

Lab 4 Fuel Treatment Planning

Objectives

- Update LANDFIRE layers for:
 - o Current conditions
 - o Treatment alternative 1 - roads
 - o Treatment alternative 2 - wui
- Create LCP files for each of the treatment alternatives for use in Lab 5

Your Mission: You have been working hard in your new job at on the New Meadows Ranger District, and you have learned that there is a very active citizen group called the [Payette Forest Coalition](#) that is highly interested in the management activities taking place on the forest. To inform the public and other managers in the area, you have been asked to develop maps that show the expected fire before and after several different treatment scenarios. This information will be used to increase citizen by-in and funding for future projects. You will first need to update the LANDFIRE data, so it is as close to actual conditions as possible, and use the updated LANDFIRE data to reflect the expected changes on the landscape from a treatment alternative around roads and a treatment alternative around the wildland urban interface (WUI)

1. Pre-planning - Making LANDFIRE Current

1.1. Setting up workspace

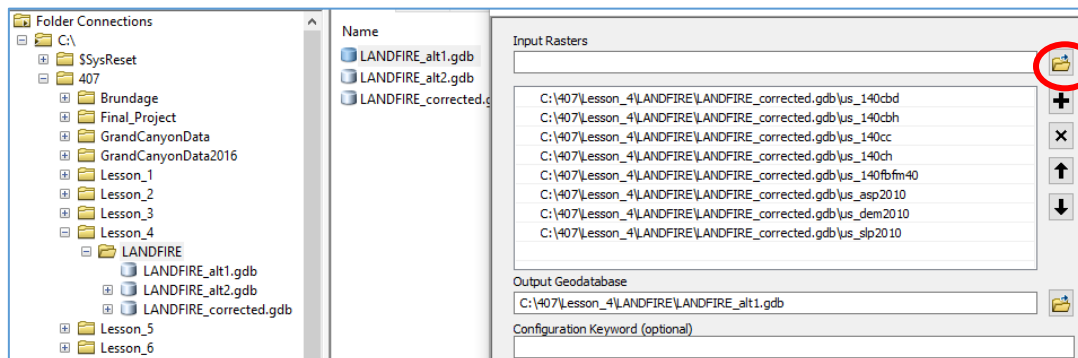
- Open ArcCatalog. In the lesson 4 folder, create a folder for LANDFIRE and a folder for Output. Create the following File Geodatabases in the LANDFIRE folder:

Note – raster data can only be stored in the root directory of a file geodatabase. Since we will be creating several categories of LANDFIRE data, we will create several geodatabases.

- LANDFIRE_corrected
- LANDFIRE_road
- LANDFIRE_wui

When renaming these .gdb files it may look initially like the names are off – they will revert to the correct name momentarily.

- Importing rasters to a geodatabase – Right-click on LANDFIRE_corrected and select *Import>>Raster Datasets*. Select the folder icon next to *Input Rasters* and navigate to your LANDFIRE data in your lesson 3 folder. Add all except EVT and FBFM13 which are optional.



For the other two geodatabases you will also *Import>> Raster Datasets for the same LANDFIRE data*. If you want to save a step you can navigate to LANDFIRE_corrected and add all the files from there.

1.2. Editing raster attributes across the project area

Based on what local experts have seen on the ground the following changes have been recommended:

1. **122** (GS2 - Moderate load, dry climate grass-shrub) needs to be changed to **121** (GS1 – Low load, dry climate grass-shrub).
2. Change **102** (GR2 Low load, dry climate grass) AND **142** (SH2 - Moderate Load dry climate shrub) to **101** (GR1 - short sparse dry climate grass) for elevations ≥ 6500 ft (**1981 m**).

We are going to perform these changes at the same time which means that we need to know which cells are both fuel model 102 and 142 and ≥ 6500 ft. Therefore we need to combine the fuel model and elevation rasters.

- a. Start a new ArcMap. Add the LANDFIRE data from the *LANDFIRE_corrected.gbd*. Go to *Geoprocessing>>Environments* and set the *Current and Scratch workspace* to the **Lesson_4>>outputs** folder.
- b. Using the **Combine** tool, combine DEM and FBFM40. Name the output **DEM_FBFM40**
- c. Open the attributes table for your combined raster (DEM_FBFM40)
- d. Add a field to the table (from table options) for the modified fuel model information, label it **FBM40_corrected**, click **OK**.
- e. Using the field calculator (right click on the column) have the FBFM40_corrected column equal the values in the US_140FBM40 column, click **OK**.

Changing 122 to 121

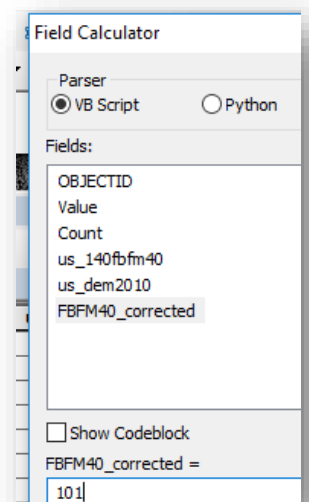
- f. Open the attributes table and click *Select by Attributes*, select all the rows that are FBFM 122
- g. Again, using the field calculator option change all the selected 122 rows to 121. Notice that the calculation is only performed on selected rows.

Changing 102 AND 142 to 101 ABOVE 1981 m

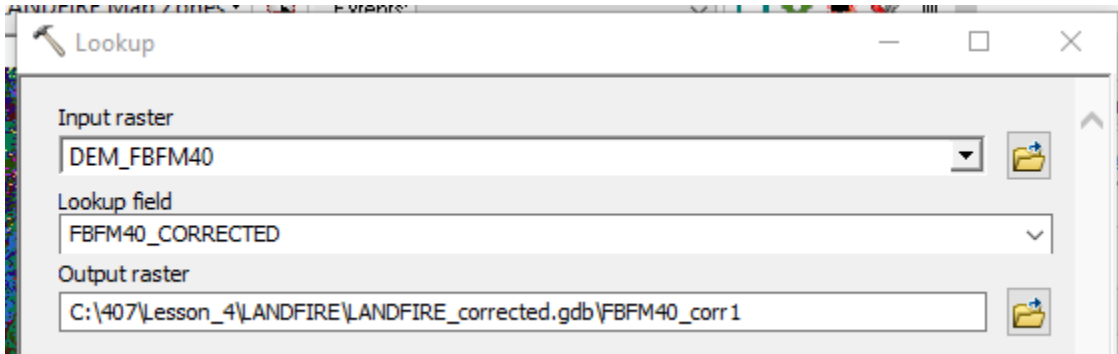
- h. Select the fields that are both over 1981 m and fuel model 102 and 142. Click *Select by Attributes* and build the following equation: "US_DEM2010" \geq 1981 AND "FBFM40_CORRECTED" IN (102, 142)
- i. Using the *Field Calculator* change the selected rows to fuel model 101 in the *FBM40_corrected* field

1.3 Convert Raster Attributes to Raster

Your combined raster now has the corrected information but cannot be used in an LCP file. This process will allow you to convert each column in your combined raster into a separate raster.



- a. **Make sure your selection is cleared!**
- b. Under *Spatial Analyst* >> *Reclass* select **Lookup**
- c. The input raster will be the one you were just working on (DEM_FBFM40)
- d. Choose the FBFM40_corrected as the lookup field and save it to the LANDFIRE_corrected.gdb as **FBFM40_corr**. *Note: if you get an error, try closing ArcMap, open a blank project and add only the DEM_FBFM40 layer.*



- e. Answering question 1: Open a powerpoint document and save as **Lab_4_your last name**. NOTE: powerpoint was chosen as a simpler way to copy and paste images, you will not be presenting. Create a slide for **Fuel Model Comparison**. Create a graph of the distribution of **FBFM40_corr** and take a screen capture. Repeat with **us_140FBFM40**. To update the display of the us_140FBFM40 layer, open the attributes table of the original FBFM40 layer, open *Properties* and under *Symbology* select **Unique values**.

Question: Include a slide in your powerpoint document for Fuel Model Comparison.

2. Creating treatment alternatives

Request from the manager - Determining which units should be treated first can be very challenging since there is only so much time and money each year. In the BBB area, there is a strong desire to protect both communities and infrastructure. The manager is also interested in whether the spatial location of the fuel treatments will have an impact on fire behavior across the landscape. It has been shown that fuel treatments that are clustered have a broader and more lasting impact than treatments that are spread out. To better understand the relationship between the location of treatments and fire behavior as well as the potential impacts for treating the roads vs. the WUI, you will create the following treatment alternatives.

1. Dispersed treatment around roads
2. Clustered treatments around structures

Download the Lab_4_data file from Bblearn. Start a new ArcMap project and add the following layers. Set your workspace folders to your Lesson_4 output folder.

- FBFM40_corr (from LANDFIRE_corrected.gdb.)
- BBB_treatments (Lesson_3>>BBB_project)

- BBB_structures
- BBB_roads

2.1 Selecting the treatment polygons for treatment alternative 1 and 2:

Treatment Alternative 1: Dispersed treatment around roads - You have enough money in your budget to treat around 520 acres. Because these treatment units are located along heavily traveled and scenic roads, the manager would prefer treatments that are a little more spread out. Easy access will decrease the cost of these treatments, so you will choose treatment polygons that are adjacent to roads that are asphalt or gravel.

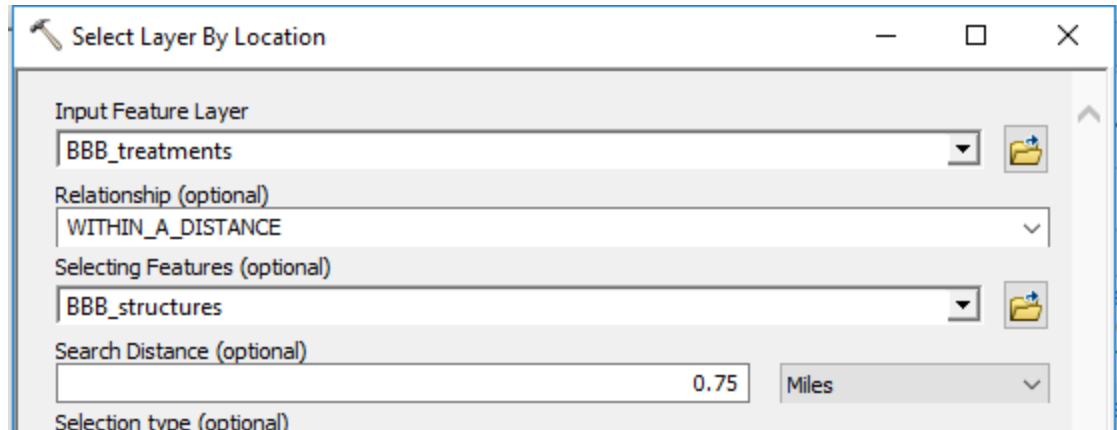
- Open the BBB_roads attributes table and select by attributes from the *surfacety* column, select roads that are 'asphalt' or 'crushed aggregate or gravel.'
- Use the search function to open the *Select Layer by Location* tool. *Input feature layer = BBB_treatments, Selecting features = BBB_roads.*



- Right-click on **BBB_treatments** and *Create layer from selected features*
- Open the attributes table in the new feature and turn off the columns between *Acres* and *DisplayC*. Sort by *DisplayC*.
- Select all rows with Intermediate treatments. Sort by *Acres* and hold down the CTRL button to select the RX polygons with the following acres: 128, 50, 49, 34.9, 27, 14.9, 12, 8.4. Right-click on the *Acres* column and select **Statistics** to confirm that the total acreage is around 520. Right-click on **BBB_treatments selection (your new treatments shapefile created in step c)** and select *Data>> Export*. Save to *Outputs* as **road_treatments**. **Make sure to change the file type to "shapefile."**

Treatment Alternative 2: Clustered treatments around structures – Based on observations of previous fuels treatments, the manager has requested that units within 0.75 miles of structures be given priority. It is also believed that more clustered fuel treatments will be more effective at reducing fire activity beyond the project boundary. With limited time and money, fuel treatments can only be performed around the community to the north of the project area.

- Clear your selection from the first treatment. Select all the structures to the NORTH of the project area.
- Use the *Select by Location* tool to select all treatment polygons within 0.75 miles of structures.



- c. Right-click on BBB_treatments and select *Data>>Export*. Save to the *Outputs* folder as **WUI_treatments**.

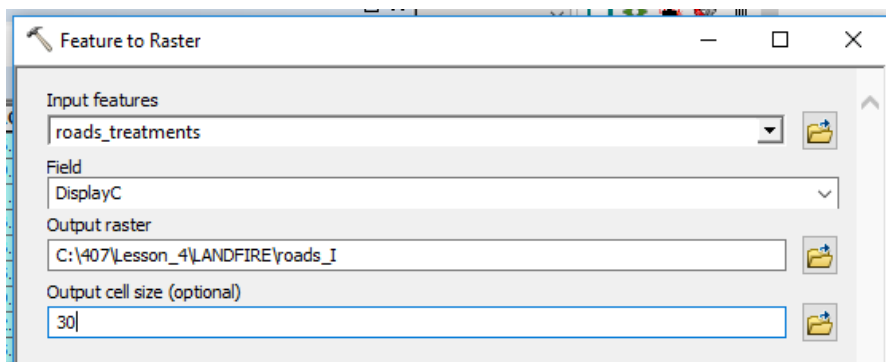
2.2 Editing Raster Attributes for treatment alternatives

We will now use the treatment polygons to modify the raster values for alternative 1 and 2. These directions are based off of [Modifying LANDFIRE layers in ArcFuels](#)

Convert Polygon to Raster

To change raster values for just the treatment areas, we will need to convert our fire polygons to rasters. Because we are going to be applying a different set of changes to each treatment, we will need a raster for each treatment type.

- a. Clear your selection from the previous step
- b. Right-click on *roads_treatments*, open the attribute table, and select the *Intermediate* rows from the *DisplayC* column. You may need to resort by *DisplayC*,
- c. Under *Conversion tools>>To Raster* select **Feature to Raster**. *Input feature* = **road_treatments**, *Field* = **DisplayC**, *output cell size* = **30**. Save to the *LANDFIRE_roads.gdb* as **roads_I**.



- d. In *roads_treatment* attributes, table select the *RxBurn* rows. Convert feature to raster, naming the output **roads_rx**. Save this file to the *LANDFIRE_roads.gdb*.
- e. In *wui_treatment* attributes, table select the *Intermediate AND Pre comm* rows. Convert feature to raster, naming the output **wui_I**. Save this file to the *LANDFIRE_wui.gdb*.

- f. In *wui_treatment* attributes, table select the *RxBurn* rows. Convert feature to raster, naming the output **wui_rx**. Save this file to the LANDFIRE_wui.gdb.

Edit FBFM40

Summary of fuels adjustments based on treatment type

- Intermediate silviculture AND Precommercial thin
 - Fuel Model - TU5(**165**) to TU1 (**161**)
 - CBH – change anything <2.5 to 2.5 meters.
 - CBD – reduce by 20%
 - CC – change anything >35 to 35

- Prescribed fire
 - Fuel Model – TU5(**165** AND TL3(**183**) to TU1(**161**), TL8(**188**) to TL3(**183**)
 - CBH – Change anything <1.5 to 1.5 meters
 - CBD – reduce by 10%
 - CC – change anything >65 to 65

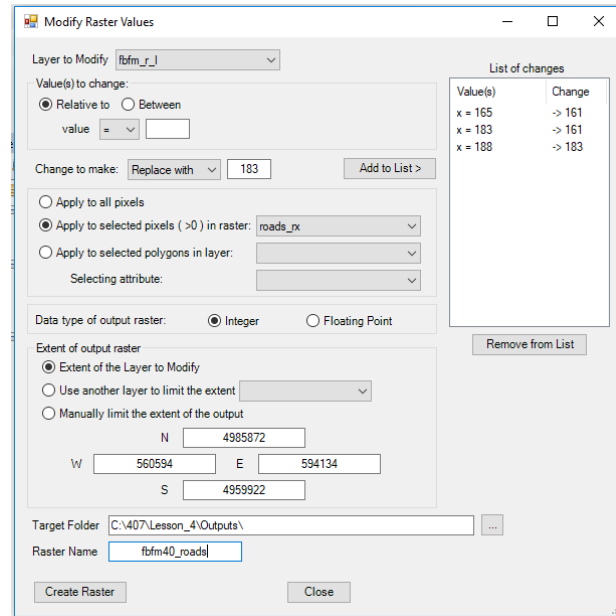
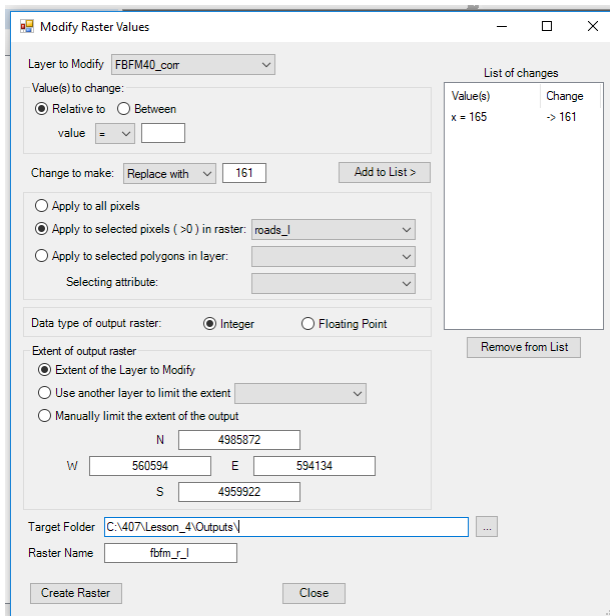
You are going to be taking screen captures of your *Modify Raster Value* runs so that you can keep track of what you have done and go back to confirm your work if you get questionable outputs. This will also help us identify if you have errors in the LCP files that we are going to be using in lab 5. *Include the screen captures of your inputs for your Modify Raster Value runs in your powerpoint.* **Each slide should be labeled and have 4 screen captures.**

- a. From ArcFuels select *Tools>>Modify Raster Values*.
- b. Set the *Layer to Modify* as **fbfm40_corr**
- c. For *Relative to:* enter **165**
- d. Replace with: **161** and **Add to list**
- e. *Apply to selected pixels in raster* choose **road_I**

Notice that there is the option *Apply to all pixels*. We could have used this for our first calculation, but we had the added complexity of also wanting to change the values at a certain elevation which would not be possible with ArcFuels. This is why it is important to know several different ways to do a similar task.

- f. Target folder = C:\407\Lesson_4\Outputs\ and name it **FBFM40_r_I**. It may save time to copy and paste the target folder path for future runs. Including an extra space at the end of the path name may cause an error.
- g. Take a screen capture
- h. Click **Create Raster**

- i. Leaving the *Modify Raster Values* window open, you can change *Apply to selected pixels in raster* to **wui_I** and name the file **FBFM40_w_I**.



- j. Take a screen capture. Create the raster.
- k. Explore the data - Right-click on the new layers, notice that there is no attributes table. By selecting *Integer* when making the layer, we avoided the loss of values less than 1 (something that will become more important later), but we did not automatically create an attributes table
- l. Select *Properties >>Unique Values* and **Yes** when prompted to create an attributes table. Explore the data using the identify tool with <visible layers> selected to ensure that the changes were made. Do this step for both new layers.

If you receive an *Error Generating Raster*, make sure there is no space after “*Outputs*”. If it is not resolved after starting a fresh arc, post a question on the discussion board.

- m. Open *Modify Raster Values* and choose **fbfm_r_I** as the layer to modify.
 - a. Add these changes to the list- 165 to 161, 183 to 161, and 188 to 183
- n. *Apply to selected pixels* = roads_rx, *Target folder* = C:\407\Lesson_4\Outputs\. *Raster name* = **fbfm40_roads**
- o. Take a screen capture and select **Create Raster**
- p. Change the *Layer to Modify* to **fbfm_w_I** and *Apply selected pixels* to **wui_rx**. Name the raster **fbfm40_wui**. Take a screen capture and **Calculate Raster**. Confirm that the changes were made.
- q. Right-click on **fbfm40_roads** and select *Data>>Export* and save to LANDFIRE_roads.gbd.
- r. Right-click on **fbfm40_wui** and select *Data>>Export* and save to LANDFIRE_wui.gbd.

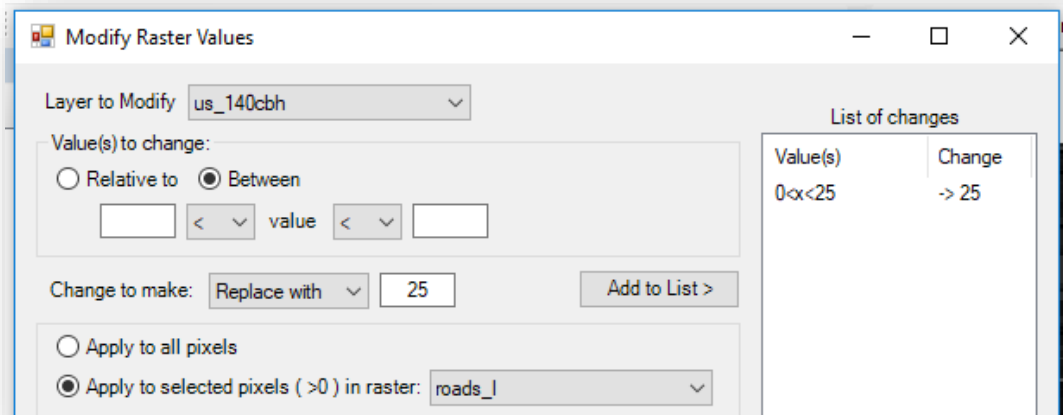
3. Edit Canopy Base Height (CBH)

Summary of changes

- Intermediate – change anything >0 and <2.5m to 2.5m (this corresponds to a *Value* of 25).
- RxBurn – change anything > 0 and <1.5m to 1.5m

- Remove all fbfm40 layers from the ArcMap project and add **us_140cbh** (it does not matter which folder it comes from)
- Using the same procedure as before, we are going to modify us_140cbh for the intermediate treatments for both the roads and wui areas. Output files will be named **cbh_r_I**, and **cbh_w_I**.
- Use the **cbh_r_I**, and **cbh_w_I** as the inputs for changing conditions for the rx treatments. Output files will be named **cbh_roads** and **cbh_wui**. Confirm that the changes were made. Export the new layers to their respective .gbd file.

Remember to take screen captures of each run.



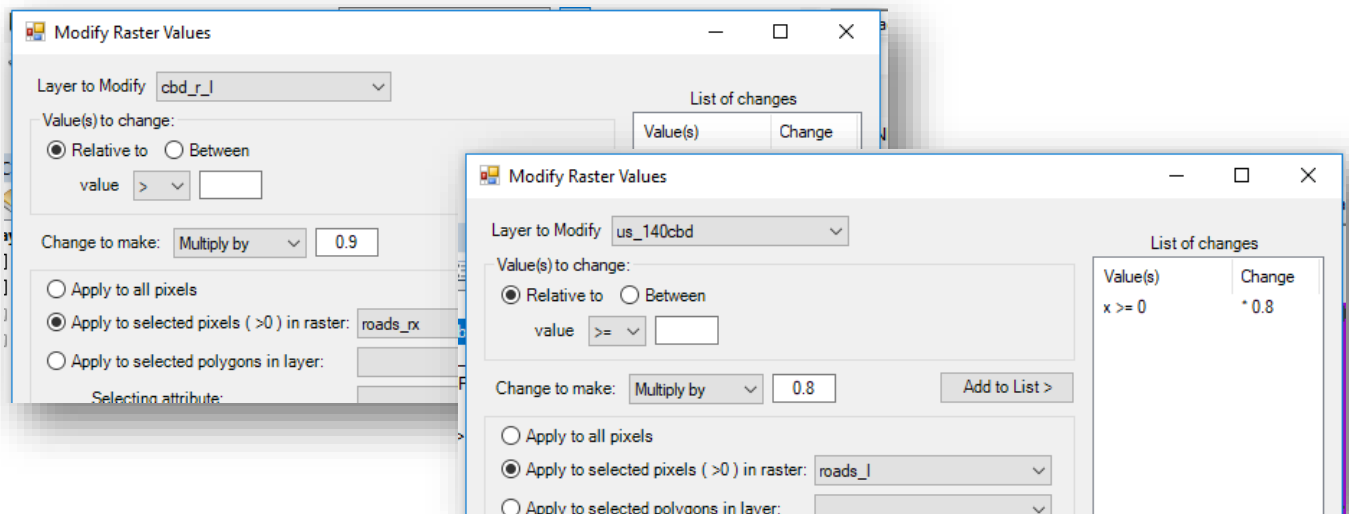
Edit Canopy Bulk Density (CBD)

Summary of changes

- Intermediate – decrease by 20% - Multiply by 0.8
- RxBurn – decrease by 10% - Multiply by 0.9

- Remove all cbh layers from the ArcMap project and add **us_140cbd**
- Using the same procedure as before, we are going to modify us_140cbd for the intermediate treatments for both the roads and wui areas. Output files will be named **cbd_r_I**, and **cbd_w_I**.
- Use the **cbd_r_I**, and **cbd_w_I** as the inputs for changing conditions for the rx treatments. Output files will be named **cbd_roads** and **cbd_wui**. Confirm that the changes were made. Export the new layers to their respective .gbd file.

Remember to take screen captures of each run.



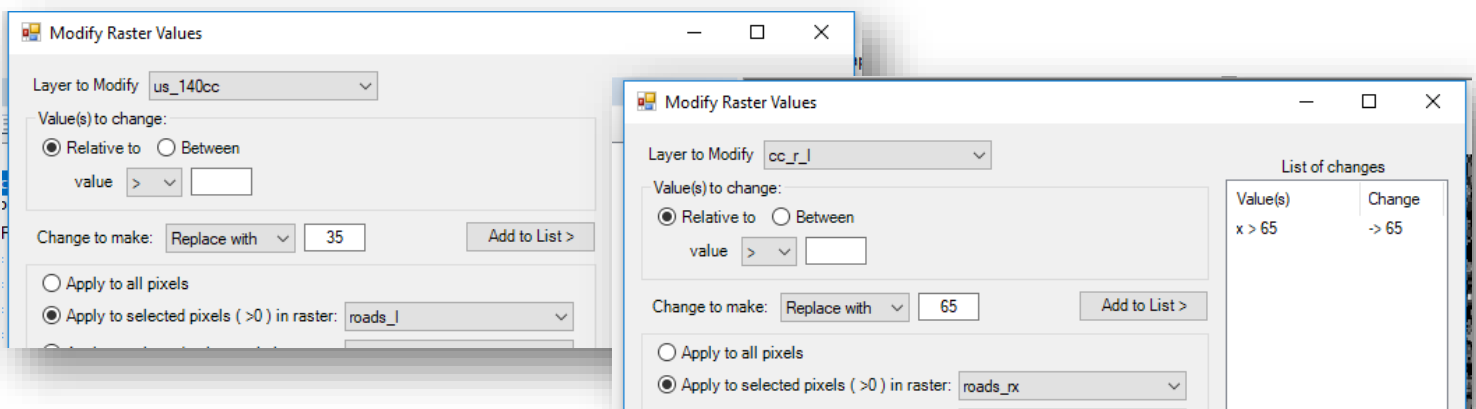
Edit Canopy Cover (CC)

Summary of changes

- Intermediate – >35 to 35
- RxBurn - >65 to 65

- g. Remove all cbd layers from the ArcMap project and add **us_140cc**
- h. Using the same procedure as before, we are going to modify us_140cc for the intermediate treatments for both the roads and wui areas. Output files will be named **cc_r_I**, and **cc_w_I**.
- i. Use the **cd_r_I**, and **cd_w_I** as the inputs for changing conditions for the rx treatments. Output files will be named **cc_roads** and **cc_wui**. Confirm that the changes were made. Export the new layers to their respective .gbd file.

Remember to take screen captures of each run.



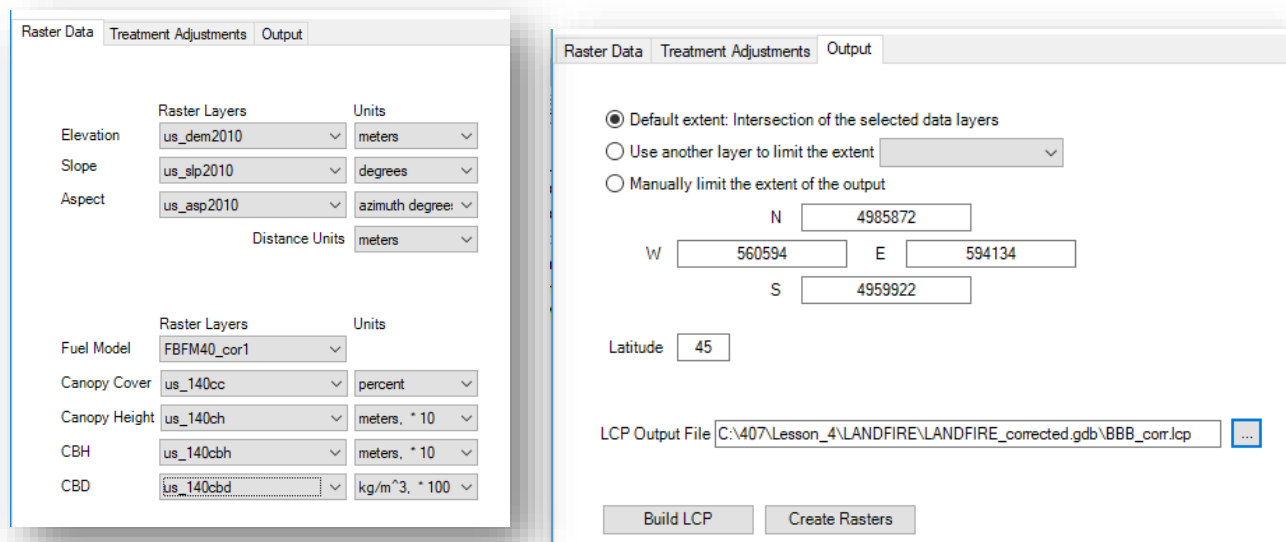
2.3 Clean up

Open ArcCatalog. In each LANDFIRE....gbd. remove outdated rasters

- LANDFIRE_corrected.gbd: us_140FBFM40
- LANDFIRE_roads.gbd: us_140FBFM40, us_140CBH, us_140CBD, us_140CC
- LANDFIRE_wui.gbd: us_140FBFM40, us_140CBH, us_140CBD, us_140CC

2.4 Create LCPs

Add all LANDFIRE_corrected.gbd layers to an Arcmap project. From the ArcFuels toolbar select *Build LCP*>>*Build LCP with Raster data* and enter the shapefiles into the appropriate location. Make sure to choose the corrected layers for the inputs. On the *Outputs* tab, choose the *LANDFIRE_corrected.gbd* and name the file **BBB_corr**. Click **Build LCP**.



Repeat with the LANDFIRE_wui.gbd labeling the LCP **BBB_wui** and LANDFIRE_roads.gbd labeling the LCP **BBB_roads**.

In your powerpoint, include a screen capture from ArcCatalog with your table of contents expanded to show the contents of your three LANDFIRE...gbd files.