

# Lab 5 Part 2 Wildfire Risk Assessment

## Objectives

- Use the .LCP files created in Lab 4 to create fire behavior outputs using FlamMap5
- Visually compare outputs in ArcMap

**Your Mission:** Now that you have your LCP files created you are asked to produce projected fire behavior output for your three scenarios, no-treatment (but corrected for current conditions), with the completed slopes units in place, and then with the future slopes units in place. You are asked to report on whether the current and future slopes projects are expected to reduce the burn probability, flame length and average fire size inside and outside of treatments. You will deliver these findings to the project stakeholders, and they will decide if additional money and time should be devoted to this endeavor.

Fire and Fuel Modeling side note: You are about to justify the existence of a very large and expensive fuel reduction project based on the output of some fire behavior models. There is a lot to learn about fire and fuel modeling to make them the most effective but that, sadly, is not the scope of this course. As we produce and analyze output in these labs, it is important to remember that “all models are wrong, but some are useful” (George Box, 1979). There are many sources of error including the error that we apply as inexperienced users. We will certainly be creating some potentially informative and useful output but remember that the *process* of thinking about the inputs and interpreting the outputs is perhaps the more important outcome of these labs.

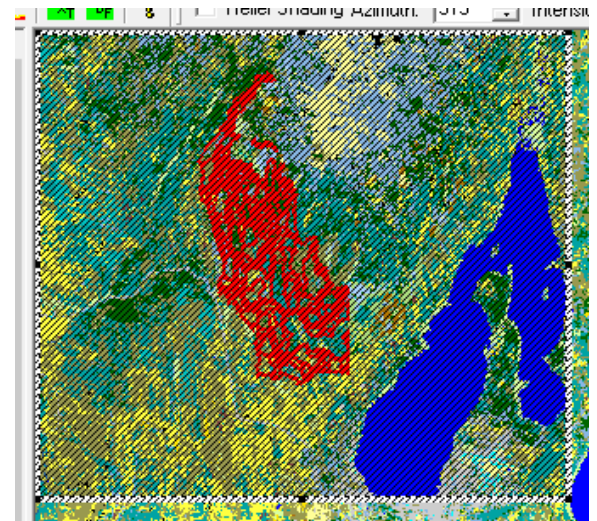
## 1. Creating fire behavior outputs from FlamMap5

Please attempt this but do not let it consume your time. Give yourself an hour to complete this output. I will meet you the rest of the way with the data that you need.

Preparing the data – Create an *Inputs* folder in your Lesson\_5 folder and place your .LCP files there. Using the directions in ‘How-to: use FlamMap’ slide 3 add a projection file from one of the LANDFIRE files and create a projection file for each LCP file.

You will complete the following steps for each of the .lcp files.

- a. Open FlamMap (you may need to search for it)
- b. Click on **No Landscape File** and navigate to *BBB\_corr.lcp*
- c. Go to *Themes>>New Vector Themes* and add the *BBB\_treatments.shp* file to give spatial context.
- d. Go to *Analysis Area>>New Analysis Area* and drag the selection box around the *BBB\_treatments* area so that there are roughly equal spacing around the project. Use Payette Lake as a reference. (see how-to slide 4)



Fire Behavior and Fire growth- Select **New Run** and enter the following information. Feel free to enter slightly different fuel moistures, winds or ignitions so that the output from our class covers a variety of conditions. Please indicate in the descriptions of your completed figures what inputs you used.

#### Inputs tab

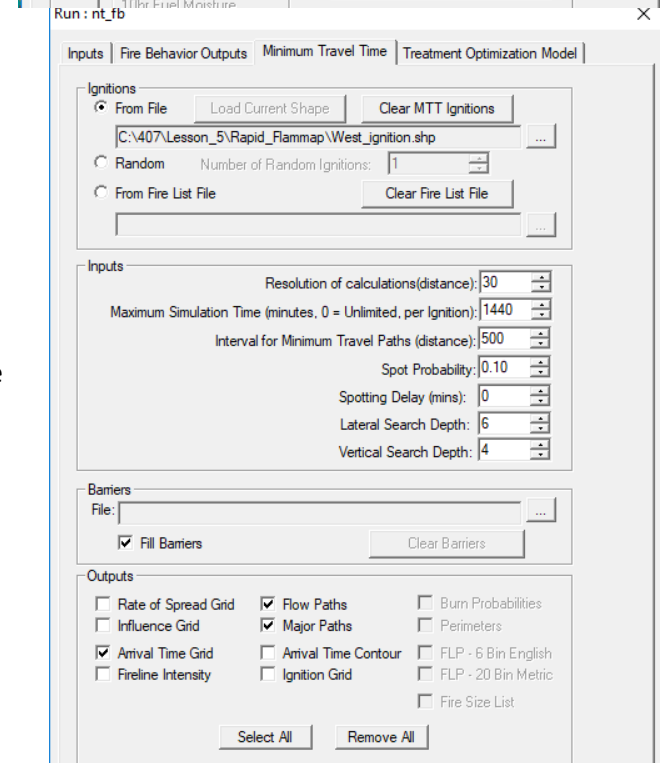
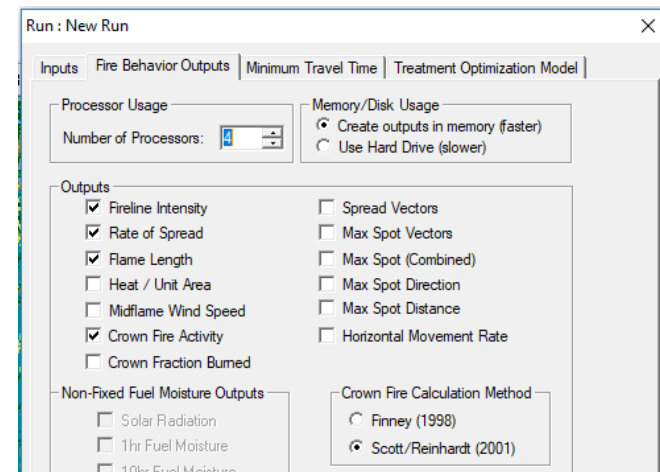
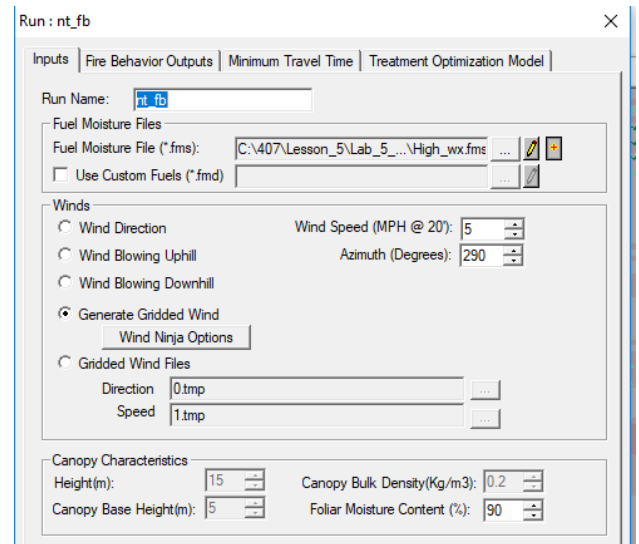
- Run Name: **nt\_fb**
- Fuel Moisture File: *Lab\_5\_data*>>**High\_wx.fws**
- Wind Speed: **15**
- Wind Direction: **290**
- Select **Generate Gridded Wind**
- Fuel Moisture Content: **90**
- Click **Apply**

#### Fire Behavior Outputs

- Leave the number of processors (the program should default to the correct number)
- Output grids
  - o **Fireline Intensity**
  - o **Rate of Spread**
  - o **Flame Length**
  - o **Crown Fire Activity**
- Crown Fire Calculation Method: **Scott/Reinhart (2001)**
- Click **Apply**

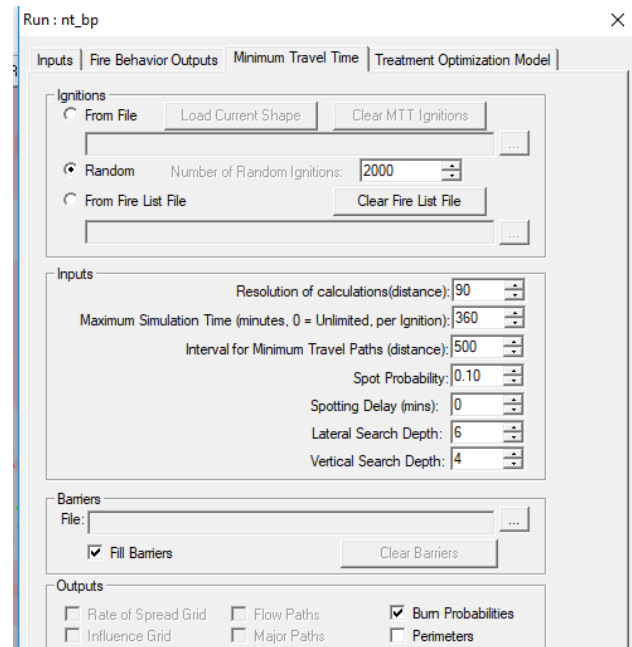
#### Minimum Travel Time

- Ignition>>From File>> press the ‘...’ button and navigate to *Lab\_5\_2\_data*>>**West\_ignition**
- Maximum Simulation Time: **1440** (this is equivalent to 4 days of burning)
- Spotting Probability: **0.10**
- Outputs
  - o Arrival Time Grid
  - o Flow Paths
  - o Major Paths
- Click **Launch MTT** (this will launch both the MTT and the Fire Behavior) close the dialog box when complete



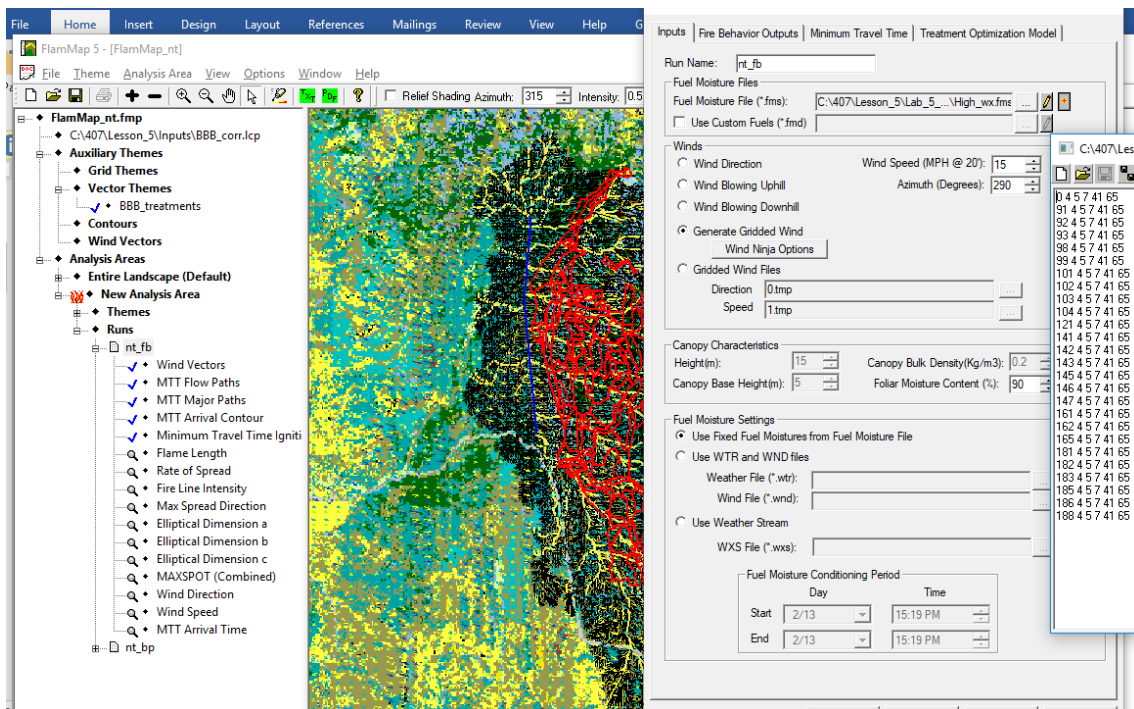
## Burn Probability - Minimum travel time

- Double-click on **Runs** to start a new run
- Label: **nt\_bp**
- Enter all the same inputs used for the fire behavior run
- Do not enter anything on the Fire Behavior tab
- On the MTT tab
  - Ignitions: **Random – 2000**
  - Resolution of calculations: **90**
  - Maximum simulation time: **360**
- Outputs
  - **Burn Probabilities**
- Click **Apply**
- Just to be safe, save any documents you may have open and limit the number of programs you have running.
- Click **Launch MTT**



## Save each of the outputs

- Right-click on the flame length and select **Save As...** and navigate to *Lesson\_5>>Outputs*.
- File name: nt = No Treatment
  - nt\_fl = flame length
  - nt\_ros = rate of spread
  - nt\_fli = fire line intensity
  - nt\_bp = burn probability
  - nt\_at = Arrival time
  - nt\_fp = Flow path
  - nt\_mp = Major path
- Save your Flammap Project and close



Repeat – Open a new FlamMap project and repeat with the roads

e. Troubleshooting

If by launching MTT your computer crashed, download the MTT data from Bblearn for all three scenarios and save the **BP** (burn probability) files to the output folder discussed in the next step

*Question 1: submit a screen capture of your inputs tab for your **nt\_fb** run (Even if you were not able to run it). Position your run window so you can see the LCP file in the background and then expand the .fms file. Match your screen capture to the one above.*

f. Save each of the outputs

- In FlamMap, right-click on the flame length and select **Save As...** and navigate to the *outputs* folder in your lesson 5 folder.
- File name:
  - o No Treatment –
    - nt\_fl = flame length
    - nt\_ros = rate of spread
    - nt\_fli = fire line intensity
    - nt\_cfa = crown fire activity
    - nt\_bp = burn probability
    - nt\_at = Arrival
    - nt\_fp = Flow path
    - nt\_mp = Major path

g. Repeat

- Complete a fire behavior and burn probability for BBB\_roads.lcp, use the same inputs
  - o Example output - r\_fl
- Complete a fire behavior and burn probability for BBB\_wui.lcp, use the same inputs
  - o Example output - w\_fl

## 1.1 Convert ASCII to Raster

- a. Open a new ArcMap project
- b. Add the BBB\_treatments layer for spatial reference
- c. *Optional:* Refer to the ArcFuels Tutorial >> ArcFuels 10 Tutorial – Toolbar >> [Tools: Convert ASCII to Raster](#) for additional instructions and screen captures. Scroll down to Exercise 39.
  1. Although directions given in this document are sufficient to complete the lab. It is useful to be familiar with the ArcFuels tutorial so you can go here to find information for use in other projects.
- d. From the ArcFuels toolbar go to *Tools >> Batch Convert ASCII to Raster*
- e. *Source folder* – Navigate to your Lesson 5 outputs folder
- f. Select all the CFA files (Crown Fire Activity)
- g. Confirm the *Data Type* is **Integer**
- h. *Target folder* – Navigate to your Lesson\_5 >> **Inputs** folder (this will reduce confusion in the outputs folder)
- i. Click **Convert**
- j. *Source folder* – Lesson 5 outputs folder
- k. *Data Type* is **Floating Point**
- l. *Target folder* – Navigate to your Lesson\_5 >> **Inputs** folder
- m. Click **Convert**
- n. Create *New Group Layers* for each treatment option and add the *fp* and *mp* shapefiles from the outputs folder.

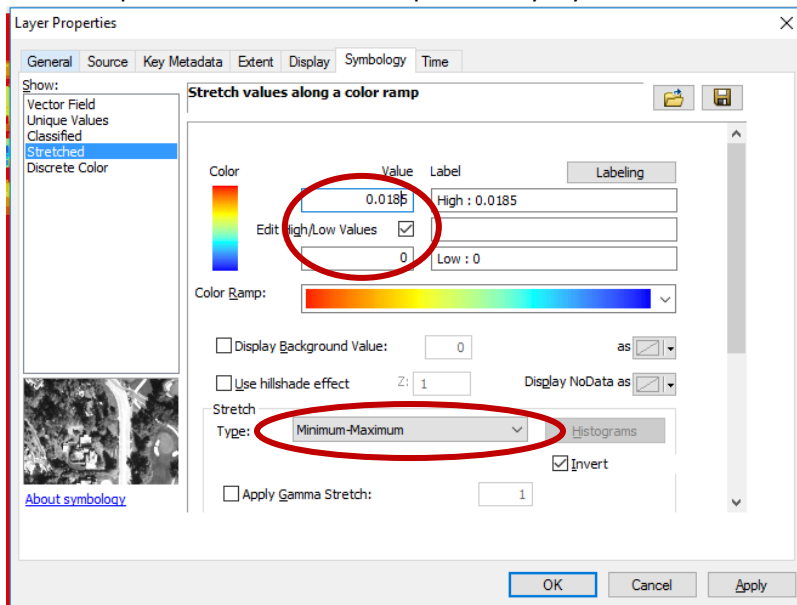
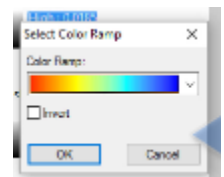
In the next section, you are going to create a series of visual comparisons of the fire behavior output between No Treatment, Roads, and WUI treatments. Your deliverable will be well organized but simple map layouts of the following categories.

- Burn probability
- Difference in Burn Probability
- Flame Length, Rate of Spread and Fire Line Intensity
- 1 scenario for fire spread

## 1.2 Creating Burn Probability Map

This is going to be a visual comparison of the burn probability across the three treatments. To make the visual comparison possible we need to change the color ramp of each of the three burn probabilities layers, so they are easier to compare.

- a. Uncheck and minimize all layers except for the burn probabilities. Examine the ranges to determine which has the largest range.
- b. Starting with the layer that has the largest range – *left-click* on the color ramp and select the one that goes from red to blue. Check the box to **Invert** the color; this will make it so areas of high burn probability are red and low burn probability is blue.
- c. Adjust the value range of the other layers
  - a. Right-click on layer name and select **Properties**
  - b. On the *Symbology* page, click the folder icon to import the symbology from another layer and select the layer you had previously edited.
  - c. Under *Stretch* >> *Type* select **Minimum/Maximum**
  - d. Check the box for *Edit high/low values* and enter the value range for the larger range raster.
  - e. If needed check the box for **Invert**
  - f. Repeat with the third burn probability layer



### 1.3 Using the Layout view to create presentable visuals of outputs

See 'How-to: Create an organized map' document on Bblearn (Next to lab demo) for additional ideas for organizing your output.

- From the top menu bar Go to *Insert >> New Data Frame* - do this once more making a total of three data frames. Rename the data frames **No Treatment, Roads, and WUI**
- Fill each data frame by dragging the whole group from the first data frame.
- From Lesson\_4>>Outputs, add **roads\_treatments** and **wui\_treatments** and place them in their respective data frames. Adjust their symbology to be hollow with a 1 point black line. This will serve as a spatial reference for your figure.
- From Lesson\_3 add **BBB Project Boundary** to the No Treatment frame. Change the symbol to hollow, 2 points black line.
- Click on the layout view icon in the lower left
- Change page orientation (optional) – *File >>Page and Print Set up* and select **Landscape**
- Organize the data frames, so they are the same size and extent (see how-to).
- Select *Insert* and add
  - Title – BBB Burn Probability
  - A text box to label each of the burn probability layers
  - Scale bard
  - North arrow
  - Legend
  - Text box to describe briefly how the data was created

We will be using this organization for the rest of the lab questions so take the time to make a quality figure.

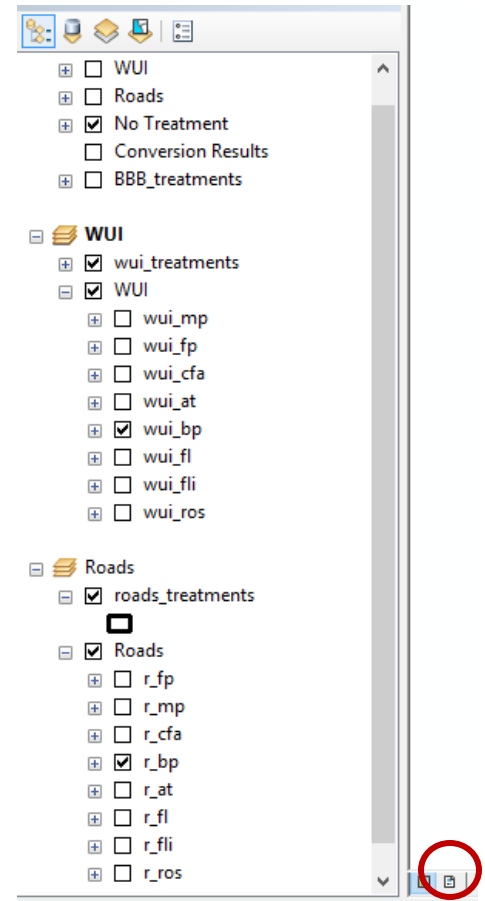
- To Export your map go to *File >> Export*
- SAVE ArcMap project!

*Question 2: Submit the map that you created for the burned probability comparison.*

**Optional** – If performing this type of analysis for a future project, this step may be useful.

**Subtracting rasters to see change between treatments** – *Calculating change in burn probability between treatments*

- Return to *Data View* (Icon next to *layout view* in lower left)
- Open ArcToolbox >>Spatial Analyst >>Math >>**Minus**
- Input raster or constant value 1* – nt\_bp
- Input raster or constant value 2* - r\_bp
- Output raster* - navigate to your Lesson\_5 outputs folder
- Label it **nt\_r\_bp**
- Save** and **OK**
- Repeat the above steps to create a file that subtracts the WUI treatment burn probability from the No Treatment burn probability
- Label it **nt\_w\_bp**
- Save** and **OK**





- k. Repeat the above steps to create a file that subtracts the WUI treatment burn probability from the Roads treatment burn probability
- l. Label it **w\_r\_bp**
- m. **Save** and **OK**
- n. Repeat steps in 1.3 and 1.4 to create the same color ramp for both layers and compare them in the layout view

**How to interpret these results?** In this analysis, we are trying to see if there was a net increase or decrease in burn probability. If your no treatment layer has HIGHER burn probability, then the treatment layer, then burn probability has gone down. Let's say no treatment has a burn probability of 1.2 and treatment has a burn probability of 0.8.  $0.8 - 1.2 =$  negative 0.4. Therefore, the negative values in your calculated layers represent areas where the probability that an area will burn DECREASED.

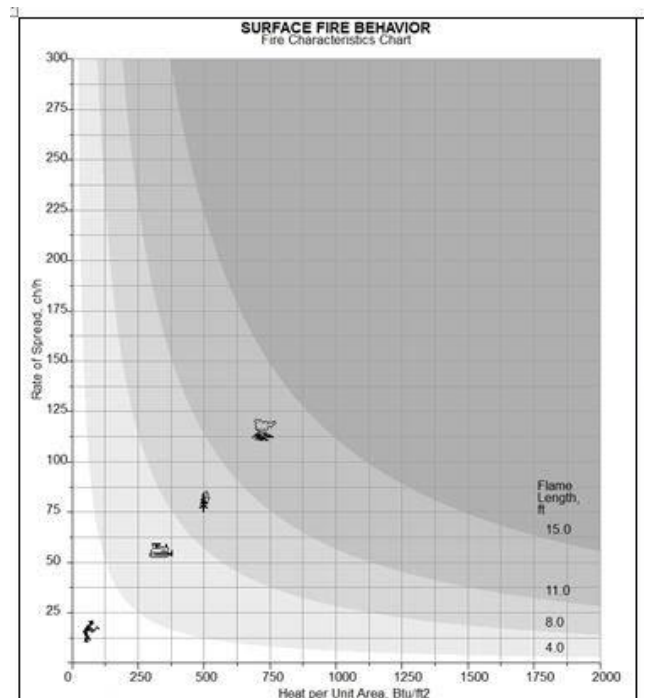
If your no treatment layer had a burn probability of 0.4 and the treatment layer had a burn probability of 0.7 then  $0.7 - 0.4 =$  positive 0.3. Therefore, positive values in your calculated layers represent areas where the probability that an area will burn INCREASED. This increase in burn probability can be due to a chance from a less-flashier fuel like timber litter to a more-flashy fuel like grass. To better understand the effects of the fuel treatment, we need to also look at flame length.

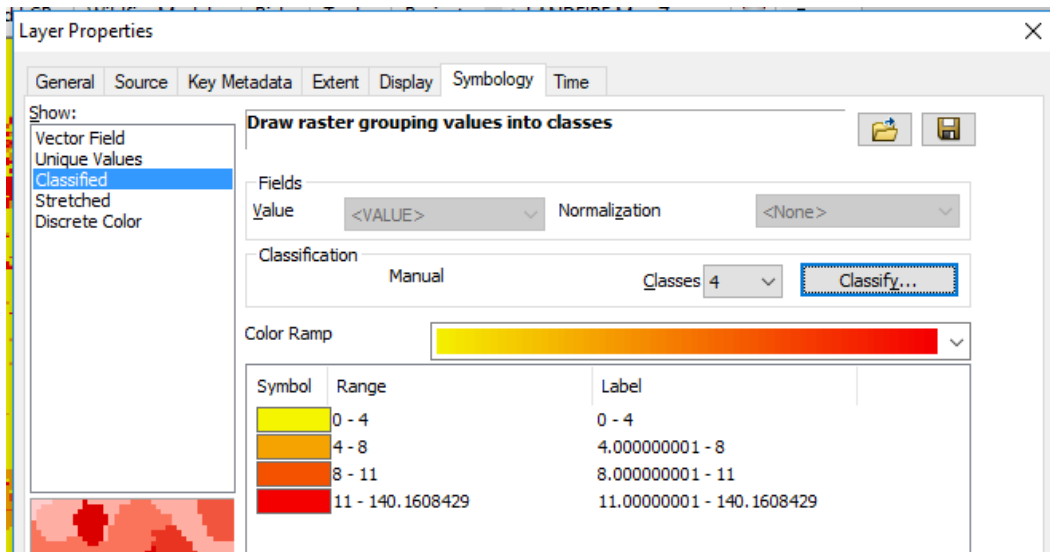
#### 1.4 Create Fire Behavior comparison maps –

##### Flame Length

- a. Right-click on a flame length layer and select *Properties>>Symbology>>Classified>>* select **Classify**
  - a. **Classes = 4**
  - b. Under *Break*, values change values to
    - i. 4
    - ii. 8
    - iii. 11
    - iv. Leave as is
  - c. Click **OK**
  - d. Adjust the colors of the categories
  - e. Turn on the Flame Length layer for each treatment and in the Layout view adjust the table of contents, title, and description
  - f. Export the map

The breakpoints that have been applied to your Flame Length layer are those commonly used in fire management to determine what kind of action is possible on the fires. Lower flame lengths allow for more direct action, and higher flame lengths require more indirect work around the fires. By categorizing the layer this way, it is now easier for managers to interpret and see what the fire behavior might be like if there were to be a fire in that area.





Question 3: Submit the map that you created for the flame length comparison.

#### Rate of spread

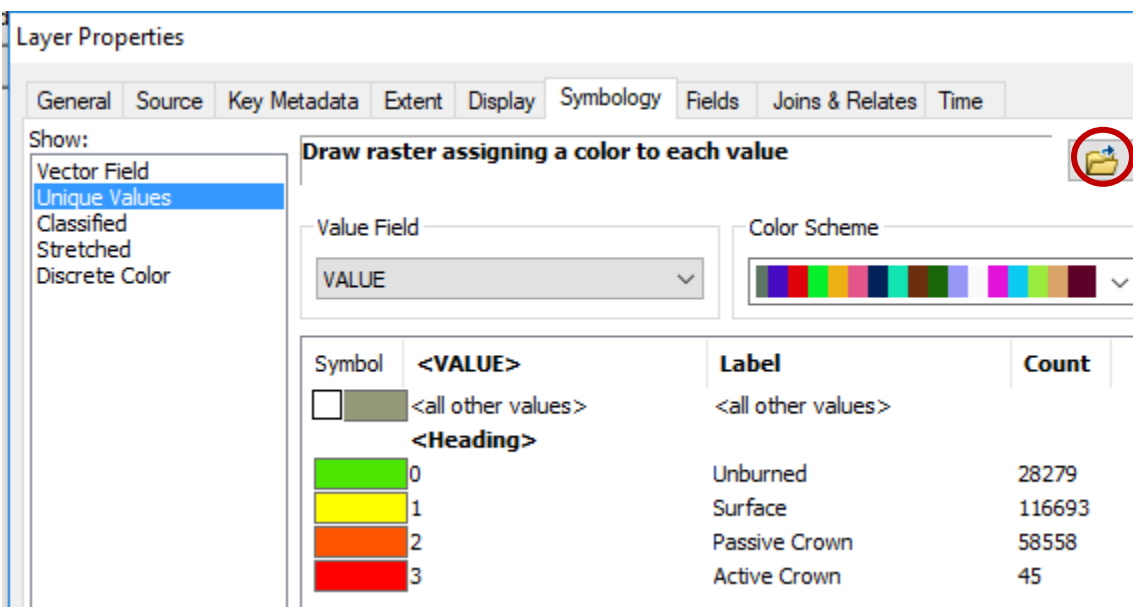
- Change the color ramp to Orange
- Turn on all ROS layers and update the layout view



Question 4: Submit the map that you created for the rate of spread comparison.

#### Crown Fire Activity

- Edit the symbology to match the following categories and colors. To transfer the symbology changes to the other two layers, you can drag the edited layer to the other two data frames and use the *folder icon* in *Layer Properties* to import the symbology changes.
- Turn on all CFA layers and update the layout view.



Question 5: Submit the map that you created for the crown fire activity comparison.



### Fire Line Intensity

- Change the color ramp to red to green
- Turn on all FLI layers and update the layout view

Color Ramp:



*Question 6: Submit the map that you created for the fire line intensity comparison.*

### Fire Spread

- Change the color ramp to red to green
- Turn on all Major Paths and Arrival Time layers and update the layout view
- From the Lab 5 data add **West Ignition** to show where the fire originated from.
- Include the wind direction and speed in the description.

Color Ramp:



*Question 7: Submit the map that you created for the fire spread comparison.*

*Question 8 –Describe the effects of the roads and wui treatment on fire behavior .*