Lab 5 Wildfire Risk Assessment

Objectives

- Use the .LCP files created in Lab 4 to create fire behavior outputs using FlamMap5
- Analyze the outputs from FlamMap5 using ArcFuels

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 stake holders and they will decide if additional money and time should be devoted to this endeavor.

1. Creating fire behavior outputs from FlamMap5

Computer requirements: Your computer has several features that make it able to perform its functions. It has memory, storage, RAM, processors etc. Most people use their machines very heavily, maxing out these functions. FlamMap is a program that requires a lot of your computers attention while it is running. If it is not given the power that it needs it will shut down your computer. Because of this, we would like for each of you to at least complete the inputs for FlamMap and run the less computationally intensive fire behavior outputs, but if you receive problems completing some of the runs we will be able to provide the data to you so that you can move forward with the exercise.

1.1 Creating fire behavior output in FlamMap

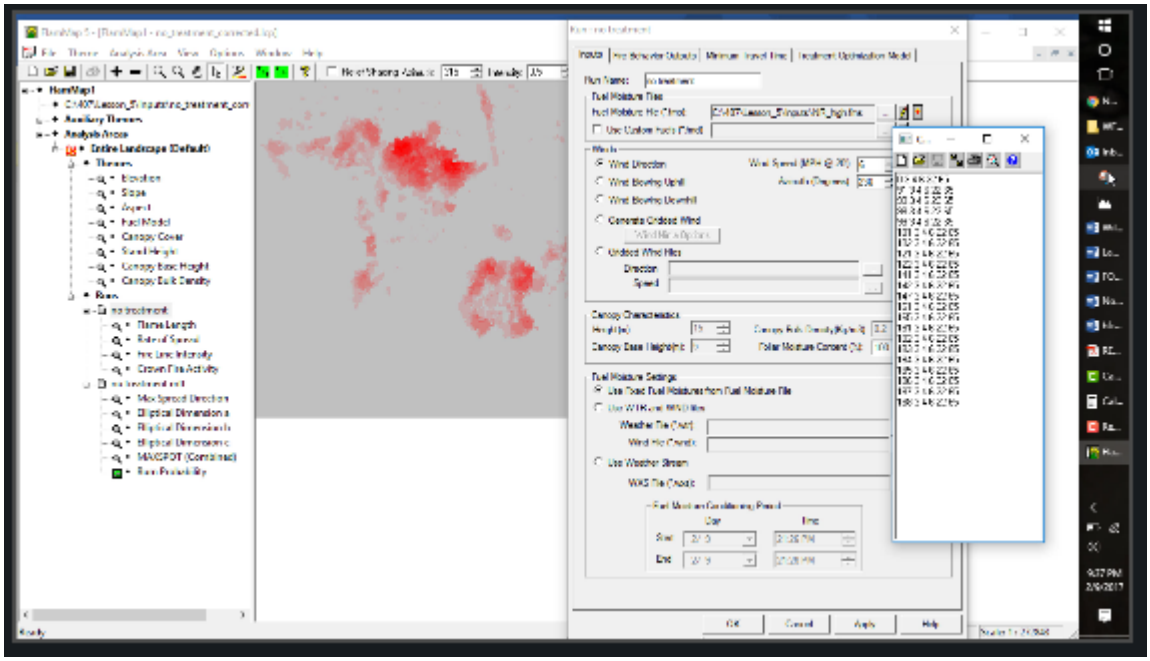
a. Take a moment to rename the LCP files that you created in Lab 4
   - LCP_Corrected_2015 to **no_treatment_corrected**
   - Slopes_2014 to **Slopes_completed_2014**
   - **Slopes_targetareas** can stay the same
b. In your Lesson 5 folder create an *Outputs* folder
c. Open FlamMap with the ArcFuels tutorial or as a separate program (you may need to locate it in C:/arcfuels/programs)
d. When FlamMap opens click on **No Landscape File** and navigate to *no_treatment_update.lcp*
e. Inputs tab
   - Run Name: **no_treatment**
   - Fuel Moisture File: Create using directions from demo
     - The demo will walk you through how to get information from Fire Family Plus to create your fuel moisture file. If you want additional information on how to use Fire Family Plus you can contact Heather Heward.
     - If you are unfamiliar with the terms 1, 10 , 100 hour fuels and fuel moisture in general you can learn more from NOAA or other sources by searching “Fuel Moisture Time Lag”.
   - Wind Speed: **6**
   - Wind Direction: **230**
   - Click **Apply**

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

g. Minimum travel time
   - Start a new run labeled for example “no treatment MMT”
   - 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**
   - Close all other programs open on your computer to free up memory and avoid the loss of information. Launching the run will take from 5 to 20 minutes
   - Click **Launch MTT**

h. Troubleshooting

If by launching MTT your computer crashed (as my laptop did) 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 **no_treatment** and **no_treatment mtt** run (if you were able to run the mtt). 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.*

i. 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:
     - 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

j. Repeat
   - Complete a run for Slopes_completed_2014.lcp, use the same inputs
     - Example output - sl_14_fl
   - Complete a run for Slopes_targetareas.lcp, use the same inputs
     - Example output - sl_ta_fl

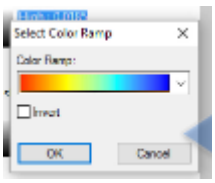
1.2 Convert ASCII to Raster

a. Open a new ArcMap project
b. Add GrandCanyonData>>Fire History Layer >> **SlopesRX_completed,** this will give the project a spatial reference.
c. 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 know 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 **Interger**
h. *Target folder* – Lesson 5 outputs folder
i. Click **Convert**
j. Open *Batch Convert ASCII to Raster* again and transfer all other files (files size list files are in .txt format, you can ignore these if you have them).
k. *Data Type* is **Floating Point**
l. *Target folder* – Lesson 5 outputs folder
m. Click **Convert**

1.3 Creating Burn Probability Map

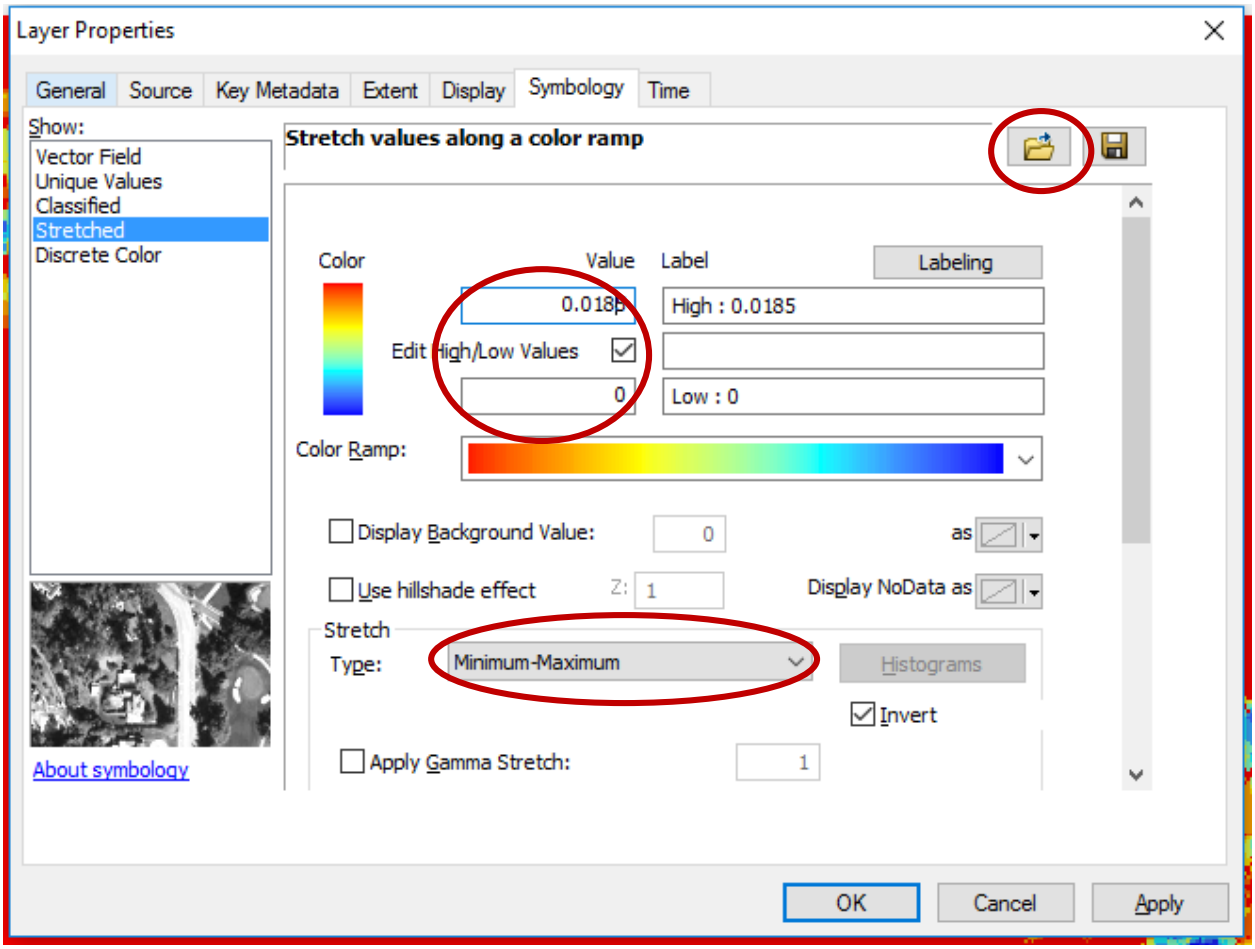
This is going to be a visual comparison of the burn probability across the three treatments. In order to make the visual comparison possible we need to change the color ramp of each of the three burn probabilities layers so they are easier to compare.

a. Slide the *Burn Probability* layers to the top in your table of contents to make it easier to access them. Expand and 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 are blue.



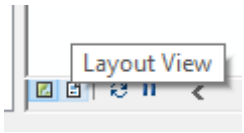
c. Adjust the value range of the other layers
   a. Right-click on layer name and select **Properties**

b. On the *Symbology* page, click the folder icon to import the symbology from another layer
c. Select the layer you had previously edited (sl_14_bp)
d. Under *Stretch* >> *Type* select **Minimum/Maximum**
e. Under *Values* enter the value range for the larges range raster (sl_14_bp)
f. If needed check the box for **Invert**
g. Repeat with the third burn probability layer



1.4 Using the Layout view to create presentable visuals of outputs

a. Click on the layout view icon in the lower left
b. From the top menu bar Go to *Insert* >> ***New Data Frame*** - do this once more making a total of three data frames



c. Drag one burn probability layer into each of the data frames
d. Change page orientation (optional) – *File* >>**Page and Print Set up** and select **Landscape**
e. Select *Insert* and add
    a. Title – North Rim Slopes Project Burn Probability
    b. A text box to label each of the burn probability layers
    c. Scale bard
    d. North arrow
    e. Legend
f. To Export your map go to *File* >> **Export**
g. SAVE ArcMap project!

Question 2: Submit the map that you created for the burned probability comparison. Take the time to format it so that it might be presentable to a stake holder in the project.

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

a. Return to *Data View* (Icon next to *layout view* in lower left)
b. Open ArcToolbox >>Spatial Analyst >>Math >>***Minus***
c. *Input raster or constant value 1* – nt_pb
d. *Input raster or constant value 2* - Slopes 2014
e. *Output raster* - navigate to your Lesson_5 outputs folder
f. Label it **nt_sl_14_bp**
g. **Save** and **OK**
h. Repeat the above steps to create a file that subtracts the Slopes target areas burn probability from the No Treatment burn probability
i. Label it **nt_sl_ta_bp**
j. **Save** and **OK**
k. Repeat steps in 1.3 and 1.4 to create the same color ramp for both layers and compare them in the layout view
l. Add the *Slopes_completed* and *Slopes_target areas* polygons and format them visually in the *Layout* view.

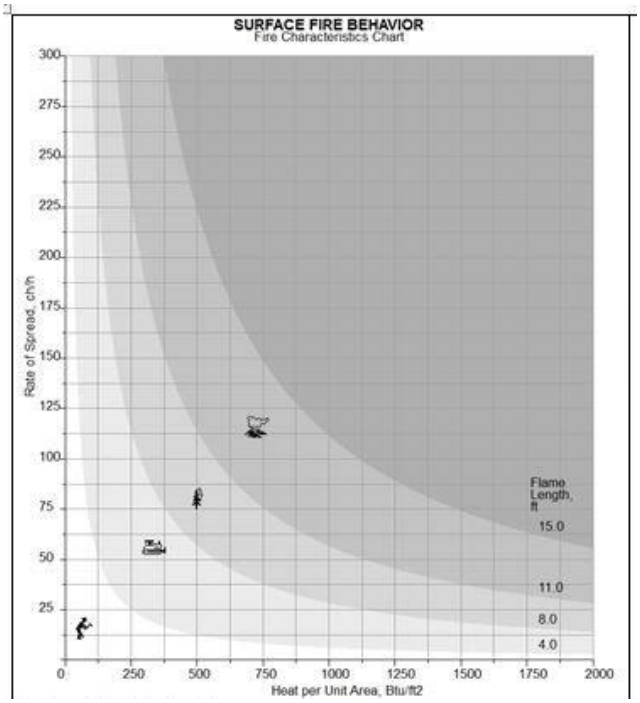
How to interpret these results? In this analysis we are trying to see if there was a net increase or decrease in burn probability. If your no treatment layer has HIGHER burn probability, then the treatment layer and then burn probability has gone down. Let's say no treatment has a burn probability of 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 littler to a more-flashy fuel like grass. In order to better understand the effects of the fuel treatment we need to also look at flame length.

Question 3: Submit the map that you created for the change in burn probability. Take the time to format it so that it might be presentable to a stake holder in the project.

1.6 **Reclassify rasters and compare area** - *Calculating area by flame length category and fire type*

a. Go to *ArcToolbox >> Spatial Analyst Tools >> Reclass >>***Reclassify**
b. *Input raster* >> **sl_14_fl**
c. Reclass field >> **VALUE**
d. Click **Classify**
    a. *Method* = **Equal interval**
    b. *Classes* = **4**
    c. Change *Method* again to **Manual**
    d. Under *Break values* change values to
        i. 4
        ii. 8
        iii. 11
        iv. Leave as is
    e. Click **OK**
e. *Output Raster* – navigate to Lesson 5 outputs folder and name **sl_14_fl_hc**



NOTE: HC stands for Hauling chart. 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.

f. *Environments >> Raster Analysis >> Mask >>* **SlopesRX_completed_2014**
g. Click **OK** and **OK**
h. Repeat steps a. though g. with
    a. **sl_ta_fl** - for *Mask* use **Target_Areas_2015,** *Outputs* – **sl_ta_fl_hc**
    b. **nt_fl** - you will creating TWO versions of the no treatment file, one to compare to the completed 2014 treatment and one with the target areas for 2015
        i. *Mask >>* **SlopesRX_completed_2014,** *Output* - **nt_fl_hc_14** (video may says "sl")
        ii. *Mask* >> **Target_Areas_2015**, *Output* – **nt_fl_hc_ta**
i. Calculate the area for each of the three layers created in "h." Use the directions Lab 2 – *Calculate are from the attributes table*– It is useful to be able to refer to the previous lab directions so you can remember where to find the various processes you have learned in this class.
j. Copy the information from the Area column of each of the three layers into an Excel spreadsheet using the table structure below

	Slopes completed 2014		Target Areas	
Flame Length (ft)	No Treatment (ac) Nt_fl_hc_14	Slopes Completed 2014 (ac) Sl_14_fl_hc	No Treatment (ac) Nt_fl_hc_ta	Slopes Target Area (ac) Sl_ta_fl_hc
<4				
4-8				
8-11				
>11				

1.7 **Batch extract raster by mask** - Calculate the area in Crown Fire Activity classes for each treatment option

With FlamMap you created a whole layer of possible crown fire activity for each fuel treatment option. In order to compare them to see if there was a change you are going to be using the batch extract by mask option to trim each of the treatment options (no treatment, slopes completed, and target areas) so that only the areas affected by the fuel treatments are compared.

a. *Spatial Analyst Tools >> Extraction >>* ***Right-click*** on *Extract by Mask >>* ***Batch***
b. Click the "+" sign in the upper-right of the dialog box.
c. *Input Raster* –
    1. ConversionResults\nt_cfa
    2. ConversionResults\sl_14_cfa
    3. ConversionResults\nt_cfa
    4. ConversionResults\sl_ta_cfa
d. *Input Raster or Feature Mask Data* –
    1. SlopesRX_Completed_2014
    2. SlopesRX_Completed_2014
    3. Target_Areas_2015
    4. Target_Areas_2015
e. Output – save to your lesson 5 outputs folder. The terminology can become hard to follow, please pause the presentation occasionally to think about what each of these layers is.
    1. nt_cfa_14_c
    2. sl_14_cfa_c
    3. nt_cfa_ta_c
    4. sl_ta_cfa_c
f. Click **OK**
g. Calculate the area for each of the new clipped layers and enter the information into excel using the below table structure.

	Slopes Completed 2014		Target Areas	
Crown Fire Activity	No Treatment (ac) Nt_cfa_14_c	Slopes Completed 2014 (ac) Sl_14_cfa_c	No Treatment (ac) Nt_cfa_ta_c	Target Areas (ac) Sl_ta_cfa_c
Surface Fire (0)				
Passive Crown Fire (1)				
Active Crown Fire (2)				

Question 4 – Submit a screen capture of the excel spreadsheet with the tables for flame length and fire type (cfa).

Question 5 – Using information from the burn probability, flame length and crown fire activity output, describe the effects of the slopes project on fire behavior.

Question 6 - Based on the output that you generated and what you have learned about this project as a whole, provide an argument for why this project should or should not continue and what if anything should be changed in the way it is implemented.