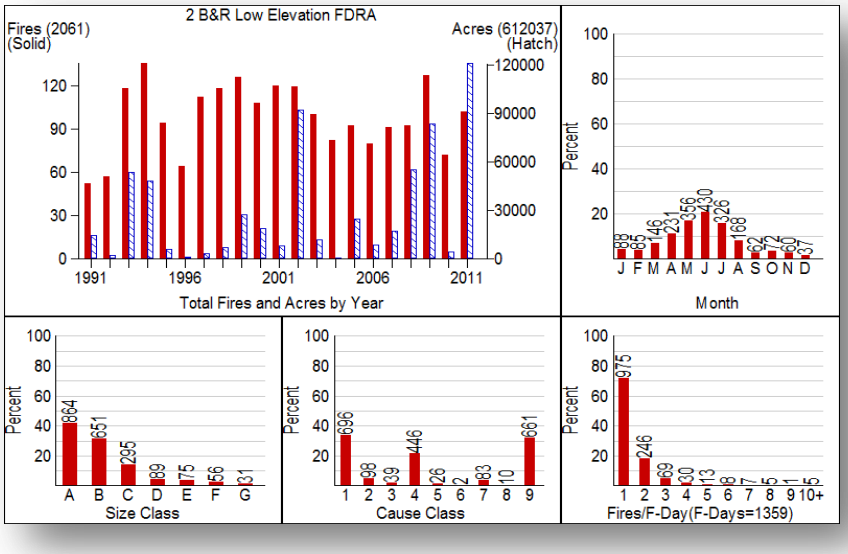
Basin and Range Low Elevation FDRA Fire Occurrence

FireFamily Plus version 4.1 (FFP) was used to compile and analyze fire history data for the Basin and Range Low Elevation FDRA. Evaluating the FFP fire summary data for the Basin and Range Low Elevation FDRA, the FDTG determined the "Large Fire Size" to be 220 acres in size and the number of fires on a "Multi-Fire Days" to be two (2). Sixty seven percent of all fires within this FDRA are human-caused (see Map, Appendix K-3).

For all cumulative and probability analyses the FDTG chose to use "Human" only as the cause class. When using "All Fires" as the fire cause in the fire analyses, the Goodness of Fit results (Chi-Square and Logistic Regression) were outside acceptable parameters. By removing lightning-caused fires from the analyses, the Goodness of Fit results fell within the acceptable range.

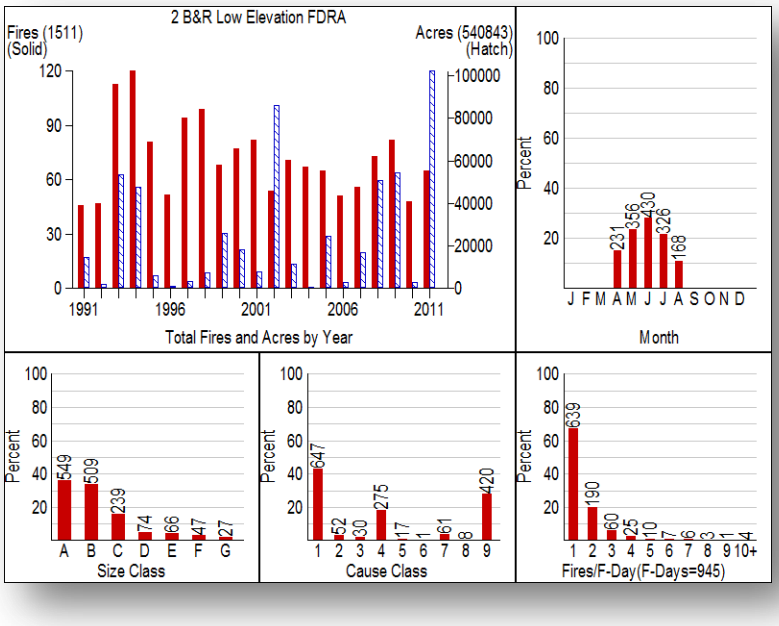
Although lightning is recognized as a contributor to the number of fire starts within this FDRA, it is not a primary fire problem. The FDTG decided that by removing the lightning-caused fires from the analysis process, the preferred predictor variables for this FDRA (ERC, IC, etc.) will provide acceptable analysis results regardless of the actual ignition source and result in more accurate development of fire business thresholds.

From 1991 through 2011, the Basin and Range Low Elevation FDRA recorded a total of 2,061 fires which burned a total of 612,037 acres. This 20-year timeframe includes all fires recorded between January 1st and December 31st for each year (see Graph 3).



Graph 3. Basin and Range Low Elevation FDRA Fire History Summary, 1991-2011, January - December.

Fire history analyses for the Basin and Range Low Elevation FDRA defined “fire season” to begin on April 1st and end on August 31st. For fire seasons from 1991 through 2011, the Basin and Range Low Elevation FDRA recorded 1,511 fires which burned a total of 540,843 acres. Approximately 647 fires (43%) were caused by lightning (Cause Class 1); approximately 444 fires (29%) were human-caused (Cause Classes 2-8); 420 fires (28%) were categorized in Cause Class 9 (Unknown) (see Graph 4).



Graph 4. Basin and Range Low Elevation FDRA Fire History Summary, 1991-2011, April – August

Basin and Range High Elevation Fire Danger Rating Area (>5,500')

Basin and Range High Elevation FDRA Location

The Basin and Range High Elevation FDRA is located in southern Arizona and comprises the eastern half of the Southeast Zone located above 5,500' in elevation (see Map, Appendix K-1). Land ownership within this FDRA includes National Park Service, USFS Coronado National Forest, BLM, Tribal Lands, Military lands, Arizona State, county and private lands (see Chart 3).

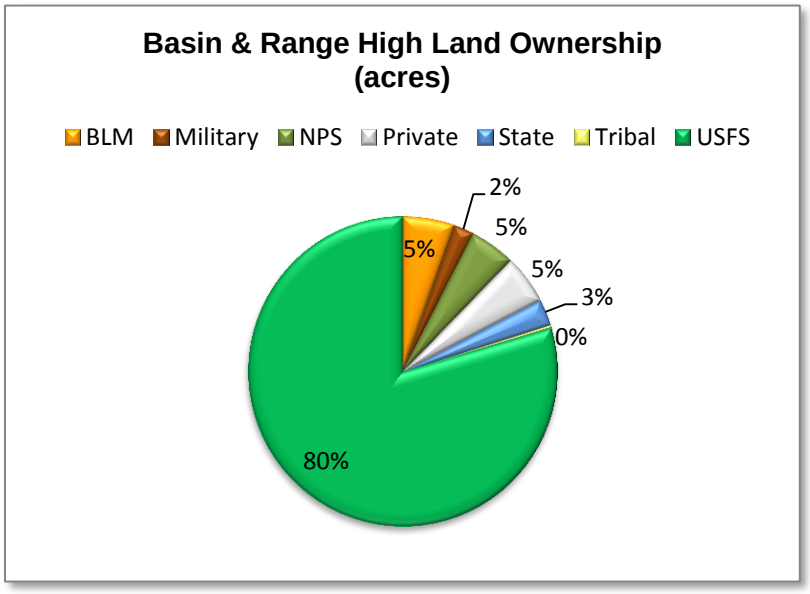


Chart 3. Basin and Range High Elevation FDRA ownership and acres.

Basin and Range High Elevation FDRA Vegetation and Fuels

The Basin and Range High Elevation FDRA is comprised of a variety of vegetative communities (see Map, Appendix K-2). Pine-oak woodlands are at the higher elevations, where ponderosa pine, Douglas-fir, live oak, New Mexico locust, Mexican pinyon, buckbrush, and manzanita grow along with an understory of muhlys, bluegrasses, sedges, pine dropseed, and squirreltail.

Evergreen woodland savannas are at lower elevations within this FDRA, where Mexican blue oak, Emory oak, and turbinella oak are the dominant species and cone beardgrass, sideoats grama, blue grama, Texas bluestem, plains lovegrass, sprucetop grama, threeawns, and needlegrass characterize the understory.

Basin and Range High Elevation FDRA Climate

FireFamily Plus was used to determine the average dry bulb temperature and average monthly precipitation totals for the Basin and Range High Elevation FDRA. The Basin and Range High Elevation SIG (Special Interest Group: Rincon RAWS, Scout Camp RAWS, Hopkins RAWS, Rucker RAWS) was used to compile and analyze these weather variables over a 20-year timeframe (1991 – 2011).

Analyzing weather data from the Basin and Range High Elevation SIG, the average annual precipitation is 12.78 inches for most of this area (Table 13). Typically, more than half of the precipitation occurs as high-intensity, convective thunderstorms during July, August, and September. Because of Pacific frontal storms, a second rain/snowfall season occurs from December to March. The average annual air temperature is 49 to 82 ºF (9 to 28 ºC) (Table 14). The freeze-free period averages 245 days and ranges from 160 to 335 days, decreasing in length with elevation.

Basin and Range High Elevation FDRA			
Month	Mean Monthly Precipitation (in)	Average High Monthly Precipitation (in)	Average Low Monthly Precipitation (in)
January	1.39	4.44	0.00
February	1.49	4.97	0.00
March	0.46	1.99	0.02
April	0.27	0.96	0.00
May	0.20	1.41	0.00
June	0.30	1.69	0.00
July	2.97	9.50	0.04
August	2.64	6.75	0.11
September	1.14	2.89	0.01
October	0.61	4.06	0.01
November	0.52	1.63	0.00
December	0.80	4.02	0.00
Total	12.78		

Table 13. Monthly precipitation averages for the Basin and Range High Elevation FDRA – Full Year. Data source: BR High SIG, FireFamily Plus.

Basin and Range High Elevation FDRA			
Month	Mean Dry Bulb Temp (°F)	Average High Dry Bulb Temp (°F)	Average Low Dry Bulb Temp (°F)
January	49	60	41
February	49	56	43
March	58	65	51
April	65	75	57
May	74	79	67
June	82	87	74
July	80	87	73
August	78	85	72
September	76	84	69
October	69	78	62
November	59	68	50
December	51	59	45

Table 14. Monthly Dry Bulb temperature averages for the Basin and Range High Elevation FDRA – Full Year. Data source: BR High SIG, FireFamily Plus.

The monthly dry bulb temperature averages for the identified fire season (May 1st – August 31st) in the Basin and Range High Elevation FDRA are shown in Table 15. Average temperatures during fire season range from 74 ºF in May to 82 ºF in June. Average temperatures tend to decline slightly after the onset of the summer rains in July.

Basin and Range High Elevation FDRA			
Month	Mean Dry Bulb Temp (°F)	Average High Dry Bulb Temp (°F)	Average Low Dry Bulb Temp (°F)
May	74	79	67
June	82	87	74
July	80	87	73
August	78	85	72

Table 15. Monthly Dry Bulb Temperature averages for the Basin and Range High Elevation FDRA – Fire Season. Data source: BR High SIG, FireFamily Plus.

The monthly total precipitation averages for the identified fire season (May 1st – August 31st) in the Basin and Range High Elevation FDRA are shown in Table 16. The months of May and June typically have the lowest total monthly averages during this timeframe with 0.20 inches and 0.30 inches respectively. The onset of the summer rain season usually begins in July and continues through August into September.

Basin and Range High Elevation FDRA			
Month	**Mean Monthly Precipitation (in)**	**Average High Monthly Precipitation (in)**	**Average Low Monthly Precipitation (in)**
May	0.20	1.41	0.00
June	0.30	1.69	0.00
July	2.97	9.50	0.04
August	2.64	6.75	0.11
Total	6.11		

Table 16. Monthly precipitation averages for the Basin and Range High Elevation FDRA – Fire Season. Data source: BR High SIG, FireFamily Plus.

C.W. Thornthwaite's "The Climates of North America According to a New Classification" publication was used to determine the climate class for each fire-danger rating area. The climate classes for the Basin and Range High Elevation FDRA includes the sub-humid climate class at the lower elevations beginning at 5,500' (climate class 3), transitioning to the humid and wet climate classes (climate classes 4 and 5) as elevation increases towards the upper elevations of this FDRA.

Basin and Range High Elevation FDRA Topography

The Basin and Range High Elevation FDRA is best characterized as the primary mountain ranges located within the FDRA. These mountain ranges include the Santa Teresa, Chiricahua, Pinaleño, Galiuro, Dragoon, Swisshelm, Huachuca and Pedregosa Mountains. Elevations range from 5,500' and above. The elevation on Mt. Graham (Pinaleño Mountains) reaches 10,717 feet (3,267 meters).

The basic consideration for selecting the slope class is the topography in the base area where initial attack is commonly taken. Precision in estimating slope class is subjective and absolute precision is not necessary. Slope classes within this FDRA are variable. The majority of fire activity within this FDRA is spread relatively evenly across Slope Classes 1 – 4. Slope Class analysis results for the Basin and Range High Elevation FDRA are displayed in Table 17.

Basin and Range High Elevation FDRA Slope Classes	
Slope Class	**Fire Occurrence (%)**
1 (0-25%)	28%
2 (26-40%)	26%
3 (41-55%)	23%
4 (56-75%)	17%
5 (>75%)	7%

Table 17. Basin and Range High Elevation FDRA Slope Classes and Fire Occurrence per Slope Class category.

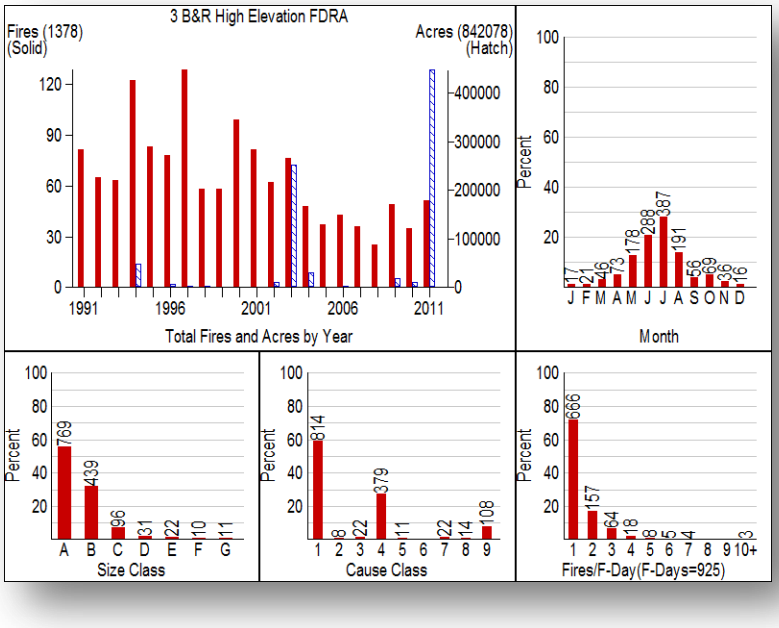
Basin and Range High Elevation FDRA Fire Occurrence

FireFamily Plus version 4.1 (FFP) was used to compile and analyze fire history data for the Basin and Range High Elevation FDRA. Evaluating the FFP fire summary data for the Basin and Range High Elevation FDRA, the FDTG determined the "Large Fire Size" to be 15 acres in size and the number of fires on a "Multi-Fire Days" to be two (2). Forty one percent of all fires within this FDRA are human-caused (see Map, Appendix K-3).

For all cumulative and probability analyses the FDTG chose to use "Human" only as the cause class. When using "All Fires" as the fire cause in the fire analyses, the Goodness of Fit results (Chi-Square and Logistic Regression) were outside acceptable parameters. By removing lightning-caused fires from the analyses, the Goodness of Fit results fell within the acceptable range.

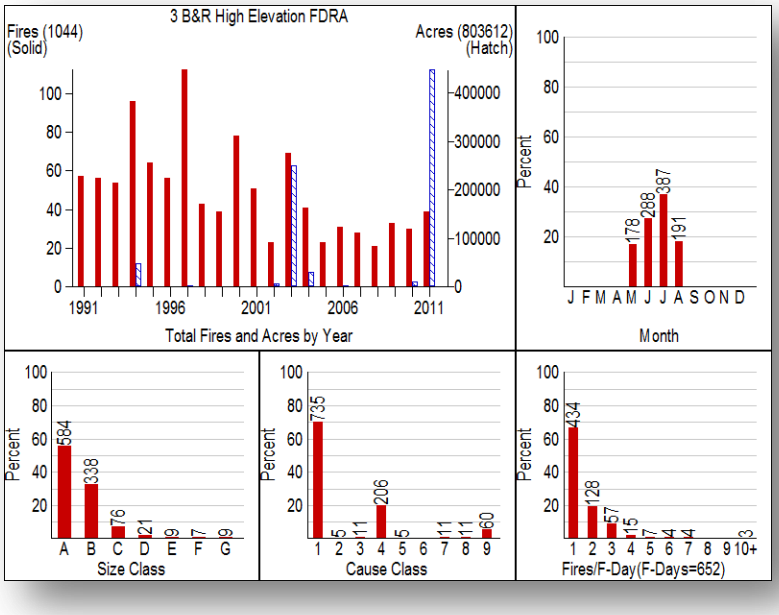
Although lightning is identified as a significant contributor to fire ignitions within this FDRA, it is not a primary fire problem. The FDTG decided that by removing the lightning-caused fires from the analysis process, the preferred predictor variables for this FDRA (ERC, IC, etc.) will provide acceptable analysis results regardless of the actual ignition source and result in more accurate development of fire business thresholds.

From 1991 through 2011, the Basin and Range High Elevation FDRA recorded a total of 1,378 fires which burned a total of 842,079 acres. This 20-year timeframe includes all fires recorded between January 1st and December 31st for each year (see Graph 5).



Graph 5. Basin and Range High Elevation FDRA Fire History Summary, 1991-2011, January - December.

Fire history analyses for the Basin and Range High Elevation FDRA defined "fire season" to begin on May 1st and end on August 31st. For fire seasons from 1991 through 2011, the Basin and Range High Elevation FDRA recorded 1,044 fires which burned a total of 803,612 acres. Approximately 735 fires (70%) were caused by lightning (Cause Class 1); approximately 249 fires (24%) were human-caused (Cause Classes 2-8); 60 fires (6%) were categorized in Cause Class 9 (Unknown) (see Graph 6).



Graph 6. Basin and Range High Elevation FDRA Fire History Summary, 1991-2011, April – August.

Weather Stations and Data

Remote Automated Weather Stations (RAWS)

The SEZ contains a network of remote automated weather stations (RAWS) (see Map, Appendix K-4). For this plan we are using nine (9) of those stations (see Table 18). Inclusion in the weather analysis depends primarily upon two criteria: 1) length of record, and 2) data consistency within the period of April to October. Each station was examined and judged upon these two criteria. In addition, two portable weather stations are available for prescribed burning and, if needed, when managing fires for multiple objectives.

Station Name and Responsible Agency	Station #	Elevation (ft)	Latitude & Longitude	Point of Contact
Horse Camp (BLM)	020903	4,040'	N32.9364° / W110.4933°	Mike Wilke
Muleshoe (BLM)*	021007	4,560'	N32.4039° / W110.2719°	Mike Wilke
Saguaro (CNF)*	021202	2,750'	N32.3184" / W110.8129"	Mike Wilke
Black Hills (BLM)	021008	3,300'	N33.0819° / W109.9511°	Mike Wilke
Guthrie (BLM)	021104	6,340'	N32.8819° / W109.3092°	Mike Wilke
Empire (BLM)*	021205	4,650'	N31.7836° / W110.6436°	Mike Wilke
Columbine (CNF)	021005	9,521'	N32.7039° / W109.9139°	Mike Wilke
Noon Creek (CNF)	021010	4,925'	N32.6678° / W109.7881°	Mike Wilke
Rucker (CNF)*	021414	5,700'	N31.7611° / W109.3486°	Mike Wilke
Carr (CNF)	021411	5,400'	N31.4450° / W110.2800°	Mike Wilke
Canelo (CNF)	021303	4,629'	N31.5497º / W110.5192º	Mike Wilke
Headquarters (NPS)	021409	5,400'	N32.0061° / W109.3569°	Mike Wilke
Sasabe (FWS)*	021206	3,500'	N31.6917° / W111.4481°	Rod Lopez
Rincon (CNF)*	021207	8,209'	N32.20638º / W110.5486º	Mike Wilke
Scout Camp (CNF)*	021208	7,554'	N32.398056º / W110.7250º	Mike Wilke
Sells (BIA)*	021209	2,262'	N31.9103° / W111.8975°	Guy Acuña
Hopkins (CNF)*	021302	7,120'	N31.675278º / W110.8800º	Mike Wilke

Table 18. Primary Weather Stations for the Southeast Zone
*Stations used for SIGs and FFP analyses.

WIMS Management

Designated personnel within the Southeast Zone will be responsible for station catalog maintenance for FDRA stations. Dispatchers will enter observations daily as scheduled. They will monitor for accuracy and inform personnel responsible for station maintenance when it appears that a station or sensor is not functioning properly. The designated personnel will ensure that stations are greened up, cured, and frozen at the proper times. Every three years the Technical Specialist will analyze data to update station catalog breakpoints whenever the breakpoints are adjusted.

RAWS Station Maintenance and Quality Assurance

RAWS will be maintained according to National Standards. Designated individuals within the TDC will be responsible for tracking the annual station maintenance of USFS (CNF) stations. BLM stations are on a "full service" contract handled from Boise. FWS and BIA are responsible for their stations. NPS stations are the responsibility of the unit (Rincon station), or the TDC (Headquarters station). All field maintenance should be completed annually. Each station has a Point of Contact (POC) (Table 13) with the responsibilities of carrying out the yearly station maintenance and to fix any problems that arise during the season. The minimum qualifications for a first responder are to have attended a RAWS station maintenance course. The stations' metadata will be kept up-to-date and monitored.

Daily Fire-Danger Rating Processes

The Tucson Interagency Dispatch Center is responsible for the daily monitoring and editing of all weather station and site inputs and the fire-danger outputs for the NFDRS. This information is to be disseminated to the field during the morning and (seasonally) afternoon fire weather forecast package. This process includes:

1. Morning - Read over the radio today's fire weather forecast and forecasted fire-danger indices for the day.
2. Afternoon – Edit observations in WIMS, keeping in mind numbers 3 and 4 below.
3. Review all other inputs from station sensors for accuracy and to assure that no station observations are missing. Fix all missing or inaccurate data in WIMS as soon as possible.
4. Review all outputs from WIMS for accuracy.
5. Afternoon – Read over the radio the afternoon fire weather forecast and the forecasted fire-danger indices for the next day.
6. Review the fire-danger rating forecasts for the SEZ posted on the Southwest Coordination Center (SWCC) Outlook page to insure accuracy (http://gacc.nifc.gov/swcc/predictive/fuels_fire-danger/fuels_fire-danger.htm).

Accuracy and storage of the daily weather data is critical for reliable outputs and future analysis. Training for persons responsible for inputting and editing weather observations and station maintenance are essential elements to maintain high-quality data going into the NFDRS calculations. Personnel responsible for these edits must have attended S-491, or have those personnel's edits reviewed by someone who has attended the S-491 National Fire Danger Rating System training.

Fire Danger Indices and Fire Business

Information Collection, Correlation and Interpretation

1. The fire weather history is created using a quality control process resulting in the most consistent, historic weather data available. Weather and fire history data from 1991 – 2011 was imported into FireFamily Plus version 4.1.
2. One Special Interest Group (SIG) was created for each FDRA.
   - The Sonoran SIG uses the Sells, Saguaro and Sasabe RAWS stations.
   - The Basin and Range Low Elevation SIG incorporates the Muleshoe, Empire, and Rucker RAWS stations.
   - The Basin and Range High Elevation SIG utilizes the Rincon, Scout Camp, Hopkins and Rucker RAWS stations.
3. Cumulative and Probability Fires Analysis graphs were used to identify the best fit by looking for the best separation between Fire Days, Large Fire Days, and Multiple Fire Days using the assigned index and fuel model (Appendix A through F). Each FDRA is unique in regard to fire cause, large fire size and multiple fire days. Fire Analysis input variables for each FDRA are:
   - Sonoran FDRA
     - Fire Cause: Human
     - Large Fire Size (acres): 9
     - Multiple Fire Days (Fires): 2
   - Basin and Range Low Elevation FDRA
     - Fire Cause: Human
     - Large Fire Size (acres): 220
     - Multiple Fire Days (Fires): 2
   - Basin and Range High Elevation FDRA
     - Fire Cause: Human
     - Large Fire Size (acres): 15
     - Multiple Fire Days (Fires): 2
4. The Fire Danger Indices that generally have the best fit for all three FDRAs are the Energy Release Component (ERC) and Ignition Component (IC). The NFDRS fuel model that best represents all three FDRAs is Fuel Model G (Tables 19.1 - 19.4).
5. Live Fuel Moisture also plays a major part in the potential of fire. Vegetative "Greenness" influences fire spread. The greener the vegetation, the lower the fire spread potential. Live fuels consist of: conifer needles; twigs and leaves of shrubs (evergreen and deciduous); and

green (live) grasses and forbs. Changes in live fuel moisture content are related to the physiological activity of the vegetation, and this activity is greatly influenced by soil moisture and the soil and air temperature. When precipitation is deficient, less new growth is produced and peak moisture in the living material can be less than during more moist years. If soil moisture deficiency persists through the summer, live fuel moisture can drop more rapidly.

6. Soil and air temperatures affect the time new growth starts and the level of moisture attained by the vegetation. In situations when soil moisture is not limiting, new growth will start earlier and often reach a higher level of moisture when the weather in late winter and spring is warm than when the weather is cold. Other factors that affect soil and air temperatures, such as slope, aspect, and elevation also affect the amount of new growth, the timing of growth, and the level of moisture in the living material.
7. Live plants may either suppress combustion or contribute to it, depending on their moisture content and flammability of chemical compounds contained in the plant. The NFDRS uses weather variables to estimate the moisture content of shrubs and herbaceous plants. These are then used in calculating the ignition component, spread component and energy release component. However, previous experience has shown that moisture content in live vegetation is controlled by species physiology and time of year and may not be accurately calculated from such external variables.

FDRA	Component Index	NFDRS Fuel Model	Probability Range	R^2	Chi^2	
Sonoran						
Sonoran SIG	ERC	7G	0.01 – 0.34	0.98	3.94	**Fire Day**
Sonoran SIG	ERC	7G	0.00 – 0.05	0.67	8.35	**Large Fire Day**
Sonoran SIG	ERC	7G	0.00 – 0.08	0.86	3.93	**Multi-Fire Day**
B&R Low						
B&R Low Elevation SIG	ERC	7G	0.09 – 0.48	0.86	23.94	**Fire Day**
B&R Low Elevation SIG	ERC	7G	0.00 – 0.12	0.83	12.59	**Large Fire Day**
B&R Low Elevation SIG	ERC	7G	0.03 – 0.18	0.78	15.51	**Multi-Fire Day**
B&R High						
B&R High Elevation SIG	ERC	7G	0.02 - 0.47	0.94	16.83	**Fire Day**
B&R High Elevation SIG	ERC	7G	0.00 - 0.17	0.85	13.94	**Large Fire Day**
B&R High Elevation SIG	ERC	7G	0.00 - 0.16	0.91	8.04	**Multi-Fire Day**

Table 19.1. Fire Season Fire Probability analyses results using ERC and Fuel Model G - FireFamily Plus.

FDRA	Component Index	NFDRS Fuel Model	Probability Range	R^2	Chi^2	
Sonoran						
Sonoran SIG	IC	7G	0.02 - 0.39	0.92	11.64	**Fire Day**
Sonoran SIG	IC	7G	0.00 - 0.06	0.67	9.25	**Large Fire Day**
Sonoran SIG	IC	7G	0.00 - 0.09	0.74	9.93	**Multi-Fire Day**
B&R Low						
B&R Low Elevation SIG	IC	7G	0.04 - 0.49	0.95	13.33	**Fire Day**
B&R Low Elevation SIG	IC	7G	0.00 - 0.13	0.93	5.34	**Large Fire Day**
B&R Low Elevation SIG	IC	7G	0.01 - 0.17	0.91	9.67	**Multi-Fire Day**
B&R High						
B&R High Elevation SIG	IC	7G	0.05 - 0.56	0.97	8.42	**Fire Day**
B&R High Elevation SIG	IC	7G	0.01 - 0.24	0.95	4.99	**Large Fire Day**
B&R High Elevation SIG	IC	7G	0.01 - 0.24	0.87	13.16	**Multi-Fire Day**

Table 19.2. Fire Season Fire Probability analyses results using IC and Fuel Model G - FireFamily Plus.

FDRA	Component Index	NFDRS Fuel Model	Probability Range	R^2	Chi^2	
Sonoran						
Sonoran SIG	ERC	7G	0.01 - 0.33	0.99	5.32	**Fire Day**
Sonoran SIG	ERC	7G	0.00 - 0.06	0.85	10.73	**Large Fire Day**
Sonoran SIG	ERC	7G	0.00 - 0.09	0.91	7.92	**Multi-Fire Day**
B&R Low						
B&R Low Elevation SIG	ERC	7G	0.01 - 0.48	0.98	10.9	**Fire Day**
B&R Low Elevation SIG	ERC	7G	0.00 - 0.12	0.93	9.29	**Large Fire Day**
B&R Low Elevation SIG	ERC	7G	0.00 - 0.16	0.96	7.58	**Multi-Fire Day**
B&R High						
B&R High Elevation SIG	ERC	7G	0.01 - 0.48	0.97	19.8	**Fire Day**
B&R High Elevation SIG	ERC	7G	0.00 - 0.21	0.93	18.62	**Large Fire Day**
B&R High Elevation SIG	ERC	7G	0.00 - 0.16	0.96	8.13	**Multi-Fire Day**

Table 19.3. Full Year Fire Probability analyses results using ERC and Fuel Model G - FireFamily Plus.

FDRA	Component Index	NFDRS Fuel Model	Probability Range	R^2	Chi^2	
Sonoran						
Sonoran SIG	IC	7G	0.02 - 0.37	0.97	8.95	**Fire Day**
Sonoran SIG	IC	7G	0.00 - 0.07	0.73	18.88	**Large Fire Day**
Sonoran SIG	IC	7G	0.00 - 0.10	0.90	7.30	**Multi-Fire Day**
B&R Low						
B&R Low Elevation SIG	IC	7G	0.02 - 0.49	0.98	8.61	**Fire Day**
B&R Low Elevation SIG	IC	7G	0.00 - 0.16	0.95	7.13	**Large Fire Day**
B&R Low Elevation SIG	IC	7G	0.00 - 0.19	0.96	8.67	**Multi-Fire Day**
B&R High						
B&R High Elevation SIG	IC	7G	0.03 - 0.59	0.99	6.28	**Fire Day**
B&R High Elevation SIG	IC	7G	0.00 - 0.36	0.98	5.08	**Large Fire Day**
B&R High Elevation SIG	IC	7G	0.00 - 0.29	0.99	0.97	**Multi-Fire Day**

Table 19.4. Full Year Fire Probability analyses results using IC and Fuel Model G - FireFamily Plus.

Fire Danger Decision Levels

The NFDRS utilizes the Weather Information Management System (WIMS) processor to evaluate weather data and forecasted data stored in the National Interagency Fire Management Integrated Database (NIFMID) to produce fire danger ratings for corresponding weather stations. NFDRS outputs from the WIMS processor can be used to determine various levels of fire danger rating to address the fire problems identified previously in the Fire Problem Analysis Chart. The system is designed to model a worst-case fire danger scenario. NFDRS will be utilized to produce outputs to assist fire management with four sets of decisions:

- ***Dispatch Levels*** will be used as a decision tool for dispatchers to assign initial attack resources to a fire reported in a specific dispatch zone.
- ***Staffing Levels*** will be used for appropriate day-to-day suppression resource staffing.
- ***Preparedness Levels*** will assist fire managers with more long-term (seasonal) decisions with respect to fire danger.
- ***Adjective Fire Danger Rating*** levels are intended to communicate fire danger to the public, such as fire danger signs.

Dispatch Level Analysis

Dispatch levels are established to assist fire managers with decisions regarding the most appropriate response to an initial fire report until a qualified Incident Commander arrives at the incident. The FireFamily Plus software has been used to establish the Dispatch Level thresholds.

A statistical analysis of fire occurrence and historical weather has been completed for each FDRA. The correlation of various combinations of NFDRS outputs with weather records is listed in Tables 19.1 – 19.4. Each agency will utilize the same Dispatch Levels calculated for each FDRA in response to wildland fires in the Southeast Zone.

Staffing Level Analysis

Staffing levels are established to assist fire managers with internal/agency staffing decisions. Staffing levels will be a function of Dispatch Level, current fire activity and the potential for ignitions in the next 24-hour period. *TDC's process for determining local Staffing Levels **is not the same** as Staffing Level calculated directly from WIMS.* WIMS calculates Staffing Level based on climatological breakpoints; TDC will calculate Staffing Level based on fire business thresholds. Each partner agency will develop their respective management actions based upon the five Staffing Levels.

Preparedness Level Analysis

Preparedness Levels are established to assist fire managers with weekly or monthly planning decisions based upon seasonal fire danger elements. FireFamily Plus was used to establish fire business thresholds (Table 20). A statistical analysis of fire occurrence and historical weather has been completed for each FDRA. The correlation of various combinations of NFDRS outputs with weather records is listed in the appendix. The final Preparedness Level determination will also incorporate a measure of current and projected levels of resource commitment due to fire activity and a measure of ignition risk. Each agency will consider management actions identified in the appendix based upon the five local Preparedness Levels.

Preparedness Level: FireFamily Plus Analysis Factors and Determinations

Rating Area	SIG/RAWS	Data Years Used	Weighting Factor	Fuel Model	NFDRS Index	Class	Range
Sonoran FDRA	SIG:			7G	ERC	1	0 – 45
	Sasabe	1991-2011	1			2	45 – 65
	Sells	1991-2011	1			3	65 – 86
	Saguaro	1991-2011	1			4	86 – 97
						5	97 - 114
Basin and Range Low Elevation FDRA	SIG:			7G	ERC	1	0 – 42
	Muleshoe	1991-2011	1			2	42 – 61
	Empire	1991-2011	1			3	61 – 86
	Rucker	1991-2011	1			4	86 – 97
						5	97 - 112
Basin and Range High Elevation FDRA	SIG:			7G	ERC	1	0 - 31
	Rincon	1991-2011	1			2	31 - 46
	Scout Camp	1991-2011	1			3	46 - 83
	Hopkins	1991-2011	1			4	83 – 94
	Rucker	1991-2011	1			5	94 - 109

Table 20. Fire Season Preparedness Level Analysis Results using FireFamily Plus.

Adjective Fire Danger Ratings

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 are described in Appendix G. In 2000, the NWCG Fire Danger Working Team reviewed and slightly revised these terms and definitions for adjective fire-danger.

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 FDRA. 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, *TIFC's process for determining local Adjective Fire Danger Ratings* ***is not the same*** *as Adjective Fire Danger Ratings calculated directly from WIMS*. TIFC will manually determine Adjective Fire Danger Rating based upon *fire business thresholds*. All partner agencies within SEZ will use the same Adjective Fire Danger Ratings calculated for each FDRA.

Climatological Percentiles

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

BLM – 80th and 95th percentiles
USFWS – 90th and 97th percentiles
USFS – 90th and 97th percentiles
NPS - 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 the calendar year (January – December) will be different from the percentile values for a given fire season (i.e. April – August). Each agency will have specific direction for the use of climatological percentiles. This plan does not support the use of ***climatological breakpoints (percentiles)*** as decision points. Instead, decisions will be based upon ***fire business thresholds*** that are determined through a comprehensive statistical analysis of historical weather correlated with fire occurrence data.

Operations and Applications

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 (NIFMID) 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. The system is designed to calculate worst-case scenario fire danger.

Worksheets (flowcharts) will be used to determine the daily Dispatch, Staffing, Preparedness and Adjective Rating levels. The resulting dispatch and staffing levels for each FDRA will be broadcast in combination with the morning information report and documented on the daily resource status report.

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

Specific Action and Staffing Guide

WIMS Setup and Application

The Weather Information Management System (WIMS) is a comprehensive system that enables users to manage weather information. SEZ will create a Special Interest Group (SIG) for each FDRA in WIMS. The SIGs represent the weather station network associated with the three

FDRAs within the SEZ. Weather observations for each station should be completed daily by TDC. Seasonal station maintenance should be completed as needed as fuels and seasonal conditions warrant.

Dispatch Level

Agency personnel use the dispatch level (response level) to assign an appropriate mix of suppression resources to a reported wildland fire based upon fire danger potential (Table 21). Dispatch levels are derived from the most appropriate NFDRS index and/or component that have a high level of correlation to historical fire occurrence. Ignition Component (IC) with NFDRS Fuel Model G has been determined to be the most appropriate NFDRS index that statistically correlates to the potential for large fires to occur (Appendix G). Due to the ability of IC to reflect the most current fire danger potential, and the TDC's ability to track agency personnel throughout the course of any given day, IC will be computed and implemented for initial attack response levels until a qualified Incident Commander evaluates the need for the dispatched resources.

Dispatch Level/Response Level Worksheet
Tucson Interagency Dispatch Center

Fire Danger Rating Area (FDRA)	Ignition Component (Fuel Model G)		
Sonoran FDRA	0-33	34-66	67-100
Basin & Range Low Elevation FDRA	0-33	34-66	67-100
Basin & Range High Elevation FDRA	0-33	34-66	67-100
Dispatch Level:	Low	Moderate	High

Table 21. Fire Season Dispatch Level Analysis based on the IC index.

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 cumulative frequency of occurrence using the Ignition Component (IC) index as related to a given Dispatch Level (Table 21). Staffing Levels are expressed as numeric values where "1" represents the low end of the fire danger continuum and "5" represents 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 personnel beyond their normal work schedules. In addition, the extended staffing of shared resources such as air tankers, helicopters, Hot Shot crews and other large fire support resources will be a function of the Staffing Level (Table 22). TDC will calculate Staffing Level based on fire business thresholds. Each partner agency will develop their respective management actions based upon the five Staffing Levels (Appendix H).

Staffing Level Worksheet
Tucson Interagency Dispatch Center

Dispatch Level		LOW		MODERATE		HIGH	
Fire Activity? Y/N	N	1	2	2	3	3	4
	Y	2	3	3	4	4	5
		N	Y	N	Y	N	Y
		Significant Fire Potential? Forecasted High Risk Day/Event (Y/N)					

Table 22. Fire Season Staffing Level Analysis based on the IC index.

1. **Dispatch Level:** The actual or forecasted Dispatch Level will be the first variable input to the Staffing Level Worksheet.

2. **Fire Activity:** Fire activity can be defined as any wildland fire (including prescribed fire) within the Southeast Zone Dispatch Area that requires a commitment of TIFC

suppression resources (i.e. if a TIFC suppression resource is committed to a local incident, “Fire Activity” is “Yes”.

3. **Southwest Area 7-Day Significant fire Potential / Forecasted High Risk Day/Event:** http://psgeodata.fs.fed.us/7day/action/forecast/6

Preparedness Level

The preparedness level is a five-tier (1-5) fire danger rating system that will be based on the ERC and indicators of fire business. The fire business indicators used to calculate the preparedness level includes an indication of fire activity, the SWA 7-Day Significant Fire Potential Outlook, Haines Index, and a measure of Ignition Risk. A worksheet can guide personnel through the process (see Tables 23 -25). Several procedures and guidelines are to be followed once the preparedness level has been determined (see Appendix I).

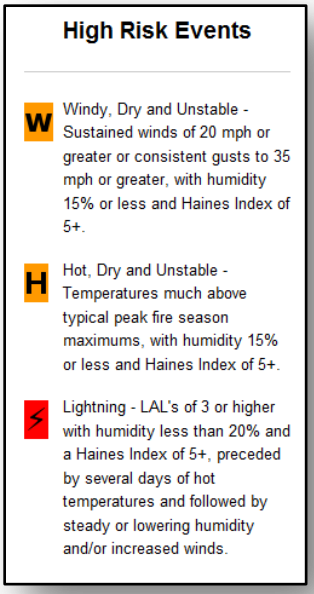
Worksheet Instructions:

1. **Staffing Index Value:** Place a checkmark in row one indicating the forecasted staffing index/component range. These indices are based on the 1300 RAWS observations which are input to the WIMS processor by Tucson Interagency Fire Center (TIFC) personnel.

2. **Haines Index**: Place a checkmark in row two indicating the forecasted Haines Index Range.

3. **Southwest Area 7-Day Significant Fire Potential Outlook:** Place a checkmark in row three based on the presence of a High Risk Day (http://psgeodata.fs.fed.us/7day/action/forecast/6).

If a *High Risk Event* in PSA SW06S for wind or lightning is forecasted for the current or next day, the Significant Fire Potential is a “Yes” input; otherwise it is a “No” input.



4. **Ignition Risk:** Place a checkmark in row four to indicate the relative risk of human and/or naturally caused ignitions. Human-caused risk is based upon activities such as holidays or special events occurring within the FDRA. During holidays (i.e. Memorial Day, Independence Day, Labor Day), the ignition risk is “High” otherwise it is “Low”. The ignition risk will also be set at “High” on the day before and after each of the above-listed holidays. Lightning Activity Level (LAL) would be the basis for relative risk for natural ignitions; a forecasted LAL of 4-6 is a “High” ignition risk, everything else is “Low”. If multiple LAL’s are forecasted within the FDRA, use the “High” risk level to complete the worksheet on row four.

5. **Fire Activity:** Fire activity will be “Yes” if approximately 50% of the suppression resources within the Tucson Interagency Dispatch Area (regardless of FDRA) are committed or responding to a fire. This may be revised if there is significant change in fire activity between the time the initial calculation is made (approximately 1500 hours) and when the Situation Report is due for submission to the Southwest Coordination Center (approximately 1900 hours). Place a checkmark in the appropriate box in row five.

Preparedness Level Worksheet – Sonoran FDRA

Name:_____ Date:_____

ERC – NFDRS Model G (Sonoran FDRA)	0 - 45		46 - 65		66 - 86		87 - 97		98+	
1 ✓ ➔	⇙⇘		⇙⇘		⇙⇘		⇙⇘		⇩	
Haines Index	2-4 ↓	5-6 ↓	2-4 ↓	5-6 ↓	2-4 ↓	5-6 ↓	2-4 ↓	5-6 ↓	2-6 ↓	
2 ✓ ➔	⇙⇘		⇙⇘		⇙⇘		⇙⇘		⇙⇘	
SWA 7-Day Significant Fire Potential Outlook	No ↓	Yes ↓	No ↓	Yes ↓	No ↓	Yes ↓	No ↓	Yes ↓	No ↓	Yes ↓
3 ✓ ➔	⇩		⇙⇘		⇙⇘		⇙⇘		⇙⇘	
Ignition Risk	Low-High ↓		Low ↓	High ↓	Low ↓	High ↓	Low ↓	High ↓	Low ↓	High ↓
4 ✓ ➔	⇩		⇙⇘		⇙⇘		⇙⇘		⇙⇘	⇩
Fire Activity	Yes or No ↓		No ↓	Yes ↓	No ↓	Yes ↓	No ↓	Yes ↓	No ↓	Yes ↓	Yes or No ↓
5 ✓ ➔										
Local Preparedness Level	1		2		3		4		5	

Table 23. Preparedness Level Worksheet – Sonoran Fire Danger Rating Area.

Preparedness Level Worksheet – Basin & Range Low Elevation FDRA

Name:_____ Date:_____

ERC – NFDRS Model G (Basin & Range Low Elevation FDRA)	0 - 42		43 - 61		62 - 86		87 - 97		98+	
1 ✓ →	⇙⇘		⇙⇘		⇙⇘		⇙⇘		⇩	
Haines Index	2-4 ↓	5-6 ↓	2-4 ↓	5-6 ↓	2-4 ↓	5-6 ↓	2-4 ↓	5-6 ↓	2-6 ↓	
2 ✓ →	⇙⇘		⇙⇘		⇙⇘		⇙⇘		⇙⇘	
SWA 7-Day Significant Fire Potential Outlook	No ↓	Yes ↓	No ↓	Yes ↓	No ↓	Yes ↓	No ↓	Yes ↓	No ↓	Yes ↓
3 ✓ →	⇩		⇙⇘		⇙⇘		⇙⇘		⇙⇘	
Ignition Risk	Low-High ↓	Low ↓	High ↓	Low ↓	High ↓	Low ↓	High ↓	Low ↓	High ↓	Low ↓	High ↓
4 ✓ →	⇙⇘		⇙⇘		⇙⇘		⇙⇘		⇙⇘	⇩
Fire Activity	Yes or No ↓		No ↓	Yes ↓	No ↓	Yes ↓	No ↓	Yes ↓	No ↓	Yes ↓	Yes or No ↓
5 ✓ →										
Local Preparedness Level	1		2		3		4		5	

Table 24. Preparedness Level Worksheet – Basin and Range Low Elevation Fire Danger Rating Area.

Preparedness Level Worksheet – Basin & Range High Elevation FDRA

Name:_____ Date:_____

ERC – NFDRS Model G (Basin & Range High Elevation FDRA)	0 - 31		32 - 46		47 - 83		84 - 94		95+	
1 ✓ →	⇙⇘		⇙⇘		⇙⇘		⇙⇘		⇩	
Haines Index	2-4 ↓	5-6 ↓	2-4 ↓	5-6 ↓	2-4 ↓	5-6 ↓	2-4 ↓	5-6 ↓	2-6 ↓	
2 ✓ →	⇙⇘		⇙⇘		⇙⇘		⇙⇘		⇙⇘	
SWA 7-Day Significant Fire Potential Outlook	No ↓	Yes ↓	No ↓	Yes ↓	No ↓	Yes ↓	No ↓	Yes ↓	No ↓	Yes ↓
3 ✓ →	⇩		⇙⇘		⇙⇘		⇙⇘		⇙⇘	
Ignition Risk	Low-High ↓	Low ↓	High ↓	Low ↓	High ↓	Low ↓	High ↓	Low ↓	High ↓	Low ↓	High ↓
4 ✓ →	⇙⇘		⇙⇘		⇙⇘		⇙⇘		⇙⇘	⇩
Fire Activity	Yes or No ↓		No ↓	Yes ↓	No ↓	Yes ↓	No ↓	Yes ↓	No ↓	Yes ↓	Yes or No ↓
5 ✓ →										
Local Preparedness Level	1		2		3		4		5	

Table 25. Preparedness Level Worksheet – Basin and Range High Elevation Fire Danger Rating Area.

Adjective Fire Danger Rating Determination

Although NFDRS processors (WIMS) will automatically calculate the adjective class rating, TDC will manually determine Adjective Fire Danger Rating based upon *fire business thresholds*. The actual determination of the daily adjective rating is based on the current or forecasted value of a selected staffing index (ERC) and ignition component (IC) using the Tables 26 - 28 below.

Sonoran FDRA

(ERC-G) ↓	Adjective Fire Danger Rating				
0 - 45	L	L	L	M	M
46 – 65	L	M	M	M	H
66 – 86	M	M	H	H	VH
87 – 97	M	H	VH	VH	E
97 - 114	H	VH	VH	E	E
IC–G →	0 - 19	20 – 39	40 – 59	60 – 79	80 - 100

Table 26. Sonoran FDRA Adjective Fire Danger Ratings

Basin & Range Low Elevation FDRA

(ERC-G) ↓	Adjective Fire Danger Rating				
0 – 42	L	L	L	M	M
43 – 61	L	M	M	M	H
62 – 86	M	M	H	H	VH
87 – 97	M	H	VH	VH	E
98 - 112	H	VH	VH	E	E
IC–G →	0 - 19	20 – 39	40 – 59	60 – 79	80 - 100

Table 27. Basin & Range Low Elevation FDRA Adjective Fire Danger Ratings

Basin & Range High Elevation FDRA

(ERC-G) ↓	Adjective Fire Danger Rating				
0 – 31	L	L	L	M	M
32 – 46	L	M	M	M	H
47 - 83	M	M	H	H	VH
84 – 94	M	H	VH	VH	E
95 - 109	H	VH	VH	E	E
IC–G →	0 - 19	20 – 39	40 – 59	60 – 79	80 - 100

Table 28. Basin & Range High Elevation FDRA Adjective Fire Danger Ratings

Seasonal Risk Analysis

Seasonal risk analysis is a comparison of the historic weather and fuels records with current and forecasted weather and fuels information. Seasonal risk analysis is a continuous responsibility for fire program managers. The most reliable indicators of seasonal fire severity have been measurements of fine fuel loading, live fuel moisture, 1,000-hour (dead) fuel moisture, and ERC. Current values will be compared to the historical maximum and minimum values as well as the historical averages. Graphs will be routinely updated and made available to fire suppression and dispatch personnel. Seasonal risk analysis information will be used as a basis for pre-positioning critical resources, dispatching resources, and requesting fire severity funding.

Key Factors and Trends

Fire Activity: The presence (or absence) of fire activity can be tracked and compared to historical occurrences in order to anticipate severity conditions. The Fire Summary module in FireFamily Plus provides an efficient means to compare monthly fire activity.

Live Fuel Moisture: Live fuel moisture plots have been established by the USFS and BLM in the SEZ. Valuable data has been collected and a direct correlation can be concluded between fire intensity (controllability) and live fuel moisture levels. Consequently, fire severity is determined by comparing current trends to historical averages. Species for fuel moisture sampling within the SEZ include: one-seed juniper, alligator bark juniper, scrub oak, Emory oak, Arizona white oak, pinyon pine, and manzanita. Comparisons of fuel moisture to historical conditions at various locations within the SEZ and surrounding areas can be located on the Southwest Coordination Center website: http://gacc.nifc.gov/swcc/predictive/fuels_fire-danger/fuels_fire-danger.htm.

Fine Fuel Loading: Fuel load samples are taken on an annual basis and compared to historical averages in order to determine the potential intensity of wildland fires in NFDRS fuel models A and L. Each agency that collects fine fuel loading data will e-mail the information to all members of the SEZ FMO group to be distributed to all fire personnel. The data will also be made available for posting on the Southeast Zone Interagency Fire website.

NFDRS Indicators: ERC and BI are used as the primary indicators to track seasonal trends of fire danger potential. NFDRS fuel models G has been chosen due to its applicability with ERC within the Basin and Range FDRA. Fuel model L has been chosen for its appropriate applicability to BI within the Sonoran FDRA. Consequently, the fuel models were selected due to their ability to predict fire occurrence; specifically on a day when a large fire is likely to occur.

Weather Trends: Seasonal weather assessments rely upon long-range (30-90 day) forecasts. This information is available in two formats: seasonal long-term outlooks and 30-90 day outlooks. This information is provided by the NOAA Climate Prediction Center: http://www.cpc.ncep.noaa.gov/

Drought Indicators: ERC and its component 1,000-hour fuel moisture has been proven in the western U.S. to be the most effective way to track seasonal drought and its effect on fire business and risk. The Keetch-Byrum Drought Index (KDBI) and the Palmer Drought Index track soil moisture and do not accurately correlate with fire risk in the western U.S. although the general public is more familiar with these indices for providing drought information. Current KDBI information is located on the Wildfire Assessment System (WFAS) website: http://www.wfas.net/. Tracking and comparing 1,000-hour fuel moisture is another method to assess drought conditions.

Normalized Difference Vegetation Index (NDVI): NDVI data is satellite imagery which displays vegetative growth and curing rates of live fuels. The WFAS website provides several different ways to analyze current and historical greenness imagery which can be a significant contributor to seasonal risk assessments.

Season Ending Events: Although fire season in the SEZ can last all year, fire activity tends to trend downward as days get shorter, average temperatures decline and RH recovery improves in the fall. "Season End" does not mean that fires cannot start and spread but that large fires are improbable.

Pocket Cards and Development

At a minimum, Pocket Cards need to directly relate to daily operations and indices with which people are familiar. That is, the fuel model and fire danger rating index must be the same as what is referred to in daily briefings and weather reports. If possible, the fuel model and index should be selected through a fire business analysis using FFP software. Because the card is meant to enhance situational awareness and firefighter safety, whatever fuel model and index are used, they need to be defined and rigorously supported with daily information to the field.

FireFamily Plus software allows users to overlay two years for comparison of fire danger conditions. One should be a year with relatively high fire danger and the other with low fire danger. Both years should be recent, to give the local firefighter a point of reference.

The Fire Danger Pocket Card is a tool based on the National Fire Danger Rating System (NFDRS) to help the firefighter develop an awareness of the current fire situation that you are about to step into. The prime objective of the NFDRS is to provide a measure of the seriousness of local burning conditions. The Pocket Card provides a visual reference of those conditions and how they compare to previous fire seasons.

- *What is Fire Danger Rating?*
  - A decision *aid* that describes the factors - fuels, weather and topography - which affect the initiation, spread and difficulty of control of wildfires on an area.
  - We emphasize *aid* because fire danger rating information is not the answer by itself; it must be considered along with local knowledge of an area.
- *What will the Fire Danger Pocket Card do?*
  - The Fire Danger Pocket Card is useful in initial fire size up, initial attack and extended attack.
  - The Fire Danger Pocket Card gives firefighters a general indicator of the potential for the fuels to support extreme fire behavior and of the difficulty of control.
- *What won't the Fire Danger Pocket Card do?*
  - The Fire Danger Pocket Card will not provide site specific fire behavior predictions.
- *How Do Firefighters use the Fire Danger Pocket Cards?*
  - Compare current and predicted local fire danger to historical local fire danger in order to enhance situational awareness.
  - Use this information to be aware of indicators that predict the potential for extreme fire behavior.

A Pocket Card (PC) will be developed for each FDRA within the Southeast Zone. All three FDRAs will use the NFDRS Fuel Model G, and the NFDRS Energy Release Component (ERC) index. Fuel Model G correlates well for both Energy Release Component (ERC) and Ignition Component (IC) with historical fire occurrence (see Exhibits 1.1 – 1.3).

The Energy Release Component (ERC) is a calculated output of the National Fire Danger Rating System (NFDRS). The 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. The ERC is considered a composite fuel moisture index as it reflects the contribution of all live and dead fuels to potential fire intensity. As live fuels cure and dead fuels dry, the ERC will increase and can be described as a build-up index. The ERC has memory. Each daily calculation considers the past 7 days in calculating the new number. Daily variations of the ERC are relatively small as wind is not part of the calculation.

SEZ Pocket Cards will be evaluated and updated each year, prior to fire crews working in the field environment. It is recommended that each station have a board to track current indices. FireFamily Plus 4.1 (FFP) will be used to create the Pocket Cards.

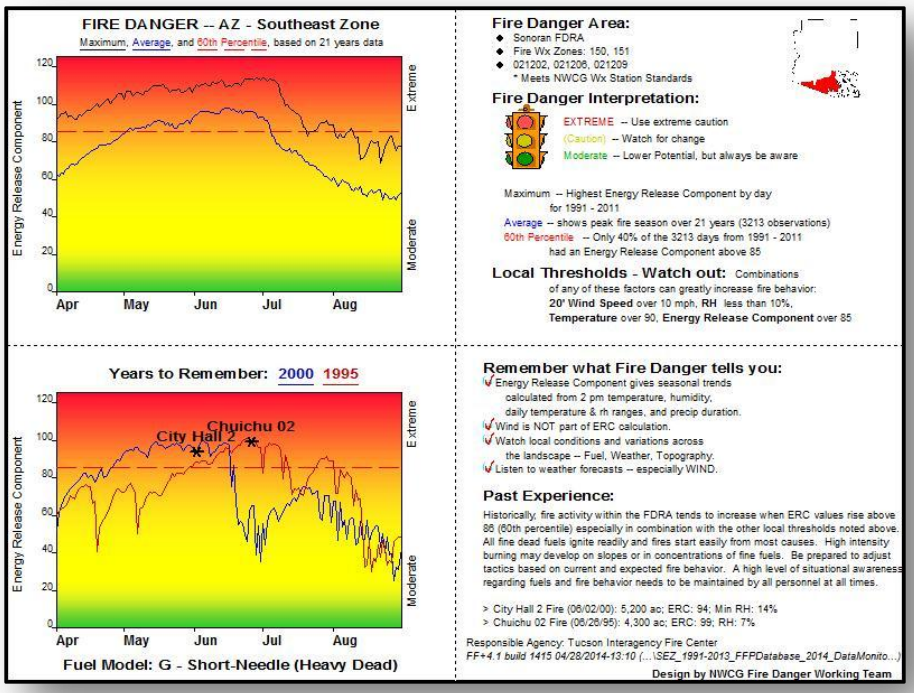


Exhibit 1.1. Sonoran FDRA Pocket Card using the ERC index.

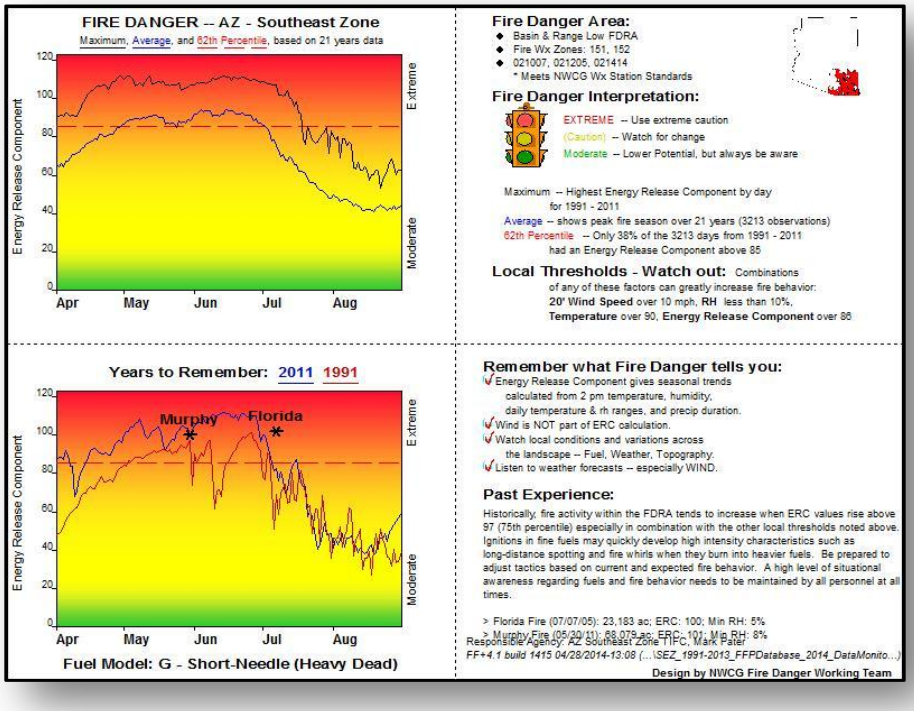


Exhibit 1.2. Basin & Range Low Elevation FDRA Pocket Card using the ERC index

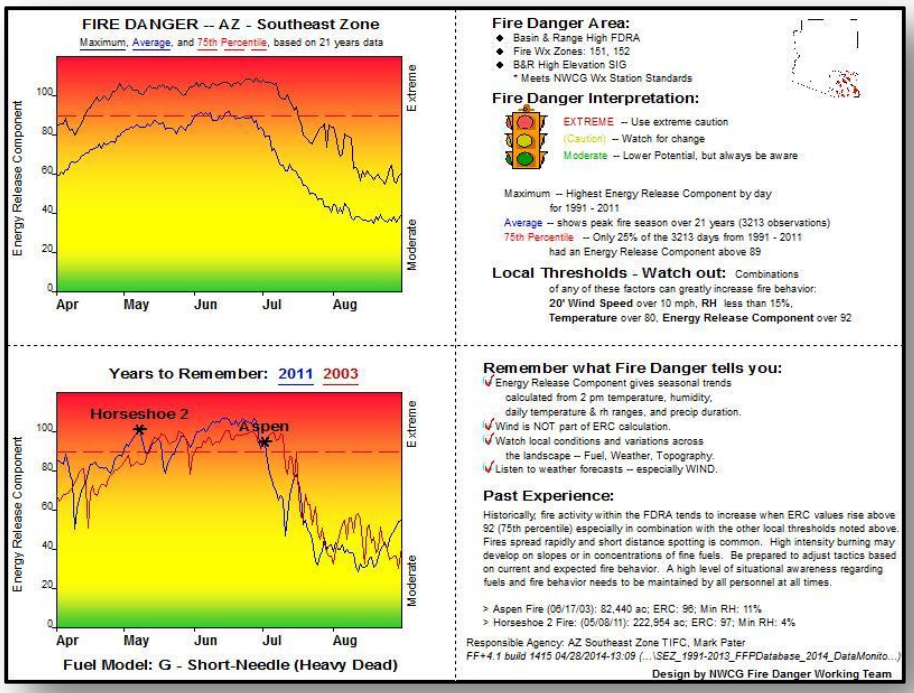


Exhibit 1.3. Basin & Range High Elevation FDRA Pocket Card using the ERC index

Seasonal Risk Analysis and Severity Funding

Seasonal Risk Analysis

A Seasonal Risk Analysis (SRA) requires SEZ fire managers to review current and predicted weather and fuels information, compare this information with historic weather and fuels records, and predict the upcoming fire season's severity and duration for any given area.

Information from a SRA can be used to augment the SEZ Fire Danger Operating Plan (FDOP), step-up and pre-attack plans. It provides the basis for actions such as prepositioning critical resources, requesting additional funding, or modifying Memoranda of Understanding (MOU) to meet anticipated needs.

SRA's for the Southwest Geographic Area are prepared, issued, and updated each year by SWCC (Southwest Coordination Center) Predictive Services staff. These analyses consider detailed information for each of the Predictive Services Areas (PSA) within the Southwest Geographic Area.

Each fire manager within the SEZ will review this comparison update as well as the 7-day Southwest Area forecast and monthly Southwest Area outlook and post this information in dispatch and crew areas. See:

- http://psgeodata.fs.fed.us/7day/action/forecast/6
- http://gacc.nifc.gov/swcc/predictive/outlooks/monthly/swa_monthly.pdf

If the SRA suggests an abnormal fire season might be anticipated, a unit should notify the state/regional office and request additional resources commensurate with the escalated risk. Each respective agency within the SEZ can calculate their own current and expected fire severity indices using FFP.

Season Ending/Slowing Event

Utilizing the Tem Module of the Rare Event Risk Assessment Process (RERAP) in FireFamily Plus, they Weibull waiting time distribution was developed from historical season-ending/slowing 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/slowing event occurring before or after the 50th percentile date.

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/slowing events have been identified:

1. **Sonoran FDRA:** Event Definition: Average (Min RH) ≥ 20.00 AND Average (Burning Index) ≤ 70.00, 5-Day Periods.
2. **Basin and Range Low Elevation FDRA:** Event Definition: Average (Min RH) ≥ 20.00 AND Average (Burning Index) ≤ 75.00, 5-Day Periods.
3. **Basin and Range High Elevation FDRA:** Event Definition: Average (Min RH) ≥ 20.00 AND Average (Burning Index) ≤ 60.00, 5-Day Periods.

Special Orders and Closures - Restrictions

During times of high fire danger within the SEZ, restrictions and/or closures may be imposed to mitigate the risk of wildland fires. Emergency closures have a substantial impact on the public and are only used under the most severe conditions. All Special Orders and Closures will be coordinated with local cooperators and regional agencies.

The Southeast Arizona Restriction Coordination Area, Fire Restrictions and Closure Operating Plan decision criteria state:

"*Fire restrictions and closures require a high degree of coordination among all levels within each agency and tribes, between all agencies and tribes within the restriction area, between restriction areas, and the restriction area and SWCG Restriction Coordinator. This process must be continuous from the time restrictions are first proposed, through the period of implementation, and until the rescinding of all restrictions / closures. The Cooperators in the restriction area will continuously monitor weather, fuel conditions and other factors that will indicate when restrictions or closures are warranted. The decision criteria are a combination of all values, not just one or two*."

The criteria listed in Table 29 were derived after evaluating fire business thresholds that were determined through a thorough statistical analysis of historical weather correlated with fire occurrence data. The Energy Release Component (ERC) index and Fuel Model G has the best fit for all three FDRAs (Appendix L).

Criteria	Stage I	Stage II	Closure
Sonoran FDRA ERC Values:	≥ 90	≥ 100	≥ 105
Basin and Range Low Elevation FDRA ERC Values:	≥ 90	≥ 100	≥ 105
Basin and Range High Elevation FDRA ERC Values:	≥ 90	≥ 97	≥ 103

Table 29. Energy Release Component values for use in evaluating restrictions and/or closures.

The additional criteria found on the SW Agency Fire Restriction and Closure Decision Checklist is used to document decisions by cooperators in the Restriction Coordination Areas when implementing or rescinding fire restrictions. The SW Agency Fire Restrictions and Closure Decision Checklist can be found in Appendix 5 of the Southwest Area Interagency Fire Restrictions and Closure Master Operating Plan.

Program Needs

New weather station sites and hardware needs; installation priorities
All stations are in working order at this time. Continued annual maintenance will be the primary issue. Some stations may need to be revaluated as to their location for better wind monitoring.

- Evaluate the need for establishing a permanent station near Cloverdale in the Peloncillo Mountains.
- Evaluate the need for establishing a permanent station in or near the San Simon Valley.
- Evaluate the need for establishing a permanent station in the Sonoran FDRA.
- RAWS stations will follow recommended maintenance schedules to ensure proper RAWS function/operations and data collection.

Plan and Data Management:
Fire reporting data quality is critical to ensuring accurate historical fire occurrence analyses. FMOs need to ensure that the information on fire reports submitted to the national database is accurate and complete.

- The FDTG will evaluate and correct fire weather and fire history data to ensure good quality data for future analyses.
- Work with Arizona State partners to evaluate the feasibility of developing a format to collect fire occurrence data for fires under Arizona State Forestry jurisdiction for inclusion in the FFP database for future analyses.
- Recommend that the FDTG develop a schedule to meet on a regular basis to review the FDOP for edits or changes.
- Recommend that the FDTG develop a schedule to meet on a regular basis to review weather and fire history data.
- Recommend that weather and fire history data for this plan will be updated every five (5) years and incorporated into the FFP database. Further recommend that a 20-year period be used for analyses.
- The FDTG will decide on an appropriate data storage process for future FDOP updates.
- Evaluate the potential for incorporating this plan into a geospatial format.
- Consider the development of formalized plan to collect fuel moisture data from specific sites across the zone for inclusion in the SEZ fire danger operational planning process.
- Recommend that all partners strive to maintain accurate and timely fuel moisture data in the NFMD (National Fuel Moisture Database).

Dispatch:
It is recommended that the Southeast Zone develop standardized dispatch procedures and protocols (e.g. WildCAD run card system) to ensure effective mobilization of suppression resources. Develop a Zone-wide response area map or map books.

Southeast Zone Partnerships:
It is recommended that the SEZ continues to work towards integrating Arizona State fire managers and suppression resources into the SEZ NFDRS planning process.

NFDRS Training Needs
It is recommended that dispatchers and Field Operations Managers/FMO's/AFMO's attend S-491 course. Field Operations Managers/FMO's/AFMO's should consider attending the Advanced National Fire Danger Rating course. Field personnel will be trained at the annual fire refreshers on the use of the pocket cards and given a basic understanding of NFDRS.

Annual Plan Maintenance and Suggestions

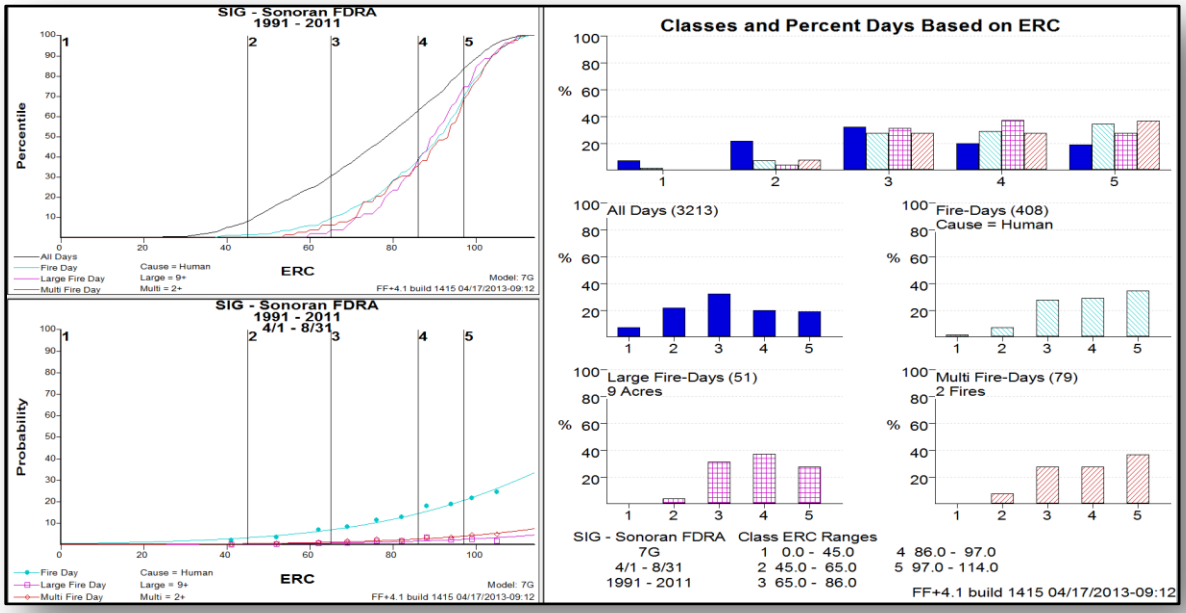
- By December 1, all weather station catalogs will be checked for appropriate freeze dates.
- By April 1, all weather station catalogs will be checked for appropriate green-up dates

- Each year (insert suggested date[s]) the SEZ NFDRS Technical Group will meet to review and update the SEZ NFDRS Operating Plan.
- Other suggestions.

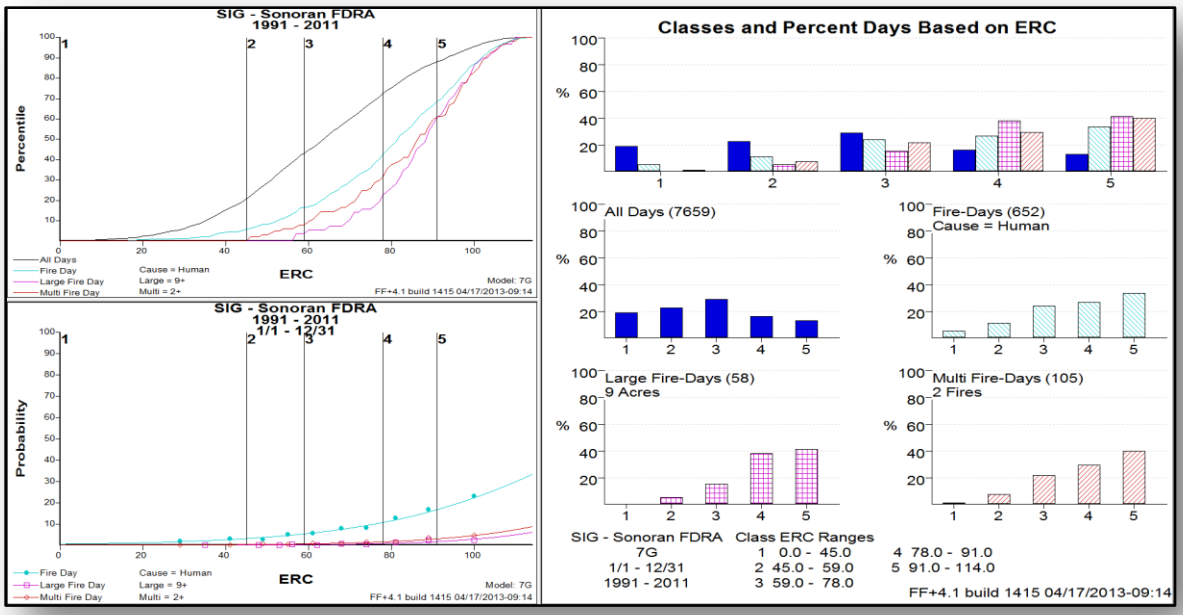
VII. Appendices

Appendix A. Sonoran FDRA Fire Business Decision Points – (ERC)

Fire Season Preparedness Level Decision Points – ERC-G (Fuel Model G)
(April 1st – August 31st)

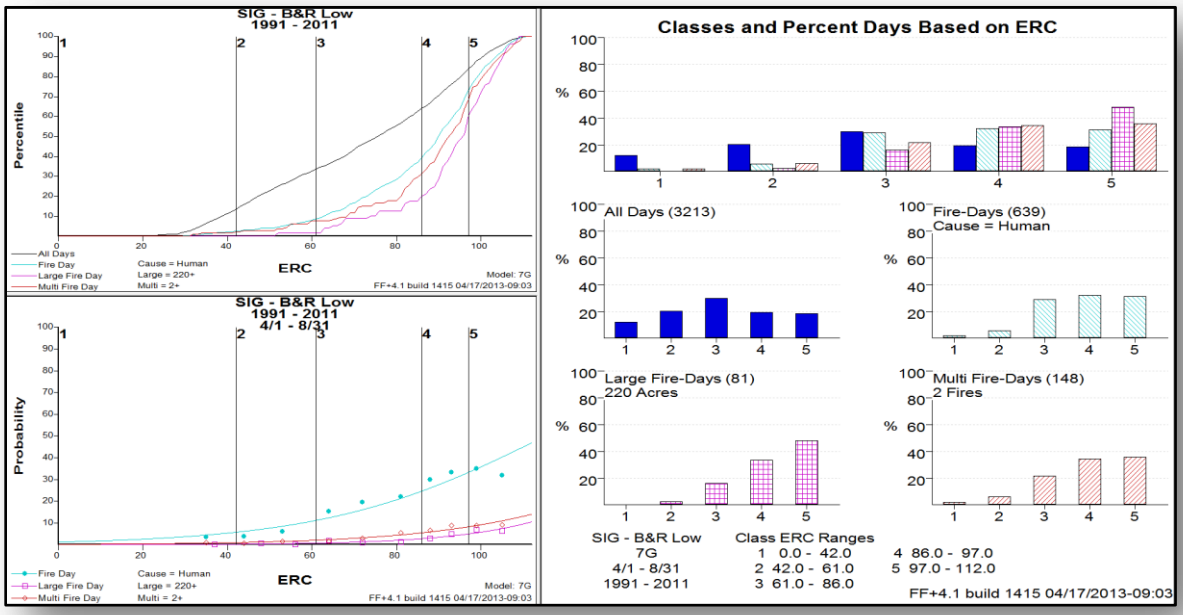


Full Year Preparedness Level Decision Points - ERC-G (Fuel Model G)
(January 1st –December 31st)

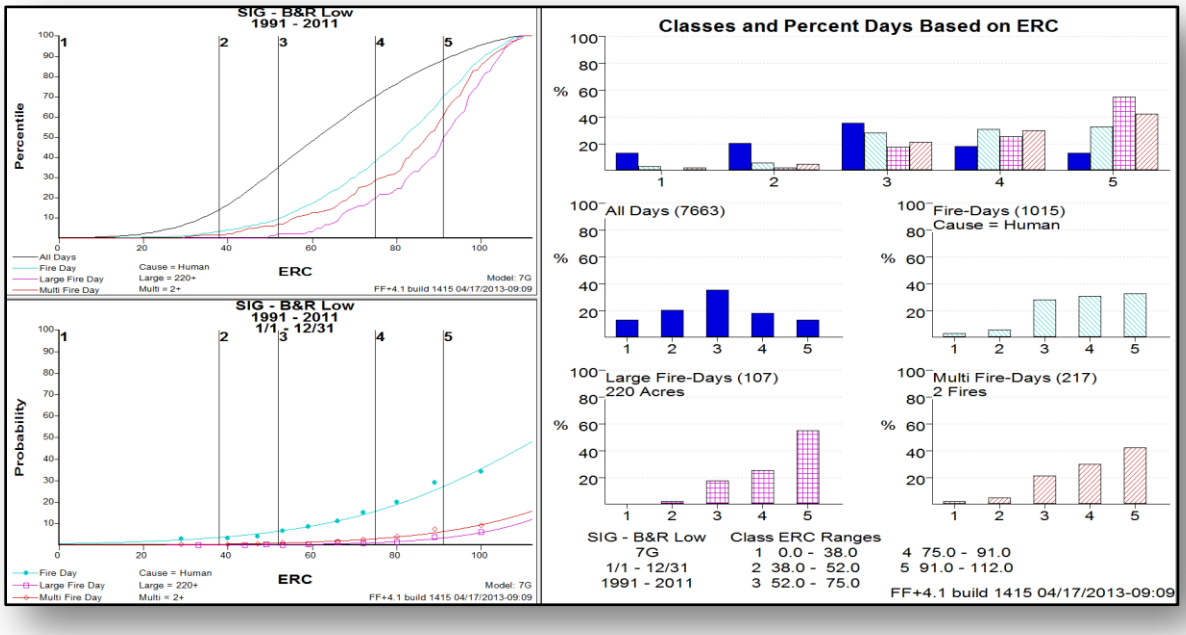

SIG - Sonoran FDRA
1991 - 2011
Percentile
ERC
All Days
Fire Day
Large Fire Day
Multi Fire Day
Cause = Human
Large = 9+
Multi = 2+
Model: 7G
FF+4.1 build 1415 04/17/2013-09:14
SIG - Sonoran FDRA
1991 - 2011
1/1 - 12/31
Probability
ERC
Classes and Percent Days Based on ERC
All Days (7659)
Fire-Days (652)
Cause = Human
Large Fire-Days (58)
9 Acres
Multi Fire-Days (105)
2 Fires
SIG - Sonoran FDRA
7G
1/1 - 12/31
1991 - 2011
Class ERC Ranges
1 0.0 - 45.0
2 45.0 - 59.0
3 59.0 - 78.0
4 78.0 - 91.0
5 91.0 - 114.0
FF+4.1 build 1415 04/17/2013-09:14

Appendix B. Basin & Range Low Elevation FDRA Fire Business Decision Points – (ERC)

Fire Season Preparedness Level Decision Points - ERC-G (Fuel Model G) (April 1st – August 31st)

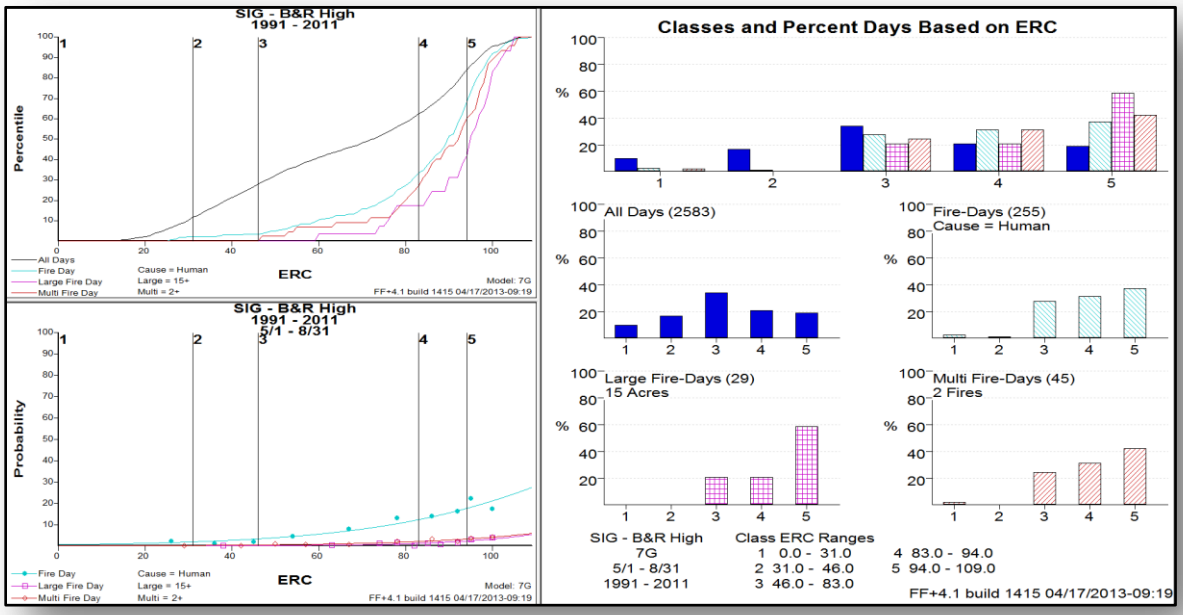


Full Year Preparedness Level Decision Points - ERC-G (Fuel Model G) (January 1st – December 31st) –

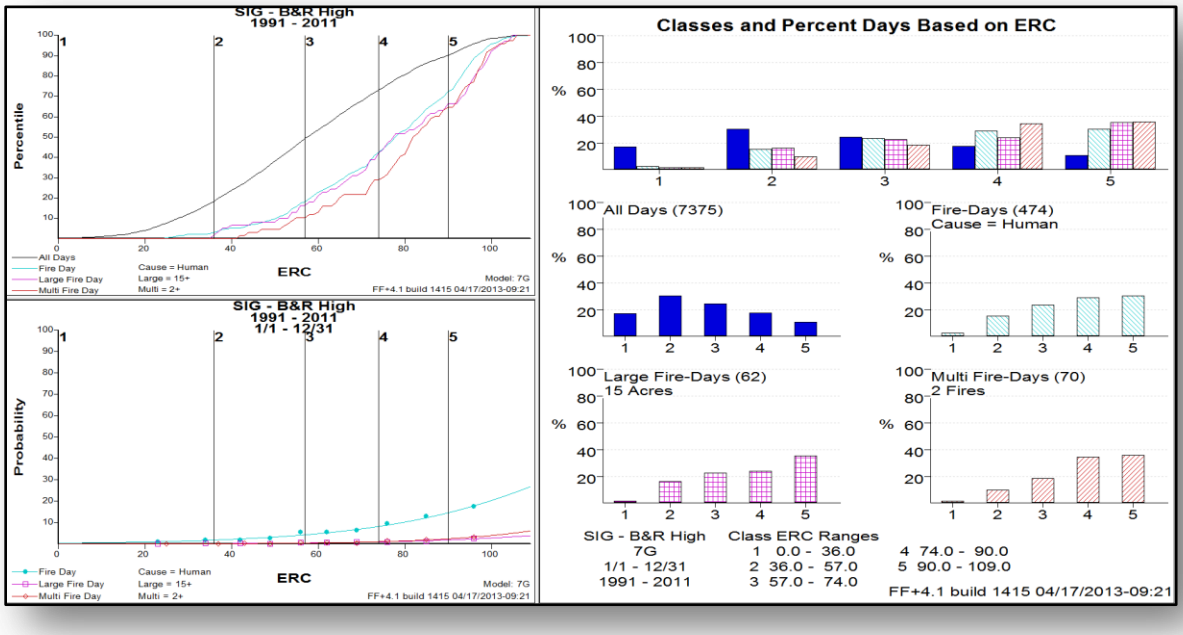


Appendix C. Basin & Range High Elevation FDRA Fire Business Decision Points – (ERC)

Fire Season Preparedness Level Decision Points - ERC-G (Fuel Model G) (May 1st August 31st)

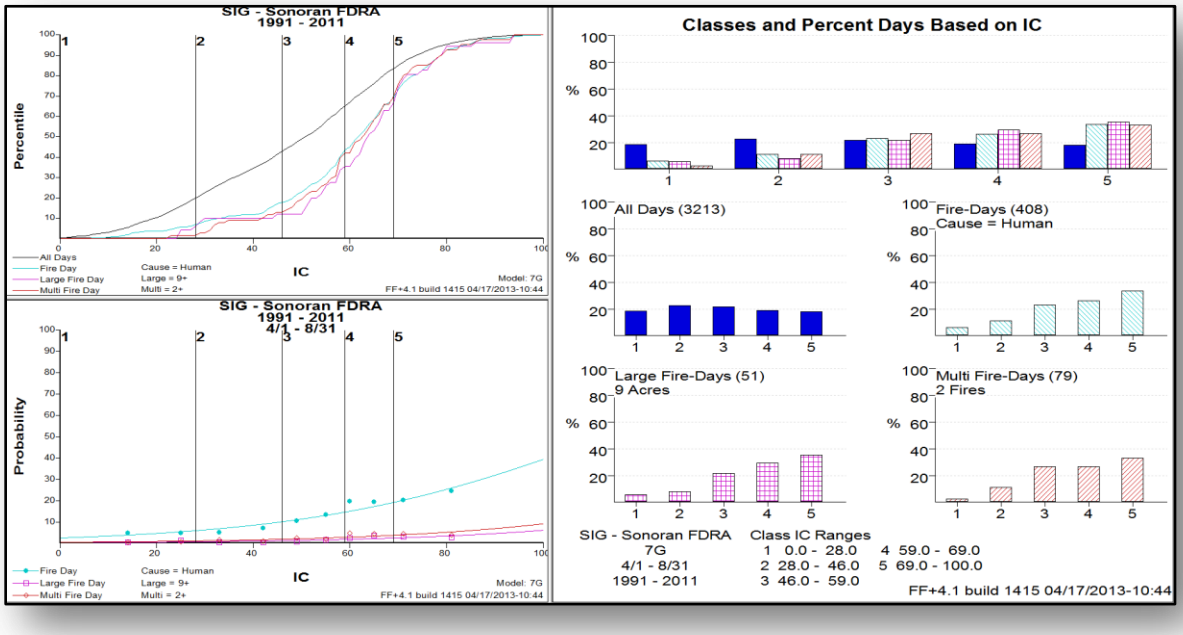


Full Year Preparedness Level Decision Points - ERC-G (Fuel Model G) (January 1st December 31st)

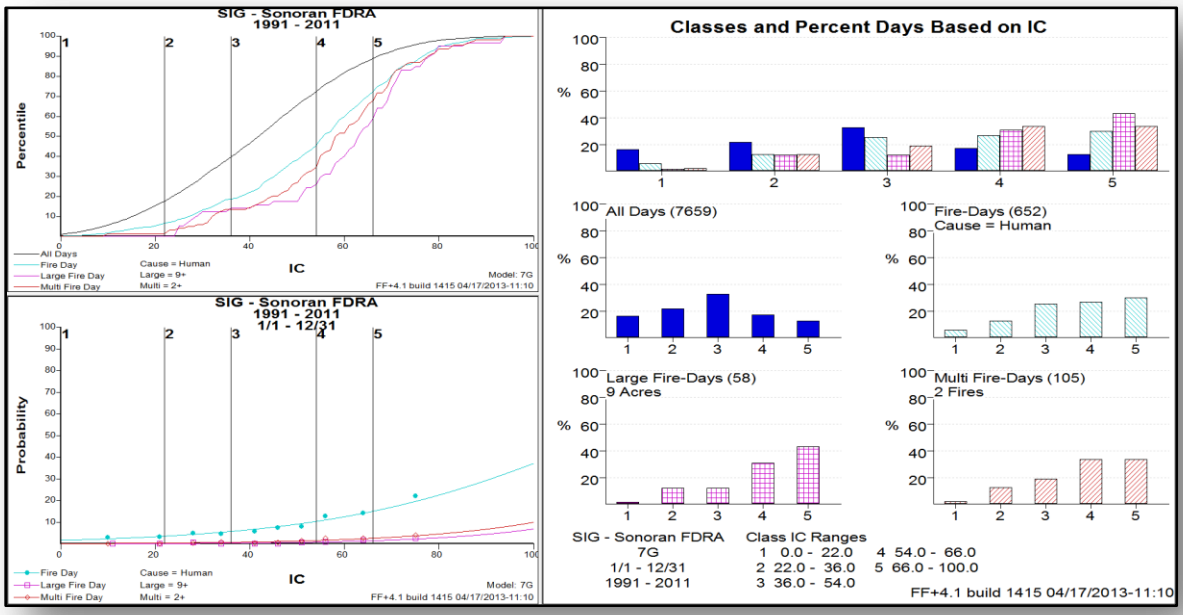


Appendix D. Sonoran FDRA Fire Business Decision Points – (IC)

Fire Season Preparedness Level Decision Points - IC-G (Fuel Model G)
(April 1st – August 31st)

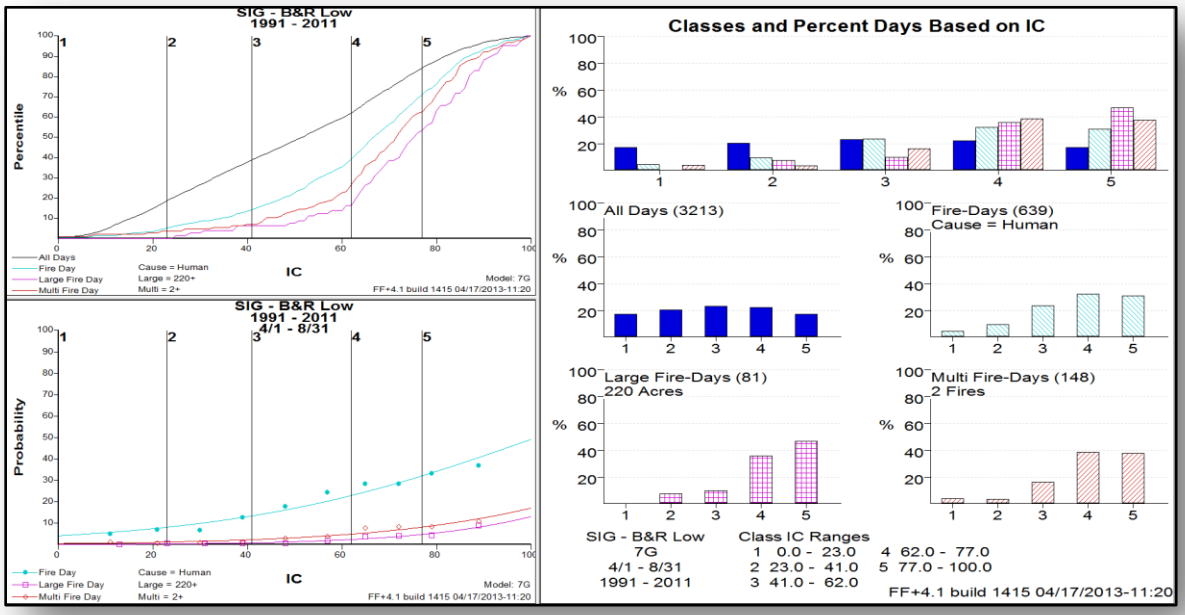


Full Year Preparedness Level Decision Points - IC-G (Fuel Model G)
(January 1st –December 31st)

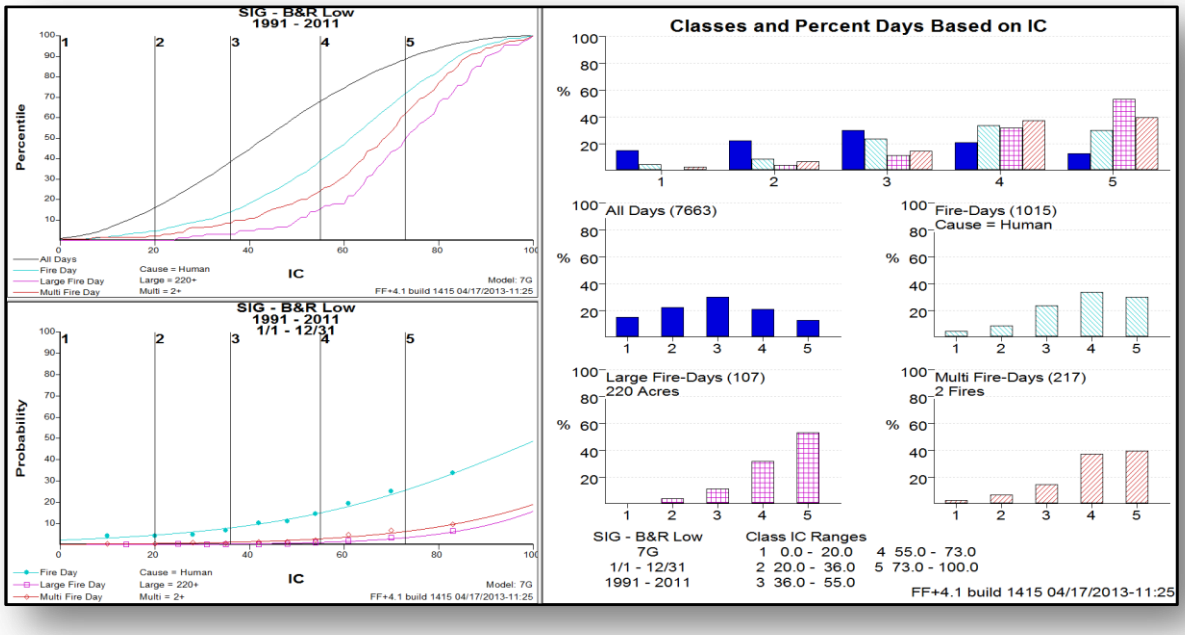


Appendix E. Basin & Range Low Elevation FDRA Fire Business Decision Points – (IC)

Fire Season Preparedness Level Decision Points - IC-G (Fuel Model G) (April 1st – August 31st)

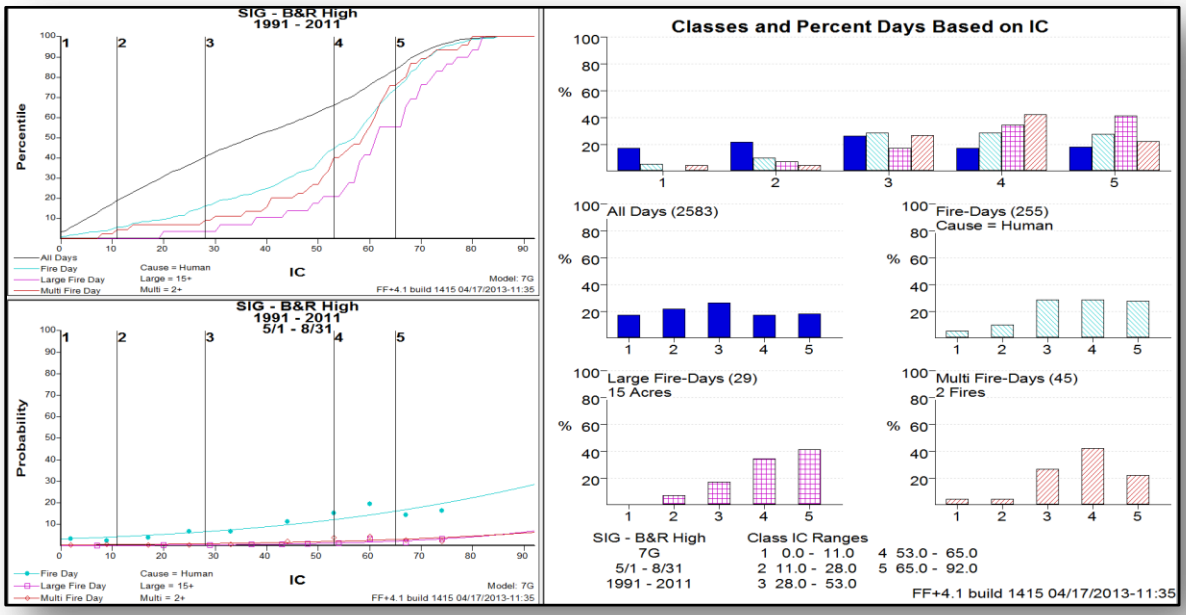


Full Year Preparedness Level Decision Points - IC-G (Fuel Model G) (January 1st – December 31st)

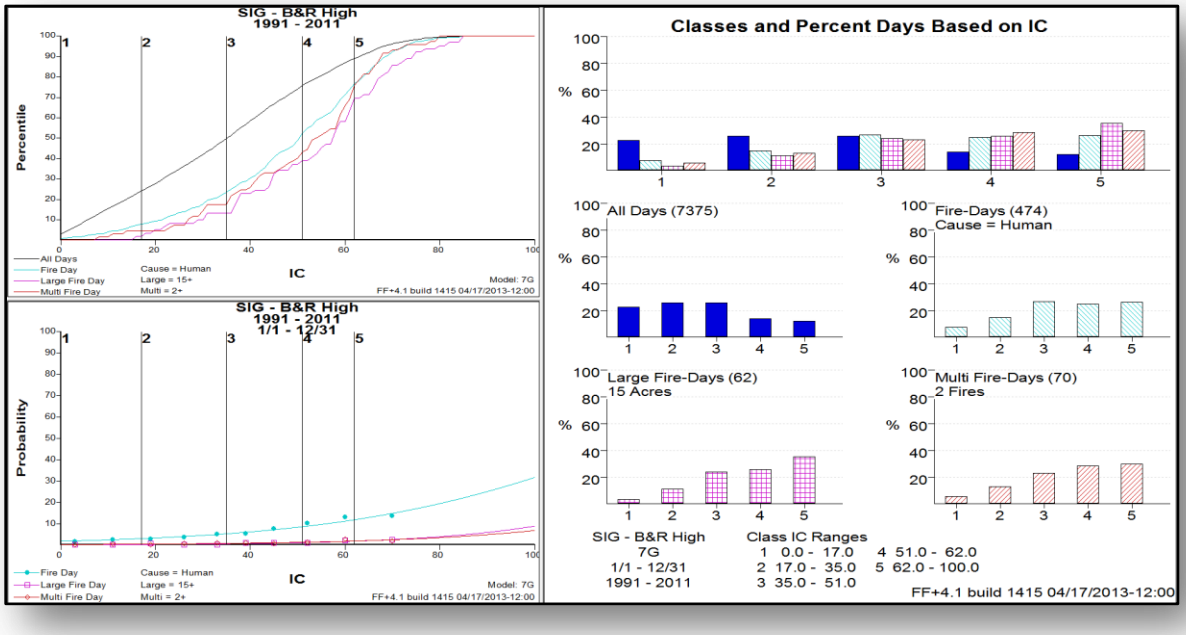


Appendix F. Basin & Range High Elevation FDRA Fire Business Decision Points – (IC)

Fire Season Preparedness Level Decision Points - IC-G (Fuel Model G) (May 1st August 31st) –

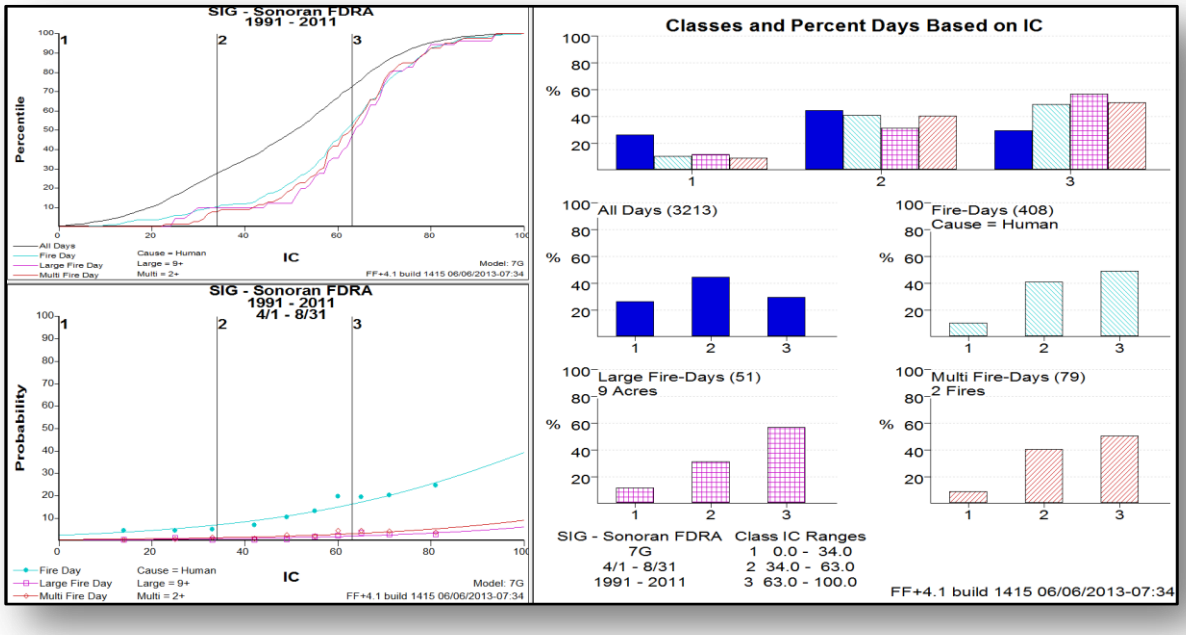


Full Year Preparedness Level Decision Points - IC-G (Fuel Model G) (January 1st December 31st)

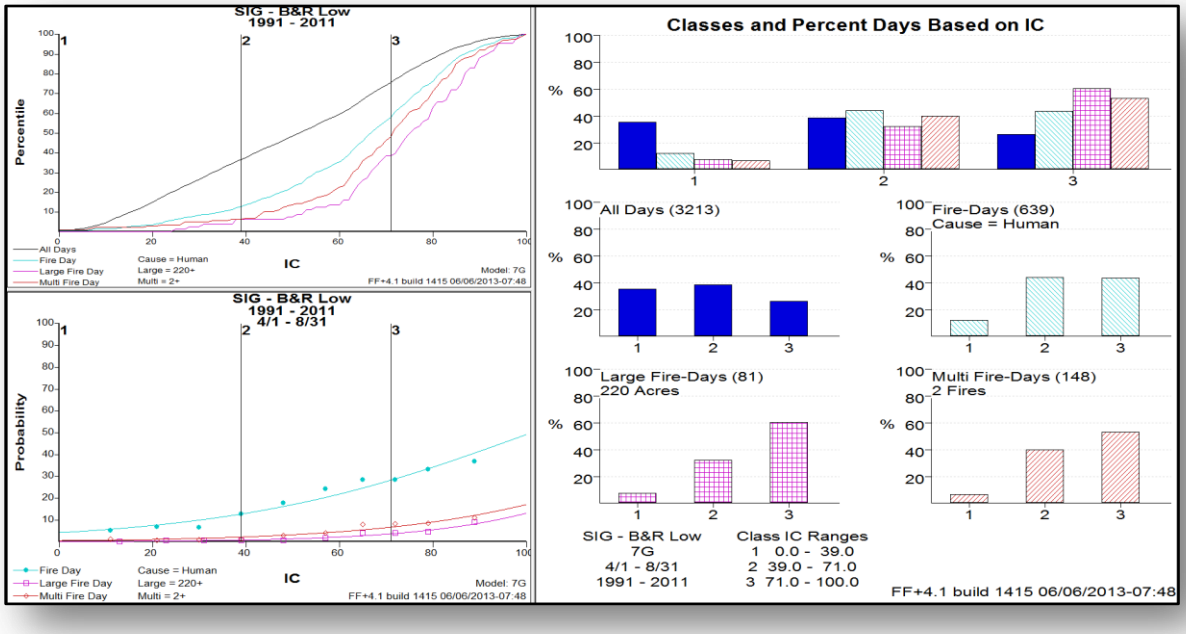


Appendix G. Fire Business Decision Points – Dispatch Levels

Fire Season Dispatch Level Decision Points - IC-G
(Sonoran FDRA)

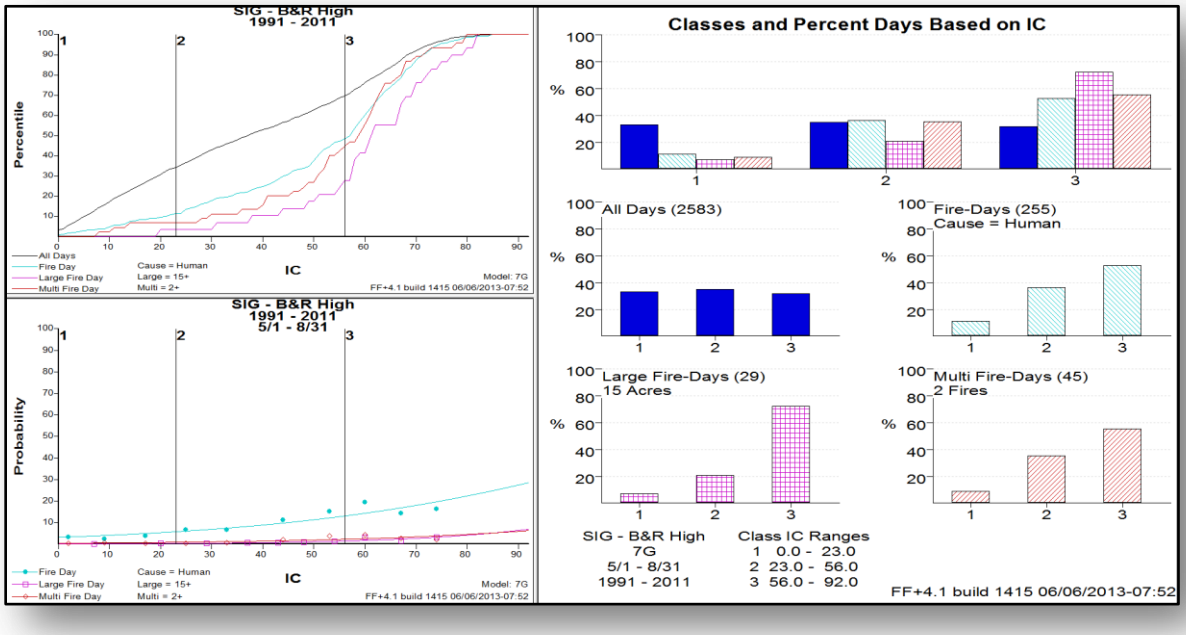


Fire Season Dispatch Level Decision Points - IC-G
(Basin & Range Low Elevation FDRA)



Appendix G. Fire Business Decision Points – Dispatch Levels

Fire Season Dispatch Level Decision Points - IC-G
(Basin & Range High Elevation FDRA)



Appendix H. Adjective Fire Danger Rating Levels

Fire Danger Rating 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 attacked successfully 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 into heavier fuels.
Extreme (E) **(Red)**	Fires start quickly, spread rapidly, 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.

Appendix I. Staffing Levels and Recommended Action Guide

Staffing Level	Fire Danger Rating	Recommended Daily Staffing and Actions
Staffing Level 1	**LOW** 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.	• Normal tour of duty • Single engine dispatch initial attack response. • Phone & radio monitored by TDC until 1630 (or longer if initial attack is extended).
Staffing Level 2	**MODERATE** 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.	All above plus: • Daily roster/staffing reports to SEZ. • Designated acting agency Line Officers for fire season weekends established. • Establish on call dispatcher list • Assess seasonal trends and the need to request severity funding. • Current MOU's with surrounding agencies in place.
Staffing Level 3	**HIGH** All fine dead fuels ignite readily and fires start easily from most causes. Unattended brush and campfires are likely to escape. Fires spread rapidly and short-distance spotting is common. High-intensity burning may develop on slopes or in concentrations of fine fuels. Fires may become serious and their control difficult unless they are attacked successfully while small.	All above plus: • 7-day staffing • Consider increased patrols following dry lightning storms. • Consider aerial recon flights after lightning storms. • Consider additional overhead for critical command functions.
Staffing Level 4	**VERY HIGH** Fires start easily from all causes and, immediately after ignition, spread rapidly and increase quickly in intensity. Spot fires are a constant danger. Fires burning in light fuels may quickly develop high intensity characteristics such as long-distance spotting and fire whirlwinds when they burn into heavier fuels.	All above plus: • Briefings for agency administrators as needed. • Notify all SEZ partners of red flag warnings. • Increased engine patrols through areas with historically high incidence of fires. • Additional recon flights after lightning. • Consider fire restrictions; fire safety messages distributed. • Consider canceling planned prescribed fires and postponing project work. • Consider staging call when needed crews on weekends.
Staffing Level 5	**EXTREME** Fires start quickly, spread rapidly, 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.	All above plus: Work with SEZ partners to: • Issue fire restrictions and closures. • Evaluate the need to order and preposition additional resources. • Consider daily briefings for agency administrators. • Media coverage on any type of additional fire restrictions or closures.

Appendix J. Preparedness Levels and Recommended Action Guide – Agency Administrator

Preparedness Level Actions *are guidelines, and as such are discretionary in nature*, for agency personnel to refer to when preparedness level thresholds are reached. If an agency doesn't have a specific position that is listed within the PL table, that agency will utilize discretion as to what position will assume those roles.

Responsible Party	Suggested Action	PL 1	PL 2	PL 3	PL 4	PL 5	Affected Entity
Agency Administrator	Ensure Resource Advisors (READ) are designated and available for fire assignments.			X	X	X	Agency
	Evaluate work/rest needs of fire staff and crews.				X	X	Agency
	Consider need for fire restrictions or closures.				X	X	Public Industry
	Provide appropriate support to fire staffs regarding the implementation of preparedness level actions.				X	X	Agency
	Issue guidance to staff indicating severity of the season and increased need and availability for fire support personnel.				X	X	Agency

Appendix J. Preparedness Levels and Recommended Action Guide – FMO's

Responsible Party	Suggested Action	PL 1	PL 2	PL 3	PL 4	PL 5	Affected Entity
CNF Fire Staff, BLM District FMO, NPS FMO, USFWS FMO, State District FMO, BIA (PPA) FMO	Evaluate season severity data (NFDRS indices for the season, fuel loading, fuel moisture, drought indices, long-term forecasts).			X	X	X	Agency
	Brief agency administrator on burning conditions and fire activity.			X	X	X	Agency
	Review geographical and national preparedness levels and evaluate need to suspend local Rx fire activities.			X	X	X	Agency
	Consider consulting with or ordering a FBAN or WFDSS Support.			X	X	X	Agency
	Ensure Prevention Officer has initiated media contacts and public education contacts.			X	X	X	Public Industry
	Ensure office staff personnel are briefed on increasing fire activity.			X	X	X	Agency
	Consider fire severity request and pre-positioning of resources including: suppression resources, aerial support, aerial supervision, command positions, dispatch, logistical support, and prevention.			X	X	X	Agency Public Industry
	If preparedness level is decreasing, consult with Duty Officer/TDC Manager and consider release of pre-positioned or detailed personnel.				X	X	Agency
	Evaluate crew and staff work/rest requirements.				X	X	Agency
	Evaluate need for fire restrictions or closures.				X	X	Public Industry
	Communicate with TDC Manager on geographical conditions and resources availability.				X	X	Agency
	Request the agency administrator to issue guidance to office staff regarding the need for increased availability in support positions.				X	X	Agency

Appendix J. Preparedness Levels and Recommended Action Guide – TDC & Duty Officers

Responsible Party	Suggested Action	PL 1	PL 2	PL 3	PL 4	PL 5	Affected Entity
TDC	If preparedness level is decreasing, consider release of pre-positioned or detailed dispatchers and logistical support personnel.			X	X	X	
	Begin weekly conference calls with SEZ FMOs and Operations staff.			X	X	X	
	Consider pre-positioning or detail of off-unit IA dispatchers and logistical support personnel.			X	X	X	
	Evaluate work/rest needs of center staff.				X	X	

Responsible Party	Suggested Action	PL 1	PL 2	PL 3	PL 4	PL 5	Affected Entity
Duty Officer*	If preparedness level is decreasing, consider releasing pre-positioned and detailed resources.			X	X	X	Agency
	Ensure incoming pre-position or detailed personnel are briefed on local conditions.			X	X	X	Agency
	Evaluate work/rest needs of IA crews.			X	X	X	Agency
	Consider patrols and pre-positioning of local IA resources in high risk areas.				X	X	Agency
	Consider pre-positioning and/or detailing of additional IA resources from off-unit.				X	X	Agency
	Consider bringing in local resources from scheduled days off.				X	X	Agency
	Consider suspending Rx fire operations.				X	X	Agency

*December 2014: USFS policy for Duty Officer Responsibilities is currently in DRAFT format and will be incorporated into this planning document after final review and approval.

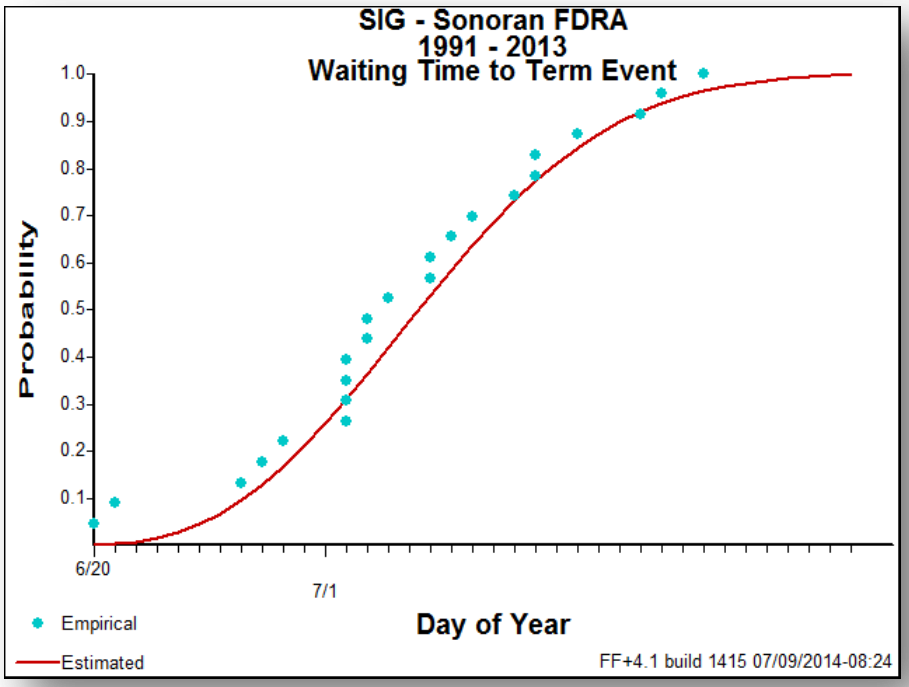
Appendix J. Preparedness Levels and Recommended Action Guide – Prevention/Mitigation

Responsible Party	Suggested Action	PL 1	PL 2	PL 3	PL 4	PL 5	Affected Entity
Fire Prevention/ Mitigation	Contact Public Information Officer, local media to inform of the start of fire season and the potential for local fire danger to increase.			X	X	X	Agency Public
	Provide public and industrial with access to fire danger information, closures, restrictions and warnings.			X	X	X	Agency Public Industry
	Contact local industrial entities to inform of hazard and risk.			X	X	X	Public Industry
	Post signs and warnings in camping and recreation areas.			X	X	X	Public
	Consider need for increased fire prevention patrols.				X	X	Agency
	Notify local media if High/Extreme fire danger and the need for increased public caution.				X	X	Public
	Contact local fire chiefs and inform of increased fire danger.				X	X	Agency
	Consult with FMO regarding need for fire restrictions or closures.				X	X	Agency

Appendix K-1. RERAP Analysis – Sonoran FDRA

Rare Event Risk Assessment Process (RERAP) Analysis (Season Ending/Slowing Event Probabilities) – Sonoran Fire Danger Rating Area

Year	#Days
1991	13
1992	17
1993	16
1995	20
1996	8
1997	27
1998	12
1999	12
2000	1
2001	13
2002	23
2003	26
2004	21
2005	29
2006	9
2007	18
2008	14
2009	7
2010	21
2011	12
2012	12
2013	16



Key Probabilities

Probability	Date
0.25	July 1
0.50	July 6
0.75	July 11
0.90	July 16
0.99	July 24

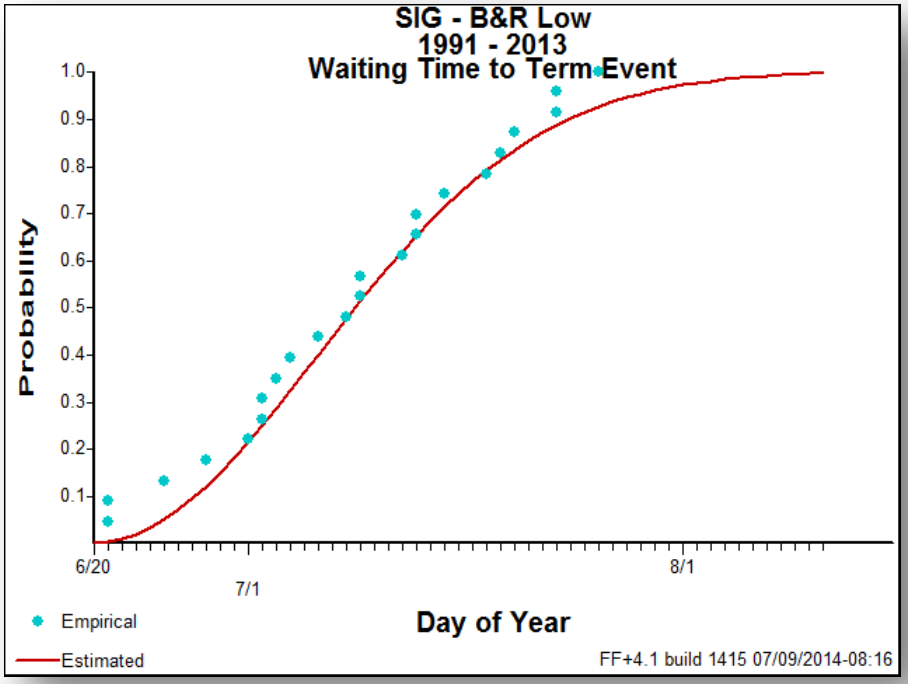
Season Start Day: 6\20
Data Years: 1992 - 2013
Alpha: 2.470056
Beta: 0.055732
R-Squared: 0.988638

Event Definition: Average (Min RH) ≥ 20.00 AND Average (Burning Index) ≤ 70.00, 5-Day Periods

Appendix K-2. RERAP Analysis – Basin and Range Low Elevation FDRA

Rare Event Risk Assessment Process (RERAP) Analysis (Season Ending/Slowing Event Probabilities) – Basin and Range Fire Danger Rating Area

Year	#Days
1991	30
1992	18
1993	11
1994	33
1995	23
1996	8
1997	36
1998	14
1999	13
2000	1
2001	1
2002	25
2003	28
2004	23
2005	33
2006	12
2007	19
2008	16
2009	5
2010	19
2011	29
2012	22
2013	12



Key Probabilities

Probability	Date
0.25	July 3
0.50	July 9
0.75	July 17
0.90	July 25
0.99	August 8

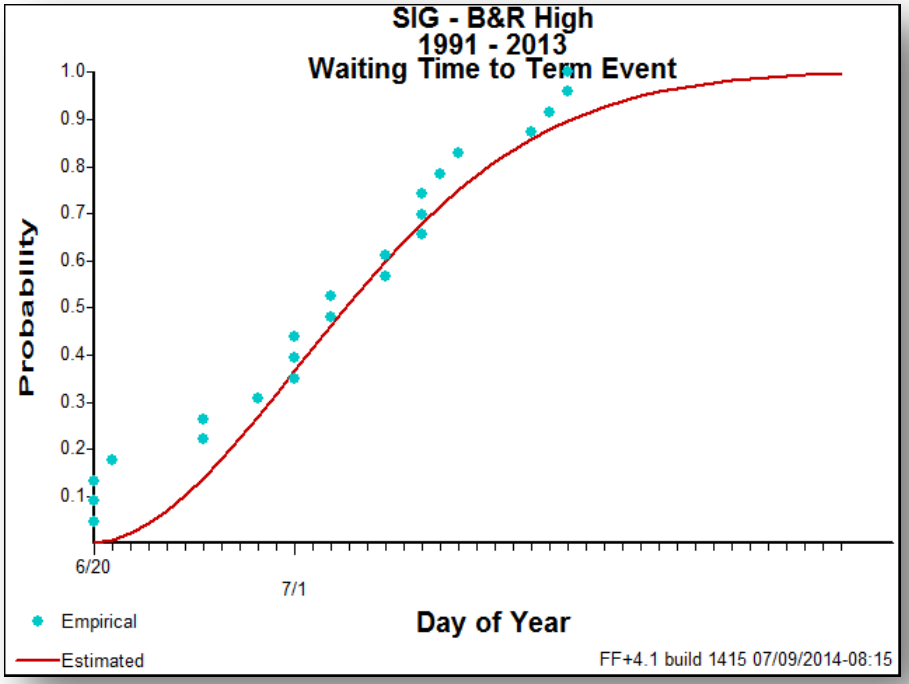
Season Start Day: 6/20
Data Years: 1991 - 2013
Alpha: 2.004104
Beta: 0.044591
R-Squared: 0.982176

Event Definition: Average (Min RH) ≥ 20.00 AND Average (Burning Index) ≤ 75.00, 5-Day Periods

Appendix K-3. RERAP Analysis – Basin and Range High Elevation FDRA

Rare Event Risk Assessment Process (RERAP) Analysis (Season Ending/Slowing Event Probabilities) – Basin and Range Fire Danger Rating Area

Year	# Days
1991	13
1992	16
1993	16
1994	25
1995	20
1996	6
1997	26
1998	11
2000	1
2002	19
2003	24
2004	18
2005	26
2006	9
2007	18
2008	6
2010	18
2011	13
2012	11
2013	11



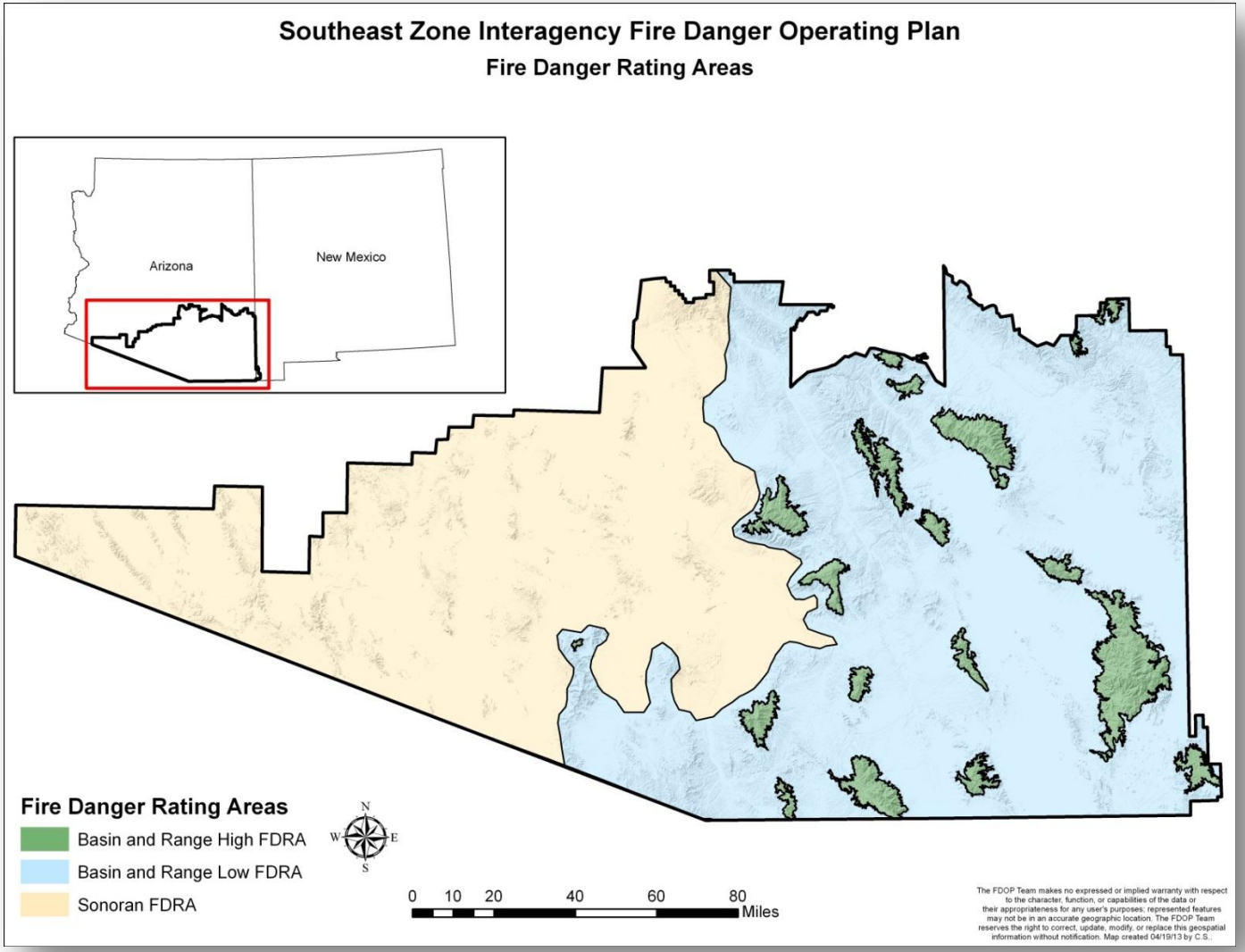
Key Probabilities

Probability	Date
0.25	June 29
0.50	July 4
0.75	July 11
0.90	July 17
0.99	July 29

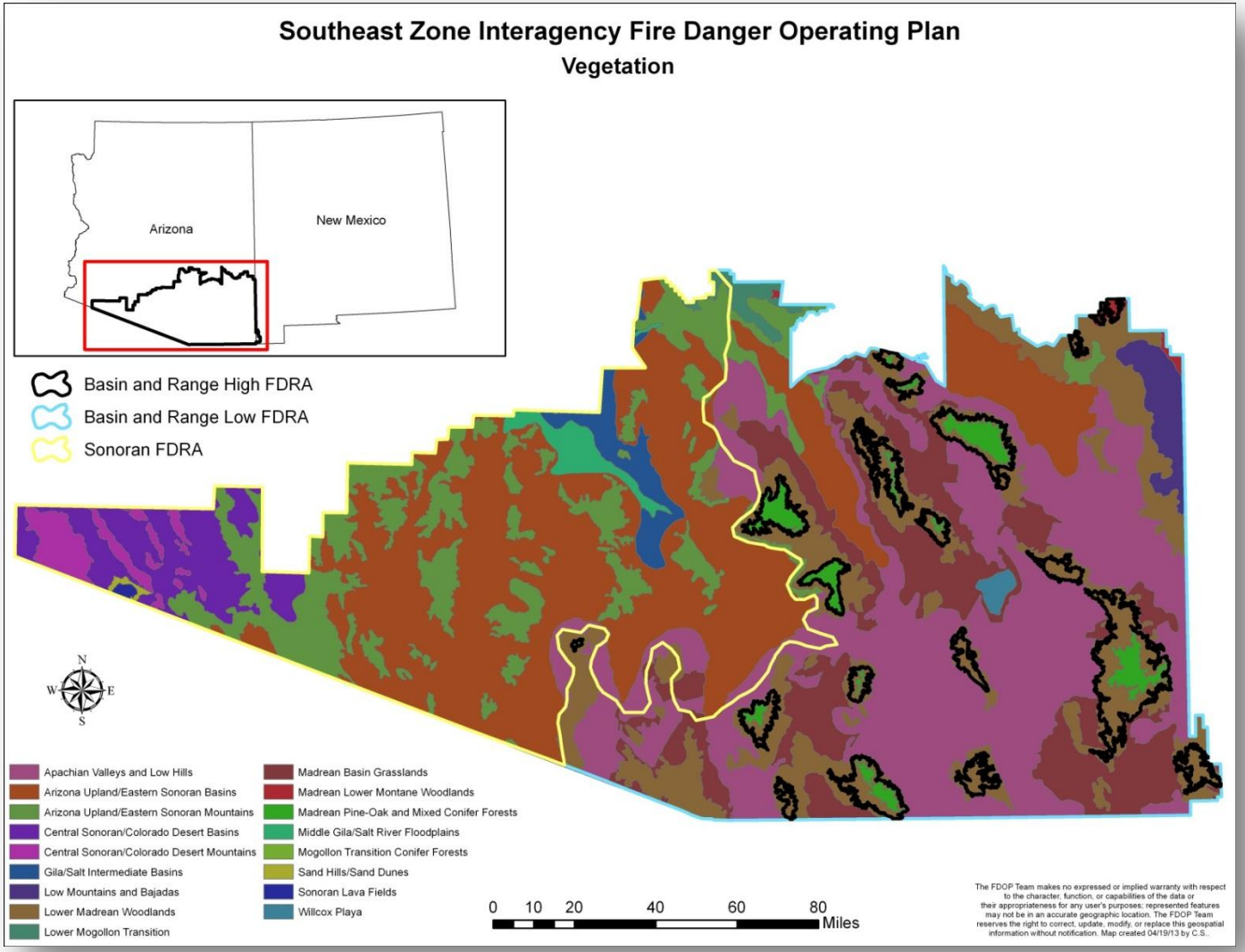
Season Start Day: 6/20
Data Years: 1991 - 2013
Alpha: 1.863411
Beta: 0.059351
R-Squared: 0.945132

Event Definition: Average (Min RH) ≥ 20.00 AND Average (Burning Index) ≤ 60.00, 5-Day Periods

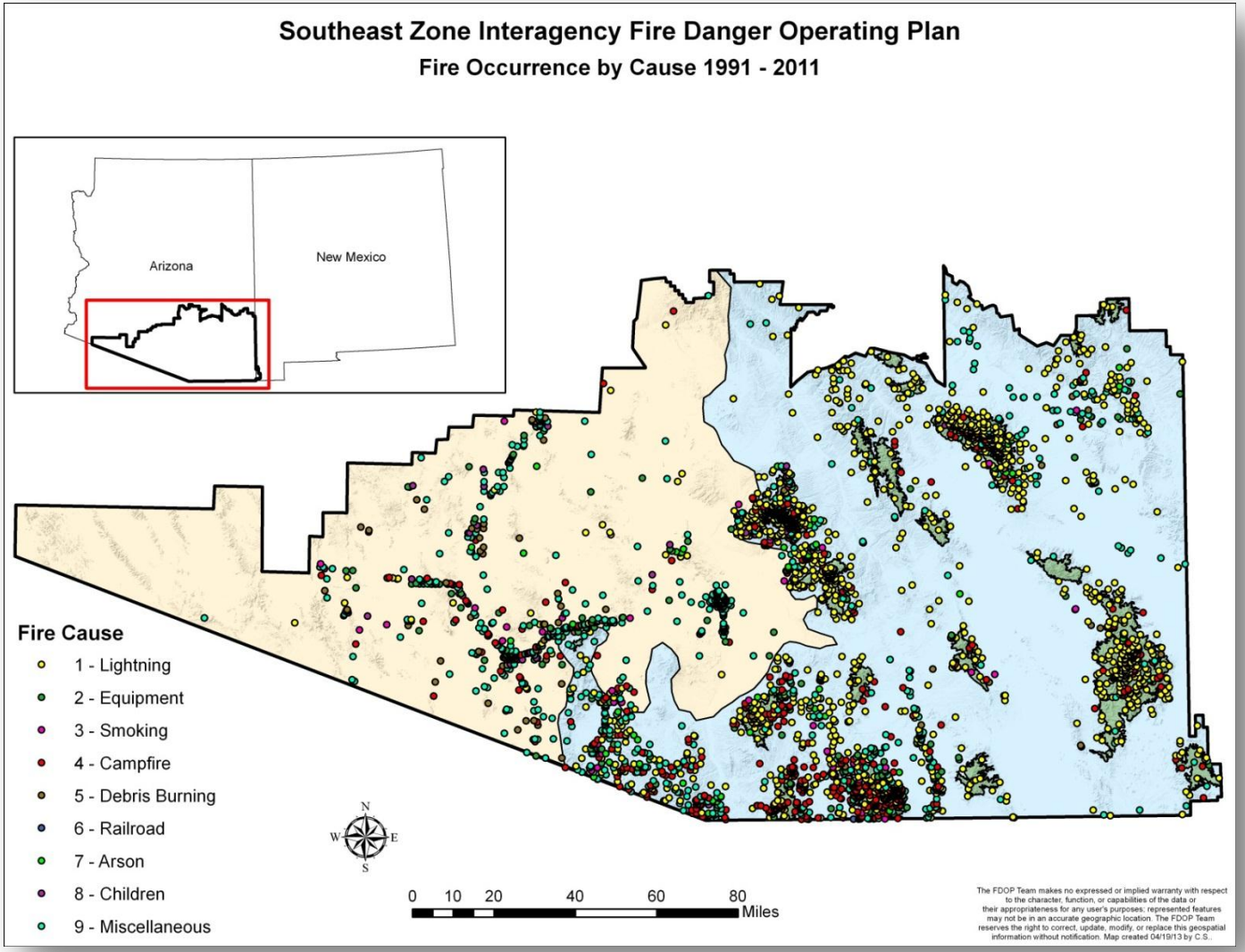
Appendix L-1. Map - Southeast Zone Fire Danger Rating Areas (FDRA)



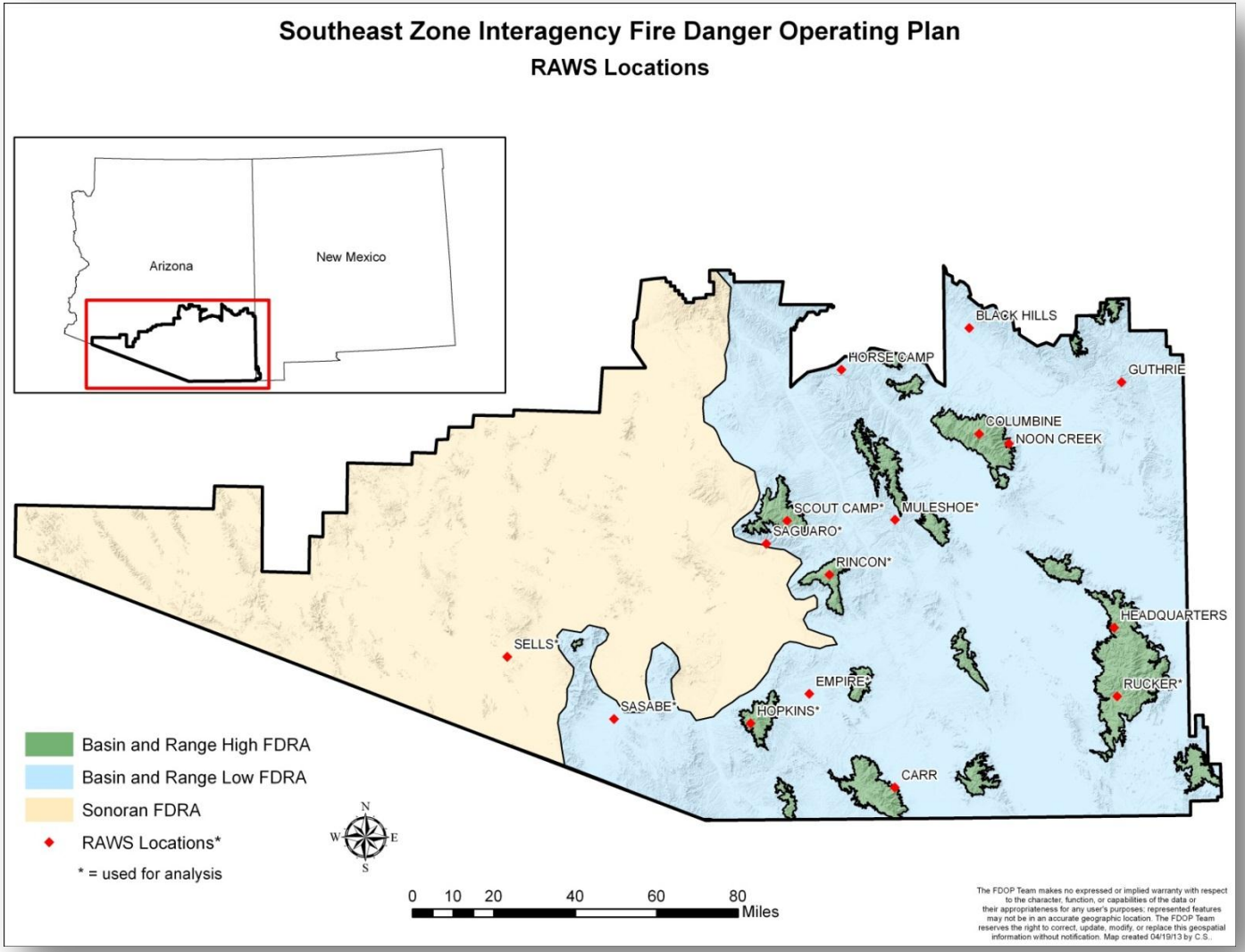
Appendix L-2. Map - Southeast Zone Vegetation



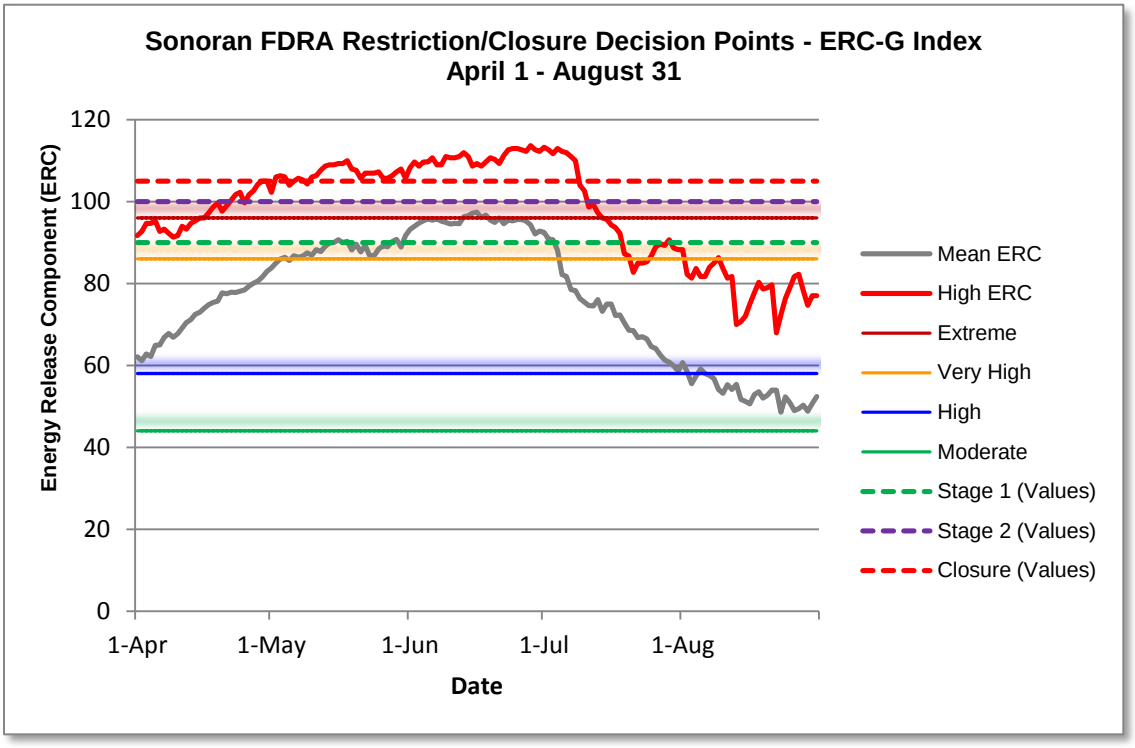
Appendix L-3. Map - Southeast Zone Fire Occurrence

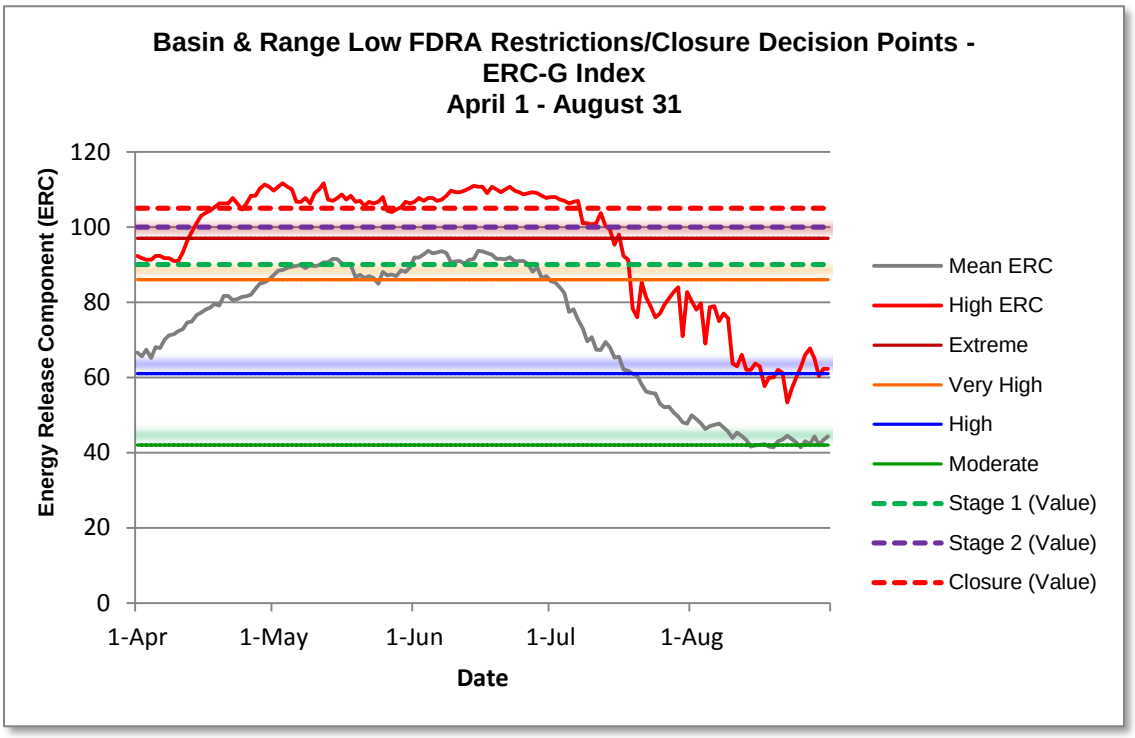


Appendix L-4. Map - Southeast Zone RAWS Locations

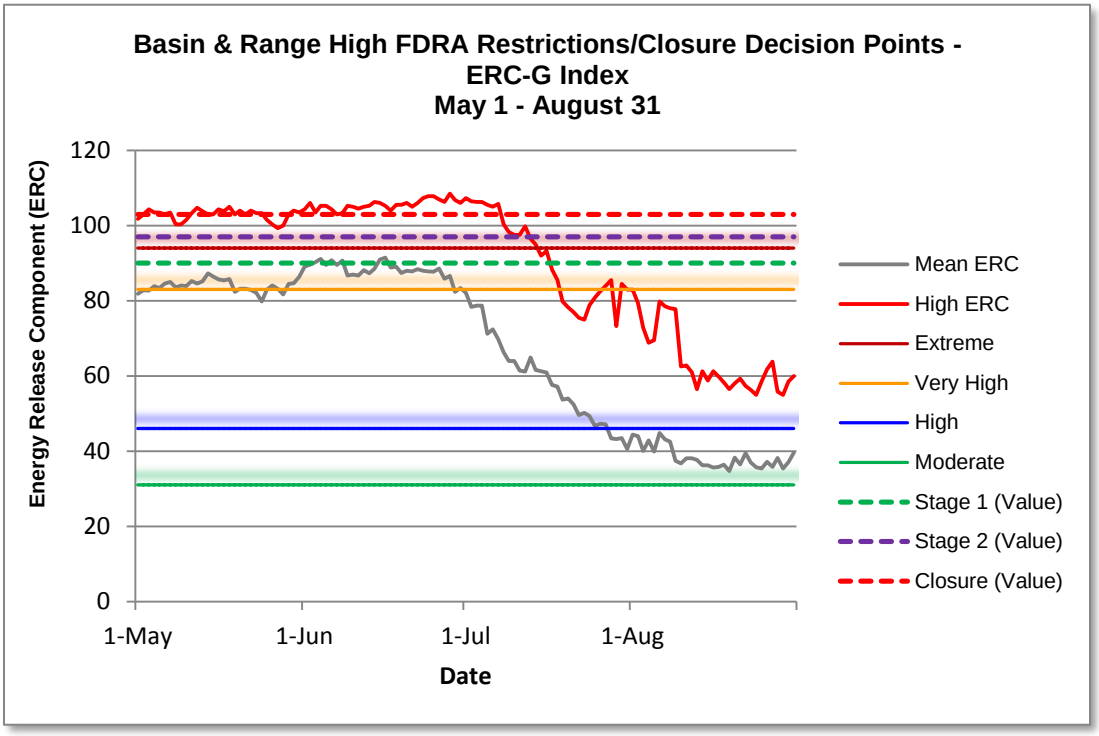


Appendix M. Restrictions and Closures – Fire Business Thresholds





Appendix M. Restrictions and Closures – Fire Business Thresholds



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