DEFINING BREAKPOINTS AND THRESHOLDS

Contents

OBJECTIVE(S)

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

1. Describe which management decisions are most appropriately supported by either climatological breakpoints or fire business thresholds.

2. Using FireFamilyPlus, discuss a process which can identify the best "fire business" relationships by examining multiple combinations of fuel models and NFDRS outputs.

3. Using FireFamilyPlus, discuss a process using statistical tools to identify appropriate decision points for staffing levels, adjective rating levels, dispatch levels, and public fire restrictions).

NARRATIVE

I. INTRODUCTION

When we talk about NFDRS, there are two methods you can use for setting decision classes: Climatological Breakpoints and Fire Business Thresholds. Both are useful in classifying fire danger, but they tell different things. In this lesson, we will talk about both methods, and then describe the process for calculating fire business thresholds.

II. CLIMATOLOGICAL BREAKPOINTS AND FIRE BUSINESS THRESHOLDS

A. **Climatological Breakpoints** are based solely on the weather data in your Working Set. They are statistical breakpoints calculated from climatology. In the U.S. Forest Service, fire staff use the 90th and 97th percentile. When the 97th percentile is selected, only 3% of the days are worse than that. Climatological Breakpoints were originally developed because there was very little fire data available. At the time, managers needed a way to determine their decision points (What does a "bad" day looked like?). According to John Deeming, the developers decided to use the 90th and 97th percentiles in the USFS to find the most extreme conditions. Similarly, the BLM decided to use the 80th and 95th percentiles. To find additional classes, the value of the NFDRS index/component at the 90th (80th) percentile is divided in half. Then, it is divided in half again. This gives you four thresholds to make five decisions.

B. **Fire Business Thresholds** are determined by analyzing the statistical relationship between weather and fire, such as you started doing in Lesson 11. Using this information, you can analyze any number of NFDRS fuel models and outputs to see which combinations explain the relationship well. Then, you can determine the points at which the decision changes. Each management tool has a set of decision classes. For example, there may be three staffing levels, and there are five adjective rating levels.

III. WHEN AND WHY TO USE CLIMATOLOGICAL BREAKPOINTS?

A. NFDRS is relative, which means that an ERC of 35 may not mean the same thing in Montana and Texas. It doesn't mean the same thing for a Fuel Model X and a Fuel Model Y. However, an ERC at the 97th percentile means the same thing everywhere and for every fuel model: only 3% of the days were worse. Using Climatological Breakpoints ensures that.

B. Climatological Breakpoints are valuable when looking at regional to national level maps. The same fuel model and NFDRS index/component are used (e.g., ERC for fuel model Y), and percentiles are calculated for each RAWS. Fire danger can then be mapped across the country, region, state, or dispatch

center to see which areas the highest fire danger have, as well as how much of the country has the highest fire danger. This assists with regional, geographic area, and national decisions, such as preparedness.

IV. WHEN AND WHY TO USE FIRE BUSINESS THRESHOLDS?

It is common to see fires occurring well below the 90th percentile defined by the Climatological Breakpoints. Fire Business Thresholds are useful at the local level. These thresholds relate to actual fire activity. It is easier to determine when a change in fire danger results in a change in fire activity. You can then answer questions such as the following:

1. At what fire danger level do fires occur?
2. As fire danger increases, when can we expect to see large fires or large fire growth?
3. When do we tend to get multiple fires in a day?
4. When does the local situation "change"? Or, when would you make a different decision?

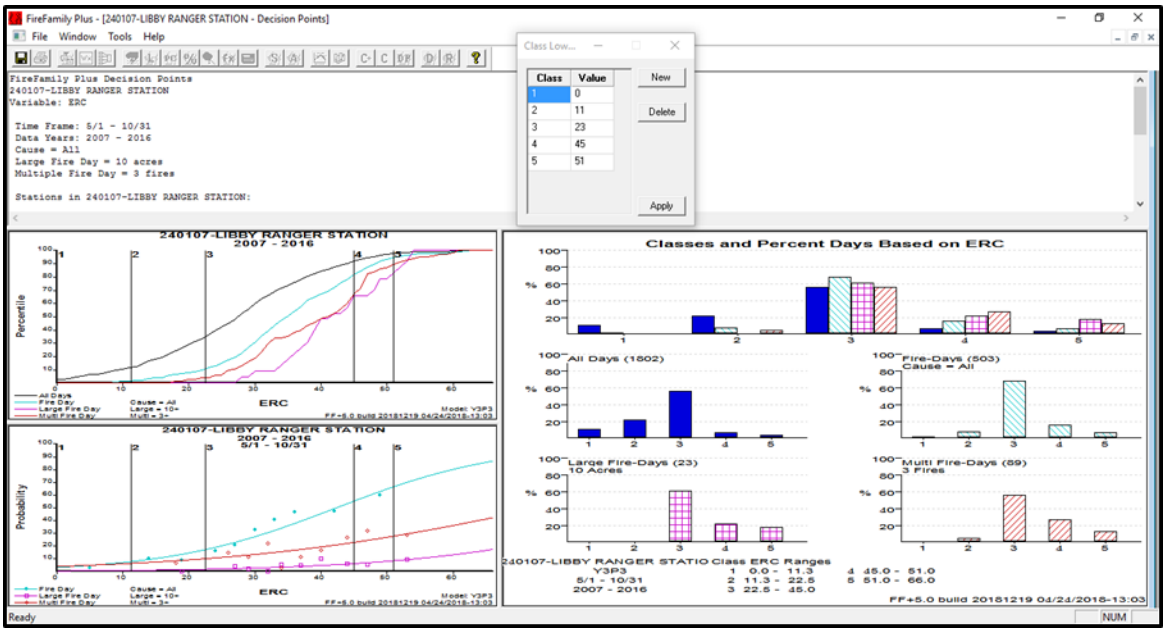
V. HOW MANY DECISION CLASSES?

The number of decision classes (thresholds or breakpoints) should reflect the associated management action. To simplify the process, consider that some management tools have pre-defined numbers of decisions classes. For example:

Management Tool	Number of Decision Classes
Staffing Levels	5
Response Levels	3 – 5
Preparedness Levels	5
Adjective Fire Danger Rating Levels	5

VI. SETTING FIRE BUSINESS THRESHOLDS

Click on the **Fires Probability Analysis** window, and the **Decision Points (DP)** icon () on the tool bar activates. Click on the **Decision Points** icon to open the Decision Points window, similar to the one shown below.



A. The Initial Class Lower Limits are shown in the figure; FireFamilyPlus divides the data into 5 classes. You can think of these as 1-5, or Low, Moderate, High, Very High, and Extreme. The initial breakpoints (lower limits) to these five classes are set using Climatological Breakpoints, which is the logic used to set Adjective Levels in WIMS.

- Class 1: Zero
- Class 2: ¼ of the value of the index's 90th percentile
- Class 3: ½ of the value of the index's 90th percentile
- Class 4: The value of the index's 90th percentile
- Class 5: The value of the index's 97th percentile

You already are familiar with the contents of the two graphs in the lower left quadrant of the window, because they are exactly the same graphs that you looked at to get to this point. You've studied them enough to make some decisions based on their information. The vertical lines show you where the current class boundaries fall along the percentile or probability curves. The lines update every time you click **Apply**.

The lower right panel in the window is really quite simple. It is the relative frequency of the four weather type days (all, fire, large-fire, and multiple) within each class. The top graph shows all types combined. The bottom four graphs simply split them out so you can easily compare the relative frequency of day types as you go between classes. The bar charts update every time you click **Apply**.

If you prefer tables, the top panel offers a table format. The table columns marked with asterisks – %, %FD, %LFD, and %MFD – are shown in the bar charts in the lower right panel. The table updates every time you click **Apply**.

B. Start converting these to fire business thresholds by looking at either the histogram or fire percentiles graph to see where you might want to put your breakpoints visually. Look for values at which fire activity starts, at which large or multiple fire days begin to occur, at which there is a large increase in fire activity, and the value when fire activity peaks. Draw lines on the graphs to visually break it into the desired number of classes.

C. Here are some thoughts related to the graphs and Decision Points in an ideal world.

- You would like to define classes so that the decision you make for fire business is different for the class above and below it.
- You would like to have a large (maybe double) increase of fire potential (for example, a large fire day) with each class.
- You have the minimum number of classes needed to support decisions and actions.

D. What should your bar charts look like, and why?

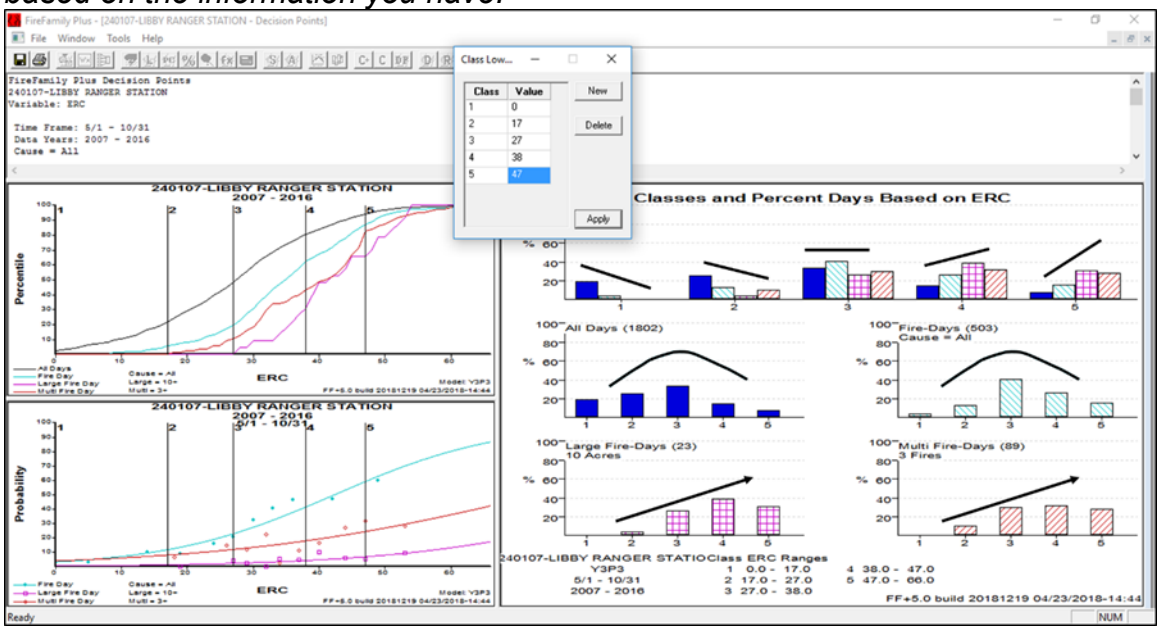
- You want to see steady increase in the number (probability) of large and multiple fire days moving from class 1 to 5.
- The ratio of large fire days to fire days should increase as you go from class 1 to class 5.
- The percentage of large fire days and multiple fire days should not decline when moving from class 3 to 4 to 5. In an ideal world, they will increase.

E. Take a few minutes to review your graphs before continuing. There is a lot of information in these graphs, and all of it is interconnected. A small change in a Class Lower Limit can have large impacts on the graphs if there is a large change in fire occurrence.

F. Modify the graphs by changing the Decision Points in the Class Lower Limits dialog box, using the graph below as a guide. Click Apply to update the tables and graphs. The lines over the bar graphs in the example below show the ideal distribution for each category if the analysis is done for the fire season. If a year-round analysis is made, then All days may decrease from Class 1 to Class 4, indicating that most days during the year are not fire days.

Note: *There is no exact recipe for success in this process. In this lesson, the process is more important than the outcome. Look at the graphs and see what makes sense and what doesn't. There may be a lot that doesn't make sense, especially if the index/fire business relationships as described above are not very good. Use your best judgment to select the Decision Points*

based on the information you have.



REVIEW OBJECTIVE(S)

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

4. Describe which management decisions are most appropriately supported by either climatological breakpoints or fire business thresholds.

5. Using FireFamilyPlus, discuss a process which can identify the best "fire business" relationships by examining multiple combinations of fuel models and NFDRS outputs.

6. Using FireFamilyPlus, discuss a process using statistical tools to identify appropriate decision points for staffing levels, adjective rating levels, dispatch levels, and public fire restrictions).