## Contents

## OBJECTIVE(S)

Upon completion of this lesson, participants will be able to:

1. Review a NFDRS 2016 prototype developed to compare legacy NFDRS model outputs with NFDRS2016 model outputs.

2. Review examples of comparative products to give participants ideas on possible comparative products for their home units.

3. Evaluate fire business thresholds in the FDOP subordinate plans.

4. Evaluate legacy model and NFDRS2016 model outputs using historical fires.

5. Compare legacy model outputs with NFDRS2016 model outputs using WIMS.

# NARRATIVE

## I.   INTRODUCTION

The National Fire Danger Rating System (NFDRS) provides managers with systematic, statistically valid decision-making tools designed to assist with the periodic assessment of potential fire danger. Like all tools, it needs to be maintained in good condition to ensure that it is working properly when it is needed.

The purpose for evaluating the model is to offer examples that highlight the value of the NFDRS2016 model as a fire danger decision support system to aid fire managers and line officers in their decision-making processes. Because this is a new model, an evaluation process can also aid users in discovering flaws or model components that may not be working correctly. Bringing these issues to light will allow the developers to make the appropriate corrections to the model.

Each dispatch zone is unique, and users are encouraged to develop an evaluation and comparison system that makes sense to them and where constructive feedback can be solicited and tracked. The overall goal is to comparatively evaluate the model outputs and fire danger support tools in order to inform users on the new science and improve the use of NFDRS through standardized, interagency applications of the system.

## II.   NFDRS2016 ANALYSIS PROTOTYPE DEVELOPMENT

NFDRS model evaluation efforts focused on the application and use of the NFDRS2016 model are intended to aid in the successful transition to the model. Efforts should be directed on refining current or developing new fire danger planning tools (i.e. Staffing, Response, Adjective Fire Danger Rating, etc.) and not get preoccupied with the statistical analyses and correlations.

The Southeast Zone Fire (SEZ) Danger Technical Group (FDTG) agreed to develop an analysis prototype using the NFDRS2016 model prior to the 2018 fire season.  The FDTG worked to create an evaluation tool that could be used during the 2018 and 2019 fire seasons to test the NFDRS2016 model utilizing the updated staffing and response tools as well as adjective fire danger rating levels, and preparedness levels. The intent of the analysis prototype was to provide an example to draw attention to the NFDRS2016 model and its use as a fire danger decision support system to aid fire managers and line officers in their decision-making processes. Efforts were directed on refining current or developing new fire danger planning tools (i.e. Staffing, Response, Preparedness, Adjective Fire Danger Rating, etc.).

   A.  Prototype Components

      1.  NFDRS2016 Fire Danger Operating Plan

The SEZ FDTG produced a draft Fire Danger Operating Plan (FDOP) using the NFDRS2016 FDOP template. This process required updates to the "Fires Analysis" process, performing new analyses using the NFDRS2016 model, and updating the fire danger planning tools. The creation of the draft NFDRS2016 FDOP required updates to the subordinate planning documents and associated planning tools as well.

2.      Weekly NFDRS Report

During fire season the SEZ FDTG provides fire managers with a weekly NFDRS report. The report features weekly NFDRS outputs specific to the SEZ that display current fire danger rating levels as they relate to Preparedness Level, Adjective Fire Danger Rating Level, Staffing Level, and Response Level. The 2018 and 2019 weekly reports featured updated information using a standardized format that displayed relative outputs using both the legacy model (NFDRS78/88) and the NFDRS2016 model. The weekly NFDRS report also provided weekly National Weather Service (NWS) outlooks that were provided by the local NWS office.
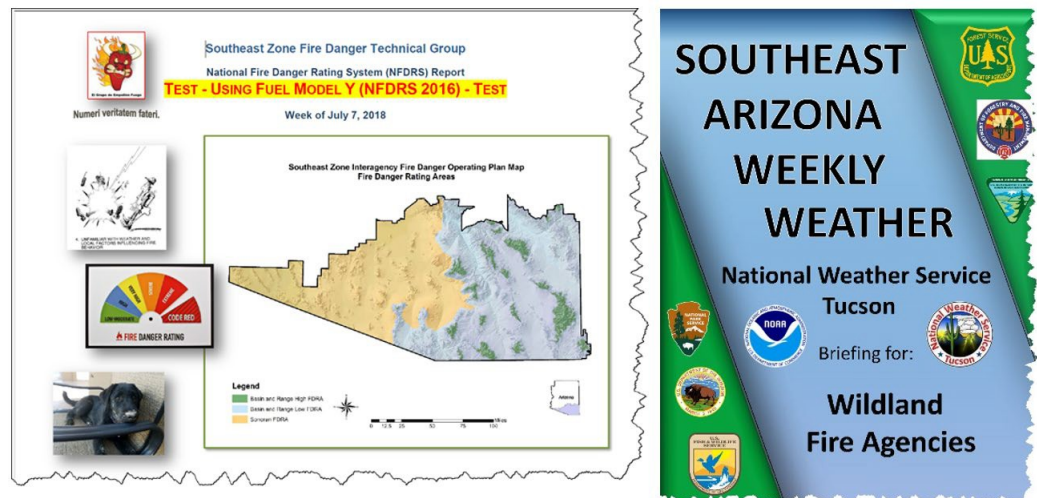


## III.   COMPARATIVE PRODUCTS

A.  FireFamilyPlus Graphs

The 2018 Southeast Zone weekly NFDRS report compared legacy NFDRS (78/88 model) outputs with the new NFDRS2016 outputs. The weekly reports displayed NFDRS2016 and legacy NFDRS outputs using ERC, BI, and IC indices for comparison and tracked the variable outputs as the fire season progressed. Fire managers were able to track the outputs and assess trend patterns during the early- and peak-season periods.

The charts in Figure 1 illustrate the "Average Maximum" (red line) and "Average" (gray line) ERC values for the time periods of January 1st through December 31st. The black line shows the daily ERC values for the current year in the evaluation (2018).

*Evaluating the Model*

The ERC charts using the NFDRS2016 fuel model Y are displayed in the graphs in the upper row with the **red** borders. The 1978 ERC fuel model G charts are displayed in the second row with the **green** borders. Since NFDRS2016 calculates fuel moistures using different models, note that the fuel model Y values are lower than values calculated for fuel model G. It should also be noted that fuel model Y does not include a live fuel component when calculating fuel loading as opposed to fuel model G (Figure 2).
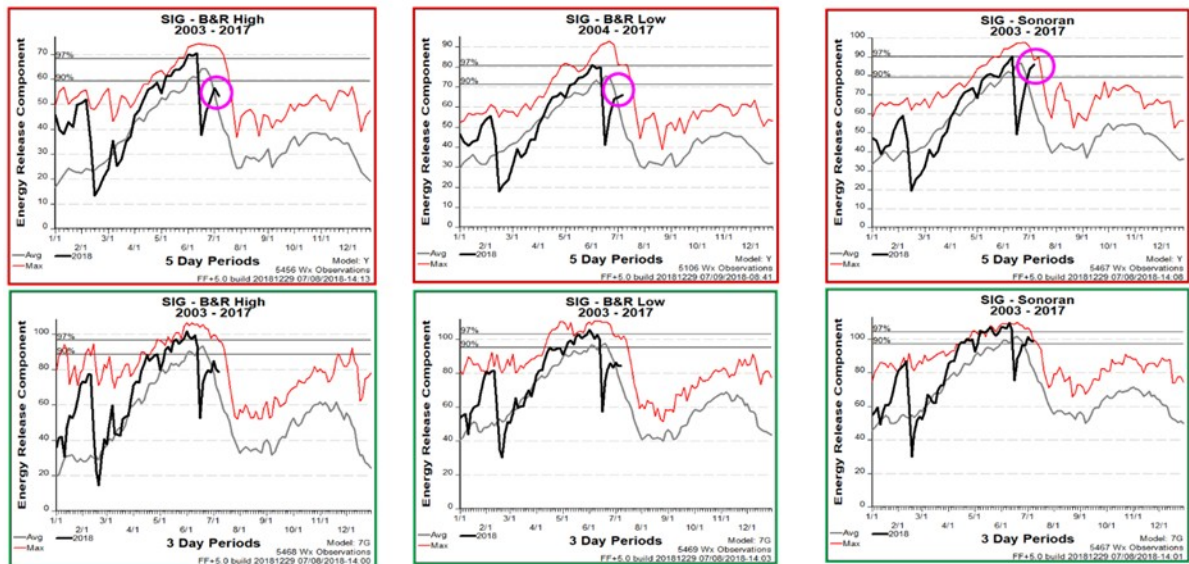


**Figure 1.** NFDRS ERC outputs comparing NFDRS2016 fuel model Y (top row) with legacy NFDRS fuel model G (bottom row). Charts were produced weekly during the course of the 2018 fire season in order to comparatively track the outputs using the two models.



**Figure 2.** NFDRS2016 fuel model parameters. Fuel model Y does not include herbaceous or woody live fuel components in the fuel loading calculations as compared with fuel model G.

B. Fuel Model Parameters

It is important for users to become familiar with and understand the fundamental differences between the legacy versus the NFDRS2016 fuel models. Users can review and compare the fuel model parameters using FireFamilyPlus (FFP) by selecting the 'NFDRS Calculator' from the dropdown menu under 'Weather' located in the menu bar at the top of the FFP screen (Figure 3).
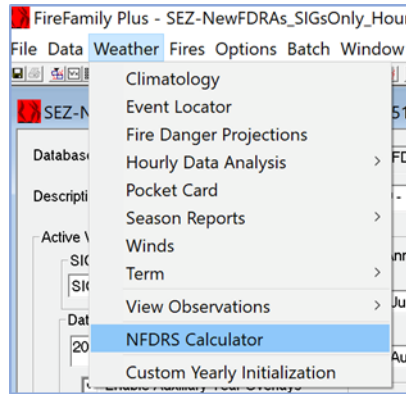
**Figure 3.** Select 'NFDRS Calculator' from the drop-down menu.

The 'NFDRS Calculator' screen will appear, click on the 'Fuel Model Parameters' button at the bottom of the pop-up window.
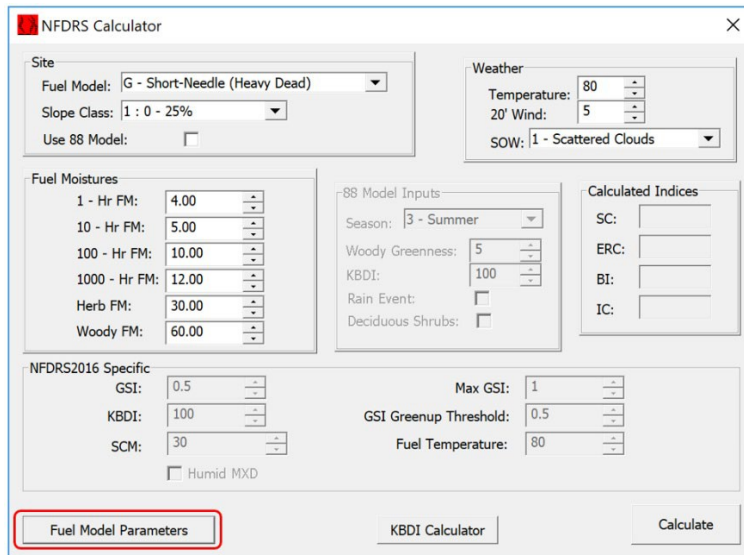


**Figure 4.** Select 'Fuel Model Parameters' in the lower left-hand corner.

The 'Fuel Model Parameters' window will appear and the user can then select which fuel models to view and compare in the table by selecting the fuel models of interest from the drop-down menu in the 'Model Selection' box and then clicking on the 'Add To Table' button.
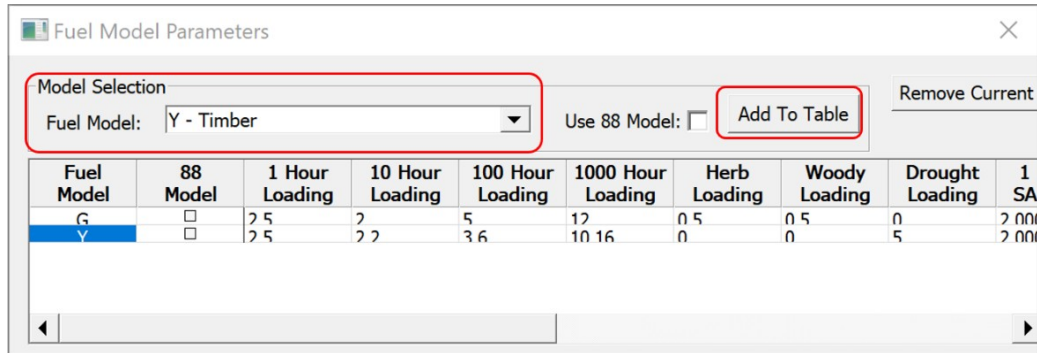
**Figure 5.** Users can make fuel model selections in the Fuel Model Parameters window in FFP. Clicking on the down arrow will display a selection window listing all of the fuel models.

Understand the similarities and differences between the legacy and NFDRS2016 fuel models will help users become more familiar with the new system. Understanding how live and dead fuel moistures are calculated using the new fuel moisture models should also aid users in understanding why the calculated values using the new system are different when compared to the legacy model. Gaining more familiarity and understanding should help users become more comfortable with the new model.

Questions should arise as users compare and contrast outputs. Users should take additional time to study the potential reasons why outputs from the NFDRS2016 model differ from the legacy model. It is recommended that users develop their own system to compare and contrast NFDRS2016 outputs during the course of their respective fire seasons. Whether users develop a weekly report or other form of documentation is up to each zone. The importance of developing, adjusting, and maintaining the tools developed for the various FDOP sub-plans cannot be overstated. These tools are intended to aid decision-makers during the course of each fire season.

C. Comparative Evaluations Using Microsoft Excel

1. Seasonal Trends

   Microsoft Excel (MS Excel) allows users to import and display FFP data using a variety of graphing options. Users familiar with working in MS Excel may find this useful for comparing and tracking FFP data from the legacy and NFDRS2016 models. Daily listing data for the various indices in FFP can be downloaded and imported into MS Excel. MS Excel allows users the flexibility to decide how they wish to display their data for comparative purposes.

   In the past, many NFDRS users tend to look at the NFDRS indices individually when gauging fire danger. Evaluating model outputs may be more meaningful if users compare two or more variables when assessing fire danger. For example, looking at ERC (relatively low daily variability) and BI (high daily variability) for a specific period of time (i.e. fire season),

may indicate periods of elevated fire danger (Graphs 1 and 2). Graph 1 displays outputs using fuel model G; graph 2 displays outputs using fuel model Y. Both graphs display an elevated BI value on June 14th matching weather forecasts for the day predicting elevated wind speeds. The low ERC and BI values on July 6th were due to a precipitation event which can be expected for this FDRA in early July. However, in a "normal" year the ERC and BI values tend to trend downward as the FDRA transitions into late-fire season with the expected seasonal monsoonal moisture. Both graphs show that the ERC and BI values rebounding to above-average levels indicating a lack of precipitation and fuels quickly drying out.

Both fuel models displayed very similar trends for this timeframe. Note that the output values are different due to the different models used to calculate fuel moisture values. Also remember that fuel model Y does not include live herbaceous and live woody fuel loads in its fuel moisture calculations.
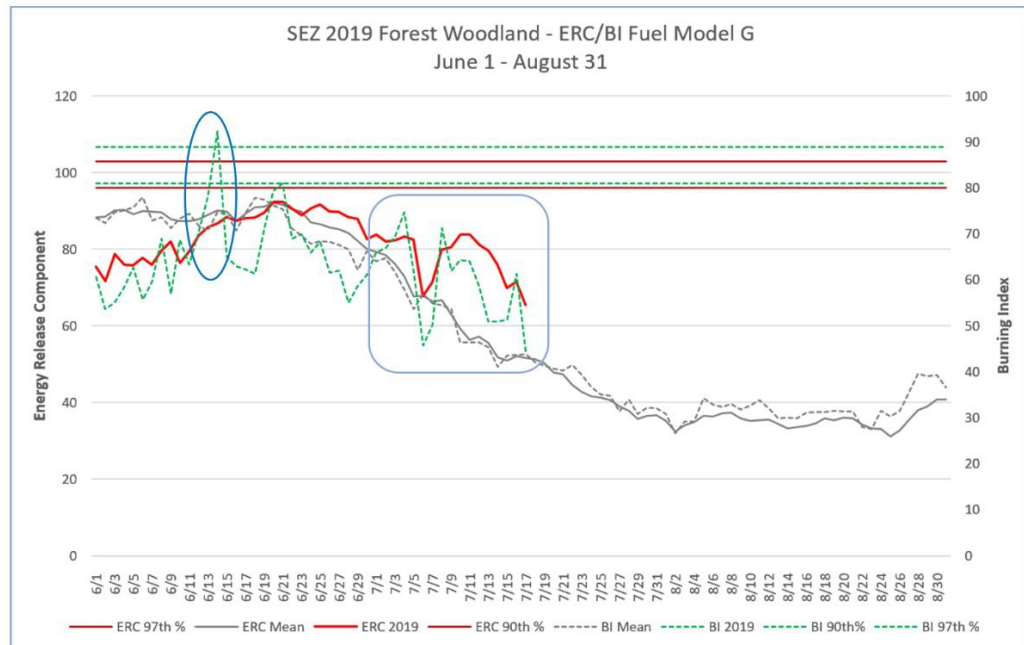


**Graph 1.** ERC and BI values using Fuel Model G looking at a three-month period; peak and late fire season.
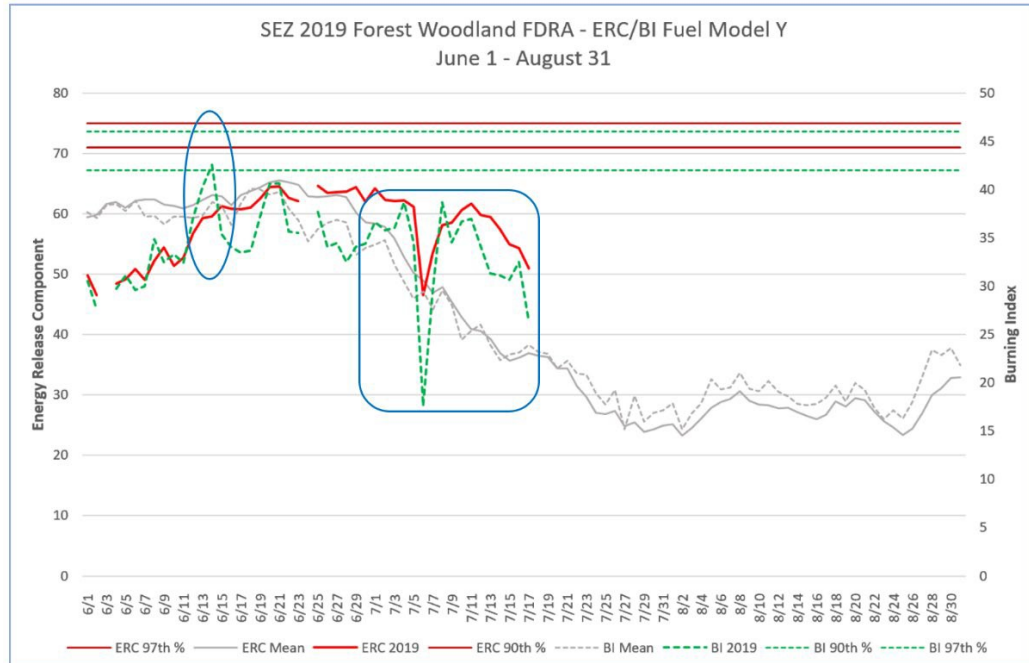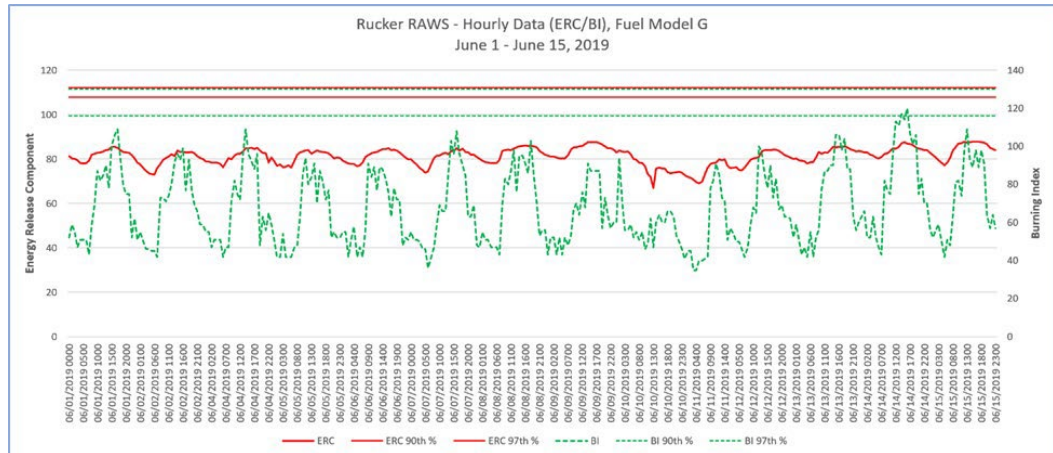
**Graph 2.** ERC and BI values using Fuel Model Y looking at a three-month period; peak and late fire season.
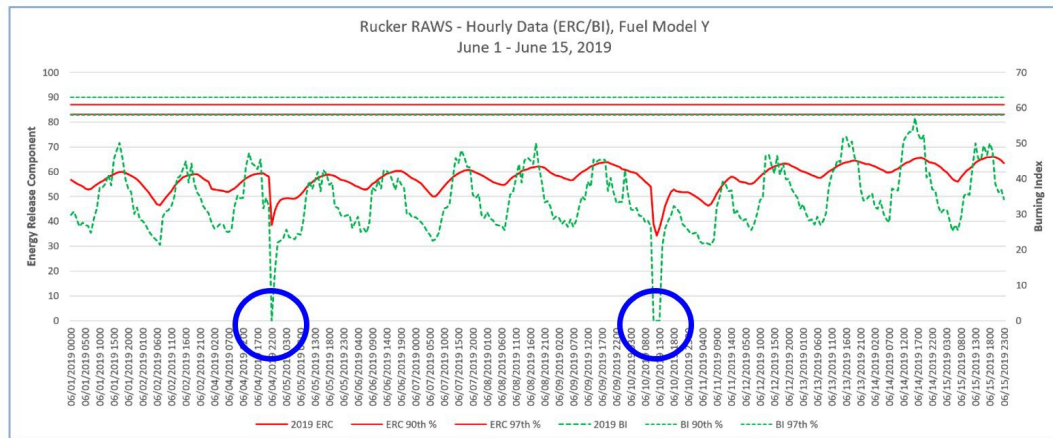
2. Hourly Data

   The availability of hourly weather data and NFDRS outputs is a new feature with the NFDRS2016 model. Hourly NFDRS outputs can provide insight to users on short-term trends. Hourly information can be used in conjunction with National Weather Service (NWS) weather forecasts to aid fire managers and agency administrators with decision making for fires that are being managed to meet resource objectives, prescribed fire planning, or maybe to aid in extended staffing decisions during peak fire season. Hourly NFDRS outputs can also be used to monitor trends for indices that are more sensitive to changing conditions during the course of a given day (i.e. 1- and 10-hr fuel moistures, Ignition Component, Spread Component, Burning Index) and how these outputs may relate to firefighter safety. Graphs 3 and 4 display hourly ERC and BI outputs for a two-week period. The 90th and 97th percentiles for these examples are the 15-year percentiles for each index calculated for the identified 3-month fire season for the zone.

**Graph 3.** Hourly ERC and BI values using Fuel Model G over a two-week period during peak fire season in 2019.



**Graph 4.** Hourly ERC and BI values using Fuel Model Y over a two-week period during peak fire season in 2019.

The hourly data using Fuel Model Y shows two periods where BI values are recorded as zero on June 4th at 2200 hours and again on June 10 at 1300 hours (Graph 4). The hourly data record in FFP shows the BI value of zero on June 4th being associated with 0.01 inches of recorded precipitation and a maximum RH value of 46%. The June 10th hourly data record shows the BI value of zero being recorded at 1100 hours through 1300 hours and is also associated with recorded precipitation values (0.01 and 0.05) and maximum RH values of 81% and 87% (Table 1).

| 021414 - Hourly Listing | | | | | 021414 - Hourly Listing | | | |
|---|---|---|---|---|---|---|---|---|
| 06/04/2019 | 1600 | 43.8 | 0.00 | 46 | 06/10/2019 | 0600 | 29.6 | 0.00 | 43 |
| 06/04/2019 | 1700 | 42.7 | 0.00 | 46 | 06/10/2019 | 0700 | 29.5 | 0.00 | 45 |
| 06/04/2019 | 1800 | 45.5 | 0.00 | 46 | 06/10/2019 | 0800 | 27.8 | 0.00 | 52 |
| 06/04/2019 | 1900 | 31.6 | 0.00 | 46 | 06/10/2019 | 0900 | 28.1 | 0.00 | 53 |
| 06/04/2019 | 2000 | 34.6 | 0.00 | 46 | 06/10/2019 | 1000 | 26.6 | 0.00 | 60 |
| 06/04/2019 | 2100 | 32.2 | 0.00 | 46 | 06/10/2019 | 1100 | 0.0 | 0.01 | 81 |
| 06/04/2019 | 2200 | 0.0 | 0.01 | 46 | 06/10/2019 | 1200 | 0.0 | 0.05 | 87 |
| 06/04/2019 | 2300 | 13.9 | 0.00 | 46 | 06/10/2019 | 1300 | 0.0 | 0.00 | 87 |
| 06/05/2019 | 0000 | 22.0 | 0.00 | 46 | 06/10/2019 | 1400 | 21.0 | 0.00 | 87 |
| 06/05/2019 | 0100 | 22.5 | 0.00 | 50 | 06/10/2019 | 1500 | 26.0 | 0.00 | 87 |
| 06/05/2019 | 0200 | 23.2 | 0.00 | 50 | 06/10/2019 | 1600 | 28.3 | 0.00 | 87 |
| 06/05/2019 | 0300 | 25.7 | 0.00 | 53 | 06/10/2019 | 1700 | 29.7 | 0.00 | 87 |
| 06/05/2019 | 0400 | 23.5 | 0.00 | 53 | 06/10/2019 | 1800 | 32.3 | 0.00 | 87 |
| 06/05/2019 | 0500 | 23.5 | 0.00 | 53 | 06/10/2019 | 1900 | 31.7 | 0.00 | 87 |
| 06/05/2019 | 0600 | 23.0 | 0.00 | 54 | 06/10/2019 | 2000 | 30.3 | 0.00 | 87 |
| 06/05/2019 | 0700 | 24.5 | 0.00 | 54 | 06/10/2019 | 2100 | 27.3 | 0.00 | 87 |
| 06/05/2019 | 0800 | 24.3 | 0.00 | 54 | 06/10/2019 | 2200 | 26.4 | 0.00 | 87 |
| 06/05/2019 | 0900 | 28.5 | 0.00 | 54 | 06/10/2019 | 2300 | 25.6 | 0.00 | 87 |

**Table 1.** Hourly Listing data in FFP for Rucker RAWS. Zero values for BI are associated with recorded precipitation amounts and elevated RH values.

Differences in model output values can be attributed, in part, to how the dead and live fuel moisture values are calculated. The Nelson Dead Fuel Model more accurately models diurnal and seasonal dead fuel moisture using hourly fire weather observations. NFDRS2016 provides hourly inputs to the Nelson model that include temperature, relative humidity, hourly precipitation and solar radiation. There are no user inputs to run the model and the model can be configured to estimate the moisture content of any size of fuel particle, from the smallest one-hour fuels to the largest 1000-hour fuels.

The Growing Season Index (GSI) is used for calculating live fuel moisture. The GSI model operates on daily surface weather observations of minimum temperature, vapor pressure deficient and photoperiod, all of which can be directly calculated from sensible weather parameters already being measured at each RAWS station.

The main benefit of GSI is that is predicts green-up and dormancy from surface weather data. GSI requires no constant human intervention yet accurately reflects within season and between season live fuel conditions from daily weather observations. This removes the need to 'manage' the live fuel conditions such as green-up date, freeze date, cure date and dormant date that are inputs to the current model.

## IV. EVALUATING FIRE BUSINESS THRESHOLDS

A. Fire Business Thresholds/Decision Points – Response Levels

Response levels (e.g. "Low", "Moderate", "High") were established to assist fire managers with decisions regarding the most appropriate response to an initial fire report until a qualified Incident Commander arrives at the incident. Response levels are derived from the most appropriate NFDRS index and/or

component that have a high level of correlation to historical fire occurrence. Burning Index (BI) with NFDRS Fuel Model Y was determined to be the most appropriate NFDRS index that statistically correlates closely to the potential for large fires to occur. Example 1 illustrates the use of BI and fuel model Y three response levels using fire business thresholds for each FDRA developed with FFP v5.

| Response Level Matrix Tucson Dispatch Center | | | |
|---|---|---|---|
| **Fire Danger Rating Area (FDRA)** | **Burning Index (BI), Fuel Model Y** | | |
| **Sonoran** | 0-25 | 26-43 | 44+ |
| **Desert Grasslands (B&R Low)** | 0-29 | 30-49 | 50+ |
| **Forest/Woodland (B&R High)** | 0-23 | 24-39 | 40+ |
| **Dispatch Level:** | **Low** | **Moderate** | **High** |

**Example 1.** Response Level matrix based on Burning Index (BI) fire business breakpoints. Analysis parameters: Fire Season (Apr. – Jul) 2004 – 2017; analysis based on conditional probability – fire days only.

During the 2019 fire season BI values were tracked and graphically displayed using MS Excel in relation to the three response levels for each FDRA (Example 2). Tracking was done to see if the response levels/fire business thresholds developed for each FDRA were credible and that dispatch personnel and fire managers were comfortable with the outputs. Reviewers were requested to critique the tracking information and provide feedback.
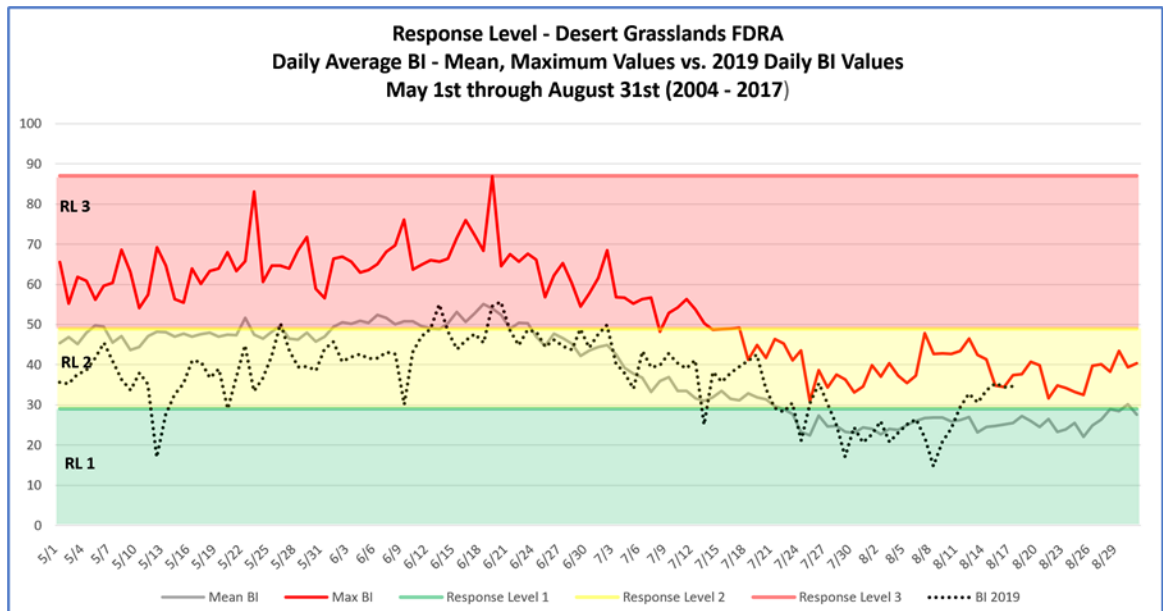


**Example 2.** Evaluating response levels during the 2019 fire season. Evaluating evaluated daily BI outputs in relation to the fire business thresholds identified for response levels for each FDRA.

B. Fire Business Thresholds/Decision Points – Staffing Levels

The staffing level forms the basis for decisions regarding the "degree of readiness" of initial attack (IA) resources and support resources. The Staffing Levels are expressed as numeric values where "1" represents the low end of the fire danger scale 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. Example 3 illustrates the use of BI and fuel model Y with five staffing levels using fire business thresholds for each FDRA developed with FFP v5.

| Desert Grasslands FDRA | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **BI Decision Thresholds** | **0-14** | | **15-29** | | **30-45** | | **46-53** | | **54+** | |
| **Significant Fire Potential** Forecasted High Risk Day/Event (Y/N) | No | Yes | No | Yes | No | Yes | No | Yes | No | Yes |
| **Staffing Level** | **SL 1** | | **SL 2** | | **SL 3** | | **SL 4** | | **SL 5** | |

**Example 3.** SEZ Staffing Level Matrix – Fuel Model Y, Burning Index, Fire Season (May 1st – August 31st).

During the 2019 fire season BI values were tracked and graphically displayed using MS Excel in relation to the five staffing levels for each FDRA (Example 4). Tracking was done to see if the staffing levels/fire business thresholds developed for each FDRA were realistic and that dispatch personnel and fire managers agreed with the outputs. Reviewers were requested to evaluate the tracking information and provide feedback.
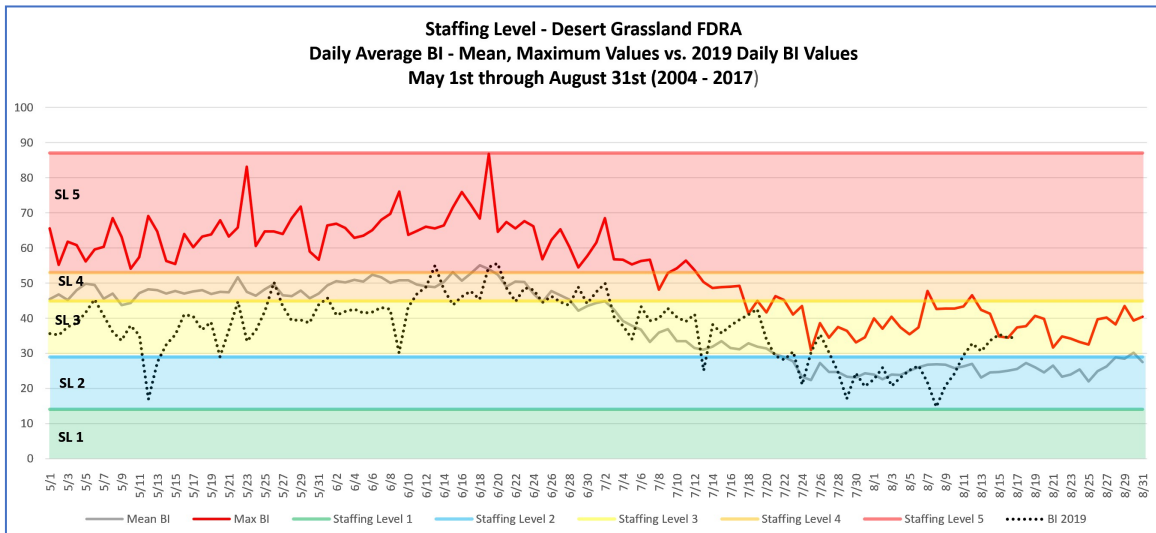


**Example 4.** Evaluating staffing levels during the 2019 fire season. Evaluating evaluated daily BI outputs in relation to the fire business thresholds that were identified for staffing levels for each FDRA.

C. Historical Fire Comparisons

Evaluating historical fire occurrences and comparing the legacy model outputs with the new NFDRS2016 outputs can provide users with a frame of reference as they begin to implement the new model.
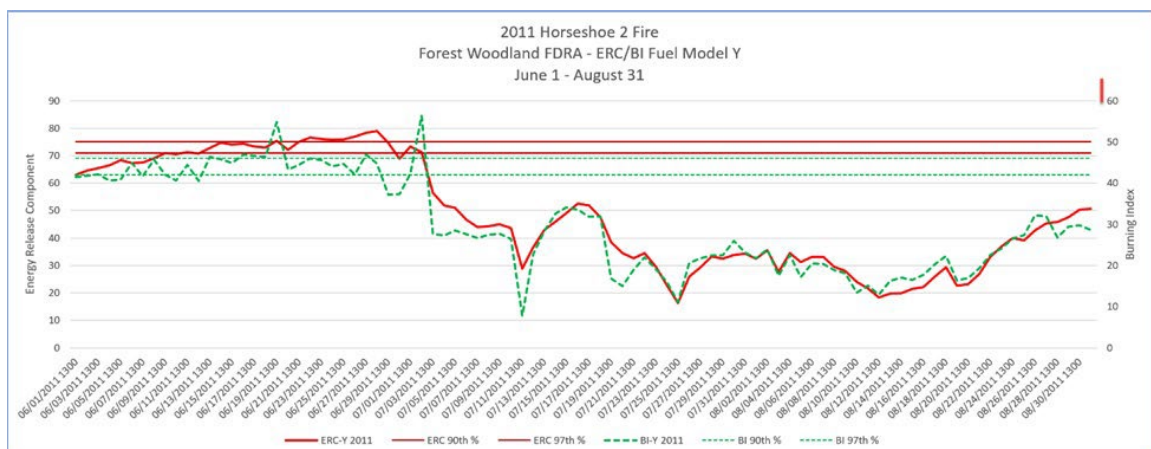
1.  Horseshoe 2 Fire

    The 2011 fire season recorded a number of large fires in the southwestern U.S. The Horseshoe 2 fire was discovered on May 8, 2011. The fire was located in the Forest-Woodlands FDRA and the final acreage was recorded to be 222,990 acres. This fire was called out on August 14, 2011.

    Graphs 5 and 6 display daily ERC and BI values for the identified fire season (June – August 2011). June typically represents the peak of fire season in the desert southwest. Both graphs show ERC values trending at or above the 97th percentile. BI values are also shown trending at or above the 90th and 97th percentiles through June. The first three weeks of June experienced very high to extreme fire behavior on this fire.
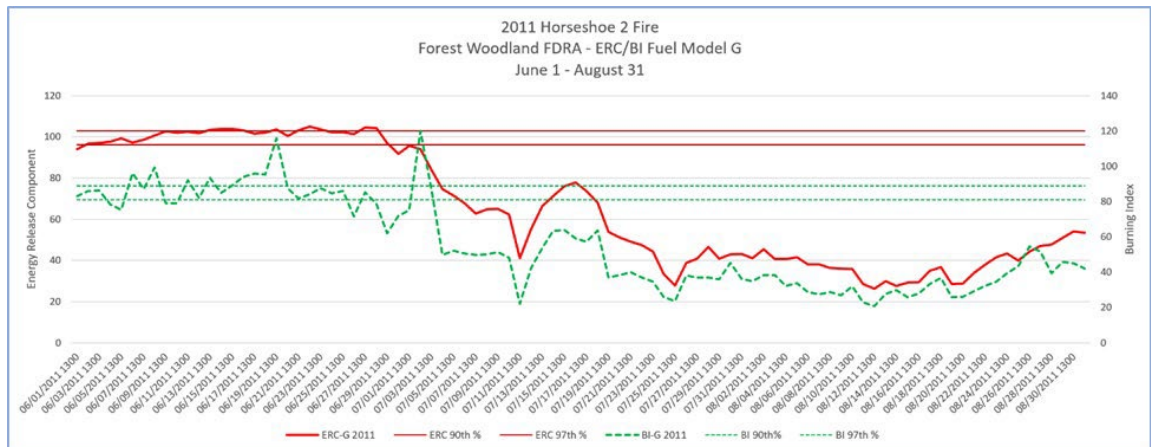


**Graph 5**. Daily ERC and BI values using Fuel Model G for the 2011 fire season during the Horseshoe 2.



**Graph 6.** Daily ERC and BI values using Fuel Model Y for the 2011 fire season during the Horseshoe 2.

Graph 7 displays hourly ERC and BI values for the period of June 7th – 20th in 2011. Fuel model G shows peak ERC values trending above the 90th percentile through June 13th and peaking above the 97th percentile beginning on June 14th at around 1500 hours. BI values peaked above the 97th percentile for most of this time period.
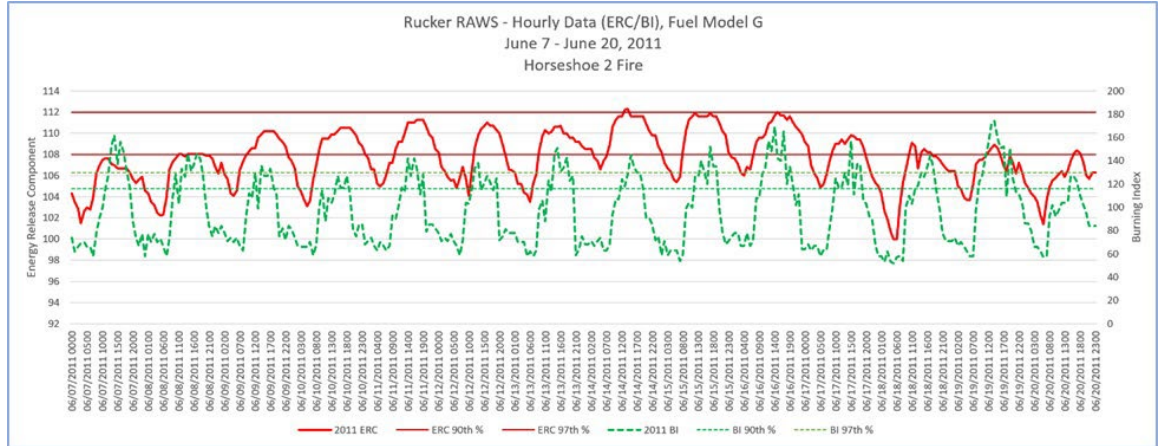


**Graph 7.** Hourly ERC and BI values using Fuel Model G over a two-week period (June 7-20, 2011) during the Horseshoe 2 fire in 2011.

Graph 8 also displays hourly ERC and BI values for the period of June 7th – 20th in 2011. Values calculated using fuel model Y indicates peak ERC values trending above the 90th percentile from June 8th through June 12th and peaking above the 97th percentile beginning on June 14th at around 1500 hours. BI values peaked above the 97th percentile for most of this time period.
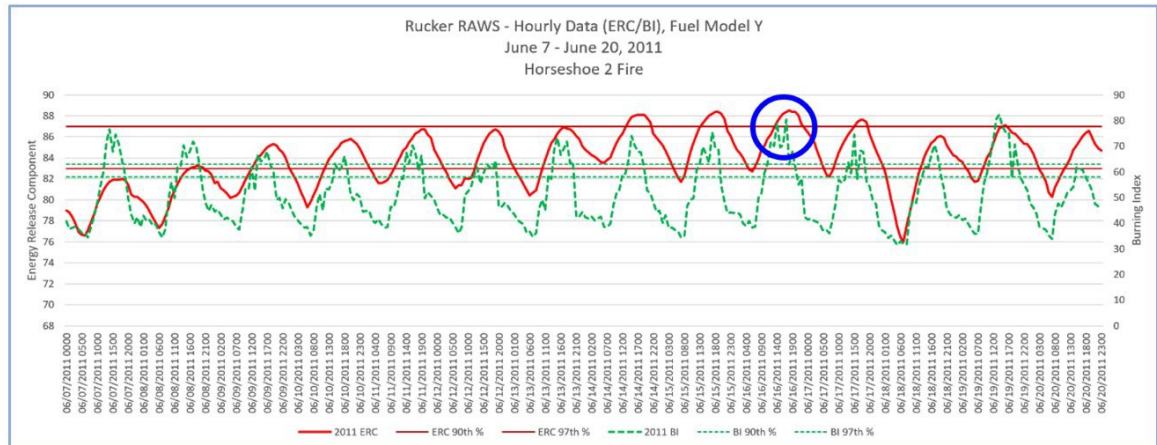


**Graph 8.** Hourly ERC and BI values using Fuel Model Y over a two-week period (June 7-20, 2011) during the Horseshoe 2 fire in 2011.

Graph 8 shows ERC and BI values on June 16th both peaking above their respective 97th percentile thresholds at 1700 hours. The hourly data in FFP for this time period shows 1-, 10-, and 100-hour fuel moisture values being critically low (1.9%, 4.5%, and 5.1%) as well as a minimum RH value of 4% (Table 2). These values indicate the potential for extreme fire behavior.

**Table 2.** Hourly Listing data in FFP for Rucker RAWS. Both ERC and BI values are well above the 97th percentile for the FDRA. The low values for the 1-, 10-, and 100-hour fuel moisture values as well as the low minimum RH value indicate the potential for extreme fire behavior.

Note that when displaying graph data in MS Excel, if the cursor is held over any point on the graph a pop-up window will appear, and display information associated with that point. Graph 9 shows an ERC value of 87.9 at 1500 hours on June 14, 2011.
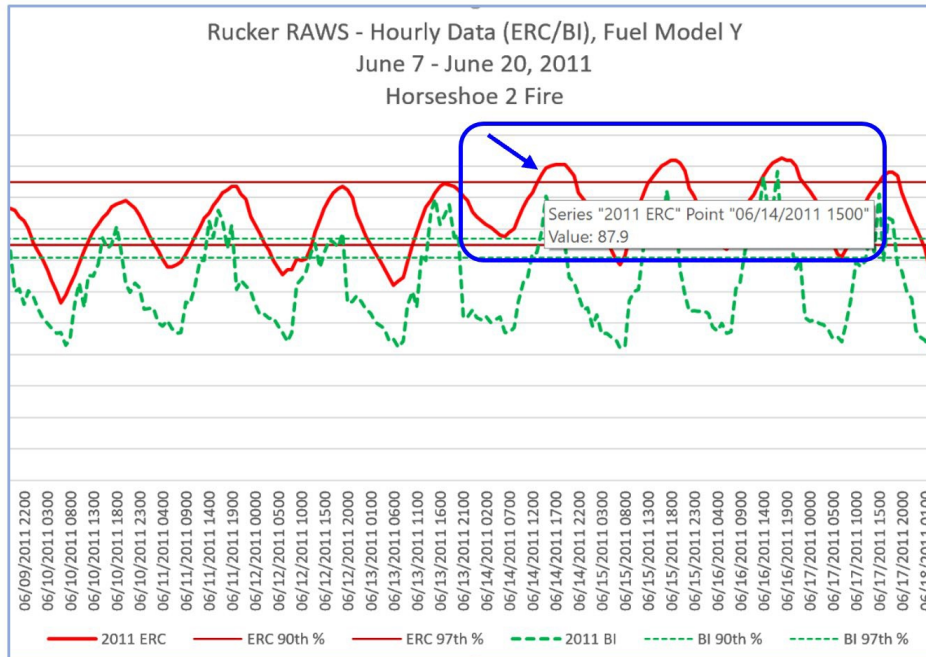
**Graph 9.** MS Excel allows users to display specific information for any data point in the graph.

## V.   WEATHER INFORMATION MANAGEMENT SYSTEM (WIMS) EVALUATION

The following information represents guidance on the operational testing of NFDRS2016 in WIMS. There are three objectives for testing NFDRS2016 in WIMS:

1.  Familiarize Subject Matter Experts (SME's) with the new WIMS functions and screens in preparation to help others within their geographic areas as they transition to the new model.

2.  Familiarize SME's with the real time differences between the legacy and NFDRS2016 fuel model(s).

3.  Test the new WIMS functionality and report problems/bugs back to the developers/programmers.

The following information includes instructions to be completed first in FireFamilyPlus and then in WIMS.

A.  FireFamilyPlus 5.0

1.  Open your most current hourly NFDRS2016 compliant database in FireFamilyPlus 5.0.

2.  Determine *climatological breakpoints* for NFDRS2016.

a.  Identify the SIG(s) or station(s) that will be used for the test.

b. Determine which fuel model(s) will be used for the test. At the minimum Fuel model 'Y' needs to be included.

c. Use FireFamilyPlus to determine the two top tier breakpoint values for ERC to be entered into WIMS for the new fuel model(s) (e.g. 90th/97th, 80th/95th). These values will be used to calculate the Staffing Index which will be used to compare legacy models with the new models.

d. Verify climatological breakpoints for the legacy fuel models that are currently be used in WIMS.

3. WIMS PROD (WIMS Production)

   a. Edit the Station Catalog (ESTA)

   b. Activate the new NFDRS16 Fuel Model(s). The new fuel models will automatically appear on the ID list, but they need to be activated.

   c. Once the new fuels models are activated the output values will begin to be calculated. WIMS automatically does a recalculation when the new models are activated so no manual recalculation is needed.



d. Add the new Staffing Index Breakpoints for the new fuel model(s) that were determined using FFP.

e. ERC will be used for this evaluation.



f. Navigate to the Default NFDRS Parameters Screen (ENFDR).

(1) There is a new role in WIMS called the 'Model Manager'. *Currently the owner of the station has been given this role and is the only one that make certain edits to the ERNFDR screen*.

(2) The Model Manager can make changes to the live and dead fuel moisture calculations by adjusting the standard inputs, but if you unsure about adjustments the default values can be used for now.
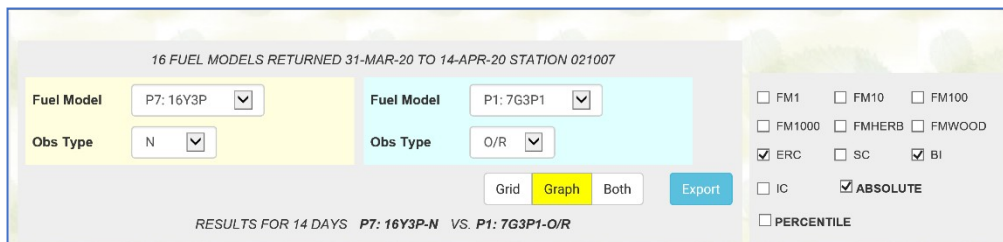
g. Navigate to the Compare Screen (COMP).

(1) Enter the desired weather station or SIG and date range.

(2) Select 'fetch station data'.



(3) A number of data types and viewing options are available to use for your analysis.



(4) Select different settings to view comparisons of output values between the legacy fuel models and the NFDRS16 fuel model(s).

(5) The data can be viewed as a grid or a time series graph.

(6) Absolute values can be compared as well as percentile values although a standard procedure has not been developed or published to create and import the percentiles. Just compare absolute values for now.
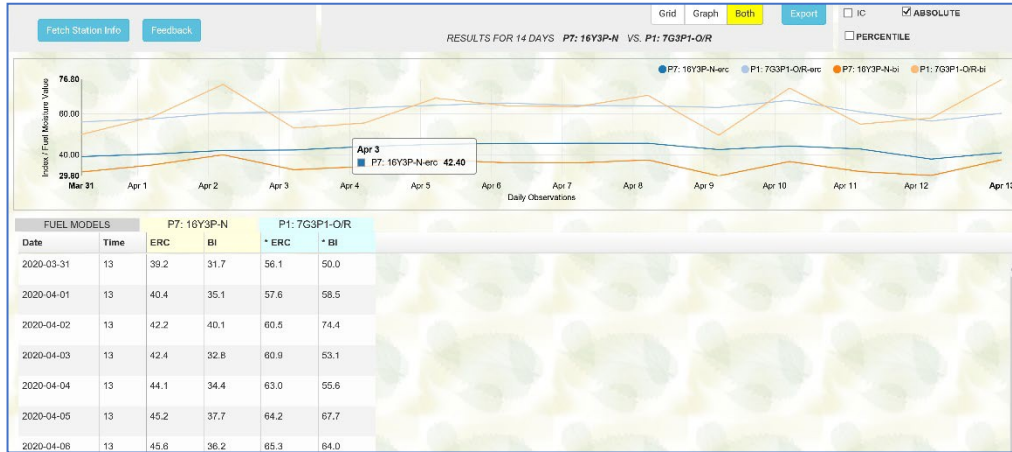
(7) Take notes of the differences and trends

(8) For the purpose of evaluation check the comp screen once a week and make notes on how the different fuel models have performed with respect to the actual fire danger/fire activity of the week.

(9) Navigate to the Display Index Format screen (DIDX).

    (a) Select the test SIG or station and select the 'O/R+N' observation type and set the date range.

    (b) Compare the calculated Staffing Level(SL) between the legacy model(s) and the NFDRS16 models.

    (c) Take note of the differences and trends.

## VI. SUMMARY

There are a wide variety of methods available to evaluate and compare legacy and NFDRS2016 model outputs. Each dispatch area/zone is unique, and users are encouraged to develop an evaluation and comparison system that makes sense to them and where constructive feedback can be solicited and tracked. Feedback information is where constructive changes or adjustments to the various FDOP tools can be effectively applied.

Weekly reports that highlight side-by-side comparisons of the NFDRS2016 and legacy models help fire mangers and dispatch center personnel become more familiar with the new science. Differences in model outputs should be expected and new users to the system have the opportunity to learn why outputs may vary. The biggest difference in the new model outputs is in how the live and dead fuel moistures are calculated.

Data with the NFDRS2016 model can be reviewed using a daily format or hourly. Evaluating NFDRS outputs using MS Excel can help users evaluate information related to staffing or response levels.

Users can also evaluate NFDRS outputs in WIMS using the 'Compare Screen' function (COMP). WIMS users can select different settings to view comparisons of output values between the legacy and NFDRS2016 fuel models. The data can be viewed as a grid or a time series graph where absolute values can be compared.

Comparative evaluations provide NFDRS users with a better understanding in how the new model operates. Improving user knowledge with the NFDRS2016 model provides the opportunity to refine current or develop new fire danger planning tools (i.e. Staffing, Response, Preparedness, Adjective Fire Danger Rating, etc.).

## REVIEW OBJECTIVE(S)

Upon completion of this lesson, participants will be able to:

1. Review a NFDRS 2016 prototype developed to compare legacy NFDRS model outputs with NFDRS2016 model outputs.

2. Review examples of comparative products to give participants ideas on possible comparative products for their home units.

3. Evaluate fire business thresholds in the FDOP subordinate plans.

4. Evaluate legacy model and NFDRS2016 model outputs using historical fires.

5. Compare legacy model outputs with NFDRS2016 model outputs using WIMS.