Lab 3 Part 2 –Evaluating LANDFIRE Data

REM 407 – GIS Applications in Fire Ecology and Management

Objectives

- Evaluate LANDFIRE data
- Record possible errors in LANDFIRE data

As you complete the reading for part 2, consider the following questions.

<u>Reflection question:</u> Discussion: With all its potential errors is LANDFIRE still a useful tool? What are some of the barriers to more accurate data nationally?

"Although LANDFIRE products are delivered as 30-meter pixels, they should not be used at the individual pixel level or on small groups of pixels. LANDFIRE products were designed to support 1) national (all states) strategic planning, 2) regional (single large states or groups of smaller states), and 3) strategic/tactical planning for large sub-regional landscapes and Fire Management Units (FMUs) (such as significant portions of states or multiple federal administrative entities). The applicability of LANDFIRE products to support fire and land management planning on smaller areas will vary by product, location, and specific use. Further investigation by local and regional experts should be conducted to inform decisions regarding local applicability. However, it is the responsibility of the local user, using LANDFIRE metadata and local knowledge, to determine if and/or how LANDFIRE can be used for particular areas of interest. LANDFIRE products are not intended to replace local products, but rather serve as a back-up by providing wall-to-wall cross-boundary products. It is the responsibility of the user to be familiar with the value, assumptions, and limitations of LANDFIRE products. Managers and planners must evaluate LANDFIRE data according to the scale and requirements specific to their needs." (LANDFIRE Metadata)

LANDFIRE data has become the backbone of many landscape-scale fire management projects. It serves as the basis for fire behavior modeling and is a tool for communicating current and future landscape characteristics to validate and justify fuel treatments. LANDFIRE data usually requires calibration—sometimes substantial changes are required—to increase the accuracy of its application. More informed and accurate fire and fuel modeling lead to more confident decision making and resource allocation. There is a need for more areas around the country to maintain updated LANDFIRE layers and contribute to the overall quality of the product for all users.

The accuracy of LANDFIRE varies depending on where you are and how you plan on using the data. Most of LANDFIRE data would be considered accurate, some might be just a little off, and some might be really off. It is therefore VERY important to calibrate the LANDFIRE product to catch the data that is

really off and some of the data that is a little off. As shown by Helmbrecht and Blankenship (2016), fully calibrating LANDFIRE can be an enormous effort and one carried out by those very familiar the area. Without that kind of time or familiarity, we will do what we can with what we have and also take some input from local resources.

GIS and fire management is often a balance of what *should* be done and what you have *time* to do. Sometimes you have to make sacrifices in what should be done to get something produced when needed.

In addition to the importance of calibrating the LANDDIRE data and correcting errors, the process of going through the data is very informative and will lead you through important decision-making processes that will help you get more familiar with your area as you move forward with fire modeling.

In the document *How to: Prepare LANDFIRE data* steps for validating LANDFIRE data have been summarized from Stratton (2009) and Helmbrect and Blankenship (2016). These steps are just a suggested starting place to think through your data, but completing these steps with some attention to detail will reveal important information about the accuracy of your data product.

The Environmental Assessment for the BBB area accomplishes the first step of *Defining objectives*. The purposes of this project can be summarized as 1. Reduce wildfire risk especially in the wildland-urban interface and 2. Return the area to a more historic fire return interval. For this class, we will be focusing our assessment on wildfire risk reduction.

You have also accomplished the second step of *Downloading the LANDFIRE data with the proper projection*. An indication that you have NOT downloaded the data in the proper projection is that your LANDFIRE data is skewed. If that is the case, you will need to re-download the data or contact Heather Heward for assistance.

In the following steps, you will be exploring each layer and some combinations of layers, and record potential changes that will need to be made before using the LANDFIRE product. The quiz questions will prompt you to think about how the layers should be changed, but you should also start to populate the table below as a summary of potential changes needed to the LANDFIRE layers.

Step	Action needed
3. Map Zones	
4. Disturbances	
5. Distribution of values	
6. Non-burnable surfaces	
7. Combine Layers	
8. Compare to stand measurements	
9. Observe general fire behavior output	
10. Compare with MTBS	
11. Compare predicted to observed fire perimeter	

Before you begin – create an Outputs folder in your Lesson_3 folder and set this folder as your default in *Geoprocessing>>Environments*.

Specific direction for each of these steps are given in *How to: Process LANDFIRE data*. You will need to reference that document for more detailed instructions.

- **Step 3:** LANDFIRE Map Zones - Turn on *Imagery Base Layer* and one of the LANDFIRE layers. If you have LFDAT, select *LANDFIRE Map Zones >>***Add Conus Layer**. As discussed by Helmbrecht and Blankenship (2016) it is important to check where your project is in relationship to the lfmap zone boundary because unique rule sets are applied at the LF map zone level. If you are not able to access LDFAT you can download the Map zones layer from landfire.gov.

Question 4: Is the BBB project between two LANDFIRE map zone?

- **Step 4:** Update disturbances – since 2012 when the LANDFIRE data was collected (produced in 2014) there have not been any significant natural or man-made disturbances.

- **Step 5**: Assess range and distribution - Familiarize yourself with the definitions and units for each of the layers (table 1). See the LANDFIRE Data Dictionary for full descriptions.). Look at the range and distribution of values for each theme ask if the values are reasonable.

Table 1: LANDFIRE layer units

LANDFIRE Layer	**Units**
Elevation	meters
Slope	degrees
Aspect	azimuth
Fuel model	n/a
Canopy cover	percent
Canopy height	meters * 10
Canopy base height	meters * 10
Canopy bulk density	kg/m^3 *100

FBFM 40 – Create a graph with **Count** in the *Value Field* and **FBFM 40** as the *X label*. (expand the graph to see all labels). Explore the potential fire behavior for each of the major fuel models by looking at their description in GTR 153 and by comparing the fire behavior fuel models in the CompareModelsFour.xlsx available on Bblearn.

Question 5: What are the 5 most prevalent fuel models?

Elevation – Use the Select Features tool  to select all the peaks in the LANDFIRE data extent. Create a layer from the selected features. Use *Extract values to points* to relate LANDFIRE elevation (dem) to the mountain peaks.

Question 6: Is the average difference between the LANDFIRE elevation and the USA Mountain Peaks > or < 200 ft?

Slope – open the attributes table and select *Table Options>>Create a graph.* For *Value Field* select **Count**, for *X Label Field* select **Value**. Think about whether the slope values seem reasonable using table 2 as a reference.

Table 2: slope conversion from degrees to percent

Slope (degrees)	Slope (%)
5	8.7
10	17.6
15	26.8
20	36.4
25	46.6
30	57.7
35	70
40	83.9
45	100
60	173.2
80	567.128
90	inf.

Canopy Cover – Open the attributes table "Does the CC exceed 70%? CC rarely exceeds 70% even in so-called closed-canopy forests (see Scott and Reinhardt 2005). Canopy cover is different than crown closure. Canopy cover refers to the horizontal proportion of the ground covered by tree crowns (e.g., bird's eye view looking down). Canopy closure, an ecological measure,
is the proportion of the sky hemisphere obscured by vegetation when viewed from a single point (Jennings and others 1999). If excessive CC values exist within
the modeling domain, rate of spread may be reduced due to increases in fuel moisture and the sheltering effect of the tree overstory from wind." (Stratton 2009).

Question 7: How many cells have Canopy Cover over >70%

Canopy Height and Canopy Base Height – Observe the distribution to see if it looks reasonable.

- **Step 6**: Confirm non-burnable areas – To make this comparison easier we will first extract the non-burnable cells from the FBFM40 layer using the directions in the How-to document.

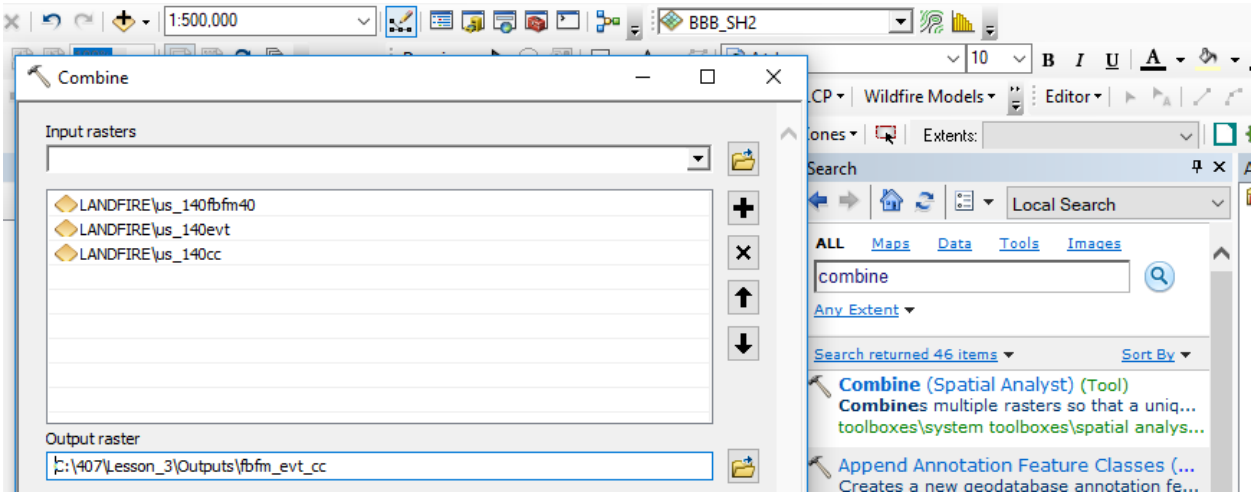
  Try and establish if there is a pattern of areas that are consistently inaccurate. If you find areas that look unburnable but are not classified as such, turn the FBFM40 layer on and use the *Identify tool* to see what the area IS classified as. It may be useful to extract other fuel models to better identify a pattern of misclassification. Use the World imagery, elevation, and Topo layers as a background for understanding patterns in misclassification. If you wish to view the layers in Google Earth you can use the *Conversion>>to KML>>Layer to KML* to convert the rasters into a KML.

  Manager tip: the elevation **6500 feet** has been identified as roughly when fire behavior changes from more to less active due to sparse vegetation. Explore fuel models above and below this breakpoint.

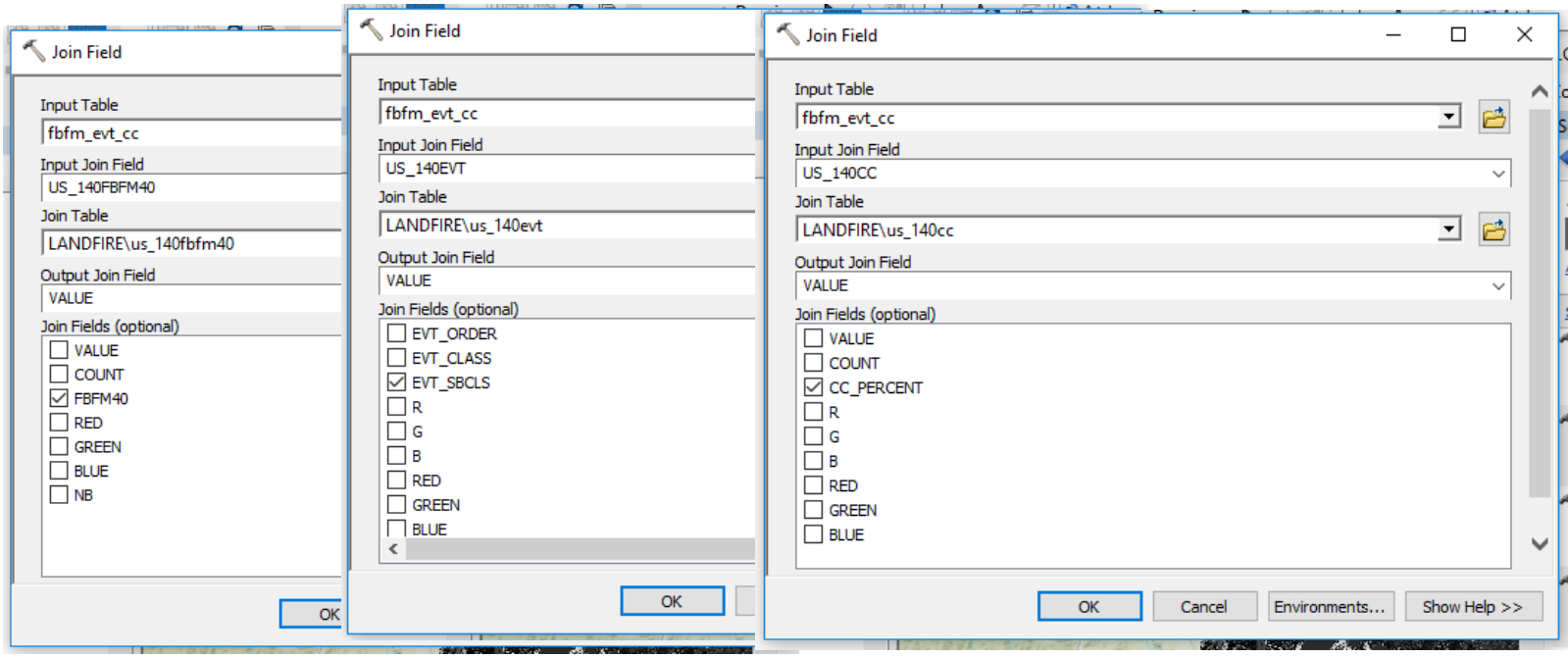
  NOTE: This has the potential of being a VERY time-consuming task. Detailed data exploration is not the purpose of this class. Explore the data enough to get a general impression of the accuracy of the non-burnable areas and develop 1 or 2 possible needed changes and then move on to the next step.

Question 8: List 1 or 2 changes that you might recommend based on your exploration of the non-burnable areas.

- **Step 7** – Combine Layers - We are interested in looking at three LANDFIRE variables combined to see if is some inconsistent information between layers. You can use any number of layer combinations, but for our purposes, we are only going to combine EVT, FBFM40, and CC.
    a. **Combine (spatial analyst)**.



    b. Add the *fbfm40*, *EVT* and *CC* layers and name it **fbfm_evt_cc** click **OK**
    c. Open the attribute table of the new layer. There is a column for FBFM, EVT, and CC. To increase our ability to interpret this table, we will join additional fields.
    d. Search for *Join Field Tool* and click on **Join Field (Data Management) tool**
    e. Complete the following joins



f. Open the attributes table of *fbfm_evt_*cc. It may be helpful to right-click on the three original value columns and select **Turn Field Off**. If you wish to turn them on in the future you can select *Table Options>>Turn all fields on*. To mark rows that you want to flag for future investigation, you can add a column for *potential_errors.* Use the editor toolbar to start editing and add a 1 to each row that seems to be questionable. When complete you can create a new raster with the flagged rows. Stratton (2009) suggests asking the following questions as you explore the data.

   i. Are the locations of the higher frequency grid combinations correct?
      a. Sort *Count* descending, and observe the first 20 to 25 rows

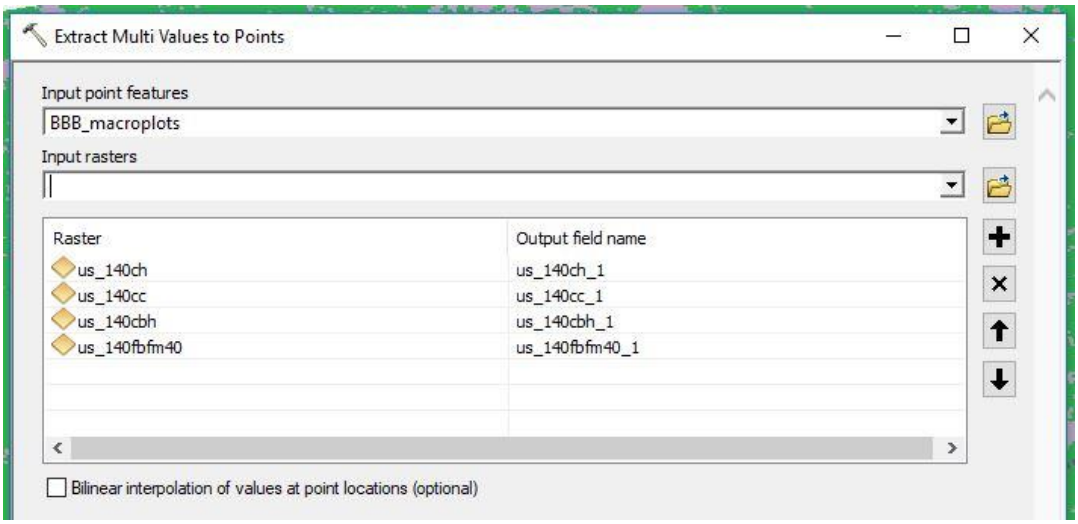
   ii. Does the EVT classification "match" with the fuel model assignment?
      a. Sort *FBFM40* ascending and explore each fuel model category.

   iii. Are the canopy characteristics adequate given the EVT, fuel model, and spatial location?
      a. Sort *CC_Percent* ascending and explore each cc class

Question 9: Discuss potential concerns that you identified in your exploration of the fbfm_evt_cc combination. What fuel models seem to match well with evt, what fuel models seem to be off?

- **Step 8** – Compare measured stand values

Use the *Extract Multi Values to Points* option to compare the measured canopy values to CC, CH, CBH, and FBFM40. Convert CH, and CBH to feet for ease of comparison. Reference the photos in the *BBB_data>>Photos* folder to get a better feel for the area.



Question 10: T/F CH and CBH appear to be accurate and should not be questioned.

Installing ArcFuels and FlamMap – To complete the steps for labs 4 and 5, you will need to have access to ArcFuels.

g. Go to the ArcFuels Homepage and read the brief background on ArcFuels
h. Navigate to or click this link to the Download page and select either "For ArcGIS installed on your computer" or "for ArcGIS run via Citrix." Note – this is an add-in which means you will not need admin privileges to install.
i. Locate the Add-in file for ArcFuels and double click – you should receive quick notification that it installed.
j. In ArcMap click **Customize>> add-in –** Arc fuels may automatically show up, or you may need to navigate to the add-in file.
k. To turn ArcFuels on go to Customize >> Toolbars >> ArcFuels
l. Download FlamMap
m. To connect Arcfuels to Flammap click the dropdown arrow next to *Wildfire Models* and under the space for Flammap click "…" to locate the .exe file for Flammap.