

Software: ArcMap 10x, FlamMap5, ArcFuels 10
Updated: April 2016

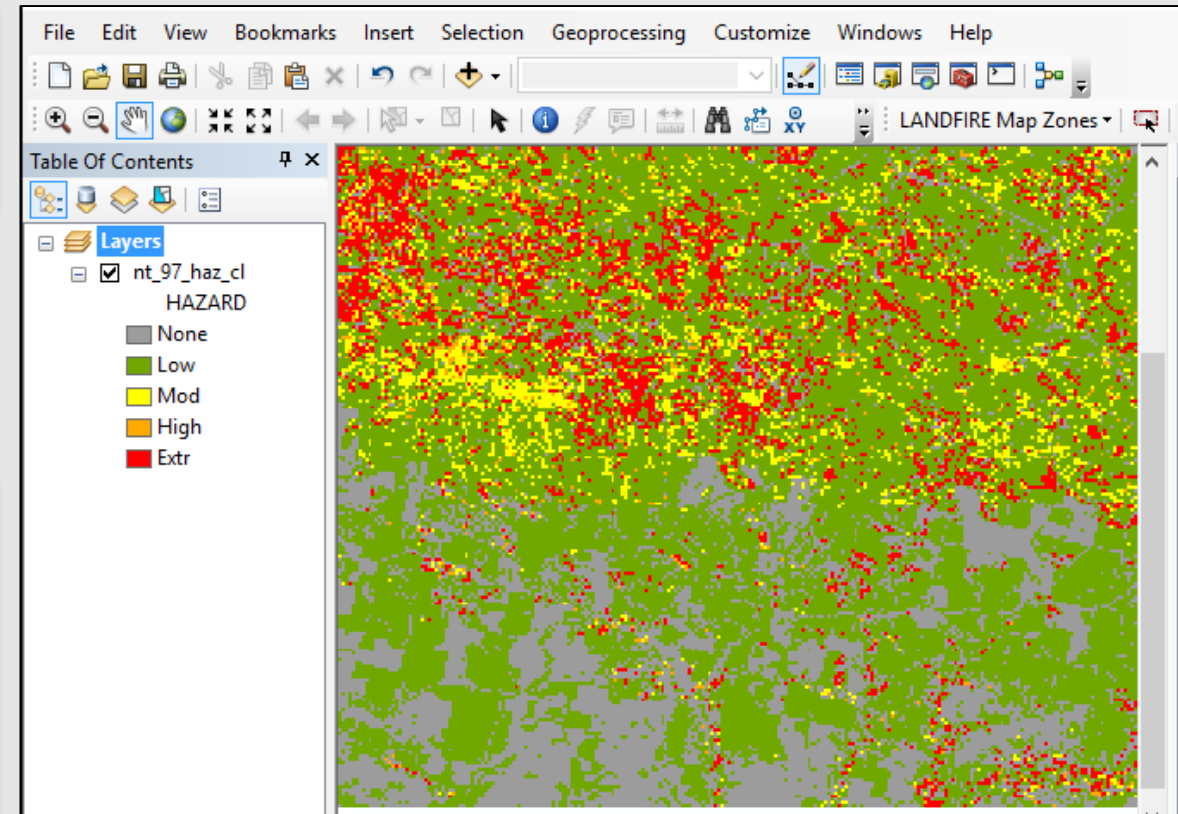
Overview

Required Data:

- Flame Length ASCII – *See How-to: FlamMap*
- Crown Fire Activity ASCII – *See How-to: FlamMap*
- WildfireHazardClassificationScript.cal (available on request)

Overview of Major Steps:

1. Convert the flame length and crown fire activity ASCIIs to rasters
2. Reclassify modeled flame length into hauling chart categories
3. Combine reclassified flame length and crown fire activity rasters to make the hazard map



Source: Most steps and images come directly from the [ArcFuels Tutorial](#).

Background

Wildfire hazard is a metric defined by end users in different ways. Some discuss wildfire hazard in terms of the proximity to the WUI while others may discuss fire hazard in terms of ambient weather conditions, fuel loading, crown fire potential, fire intensity, or the likelihood of burning.

Simplifying and combining modeled fire behavior outputs into a matrix or map is a useful way to visualize and quantify differences in fire hazard. Flame length can be categorized based on hauling categories as directly related to suppression tools and effectiveness (Rothermel 1983). Reclassified flame lengths can be combined with crown fire activity to create a matrix. The categories (i.e., low, moderate, etc.) within the matrix may differ by location and fuel type; this is only an example matrix.

The hazard map can then be used to highlight “hot spots” indicating the potential need for treatment. The same process can be completed for any number of fuel treatment alternatives where the results can be compared as a means of testing the effectiveness of reducing wildfire hazard. Just because a location has elevated hazard does not mean it needs to be treated; based on vegetation type or fire regime grouping it might be fine if it burns at a higher intensity. However, if high hazard is also coupled with high likelihood of burning or is near or within an area with highly valued resources, it might be more important to treat a given area.

| Crown Fire Activity | Flame length (ft) | | | | |
|------------------------|-------------------|--------|--------|---------|------|
| | 0 | >0 - 4 | >4 - 8 | >8 - 11 | > 11 |
| No fire (0) | None | None | None | None | None |
| Surface fire (1) | None | Low | Low | Mod | High |
| Passive crown fire (2) | None | Low | Mod | High | Extr |
| Active crown fire (3) | None | High | Extr | Extr | Extr |

Example wildfire hazard matrix using flame length and crown fire activity.

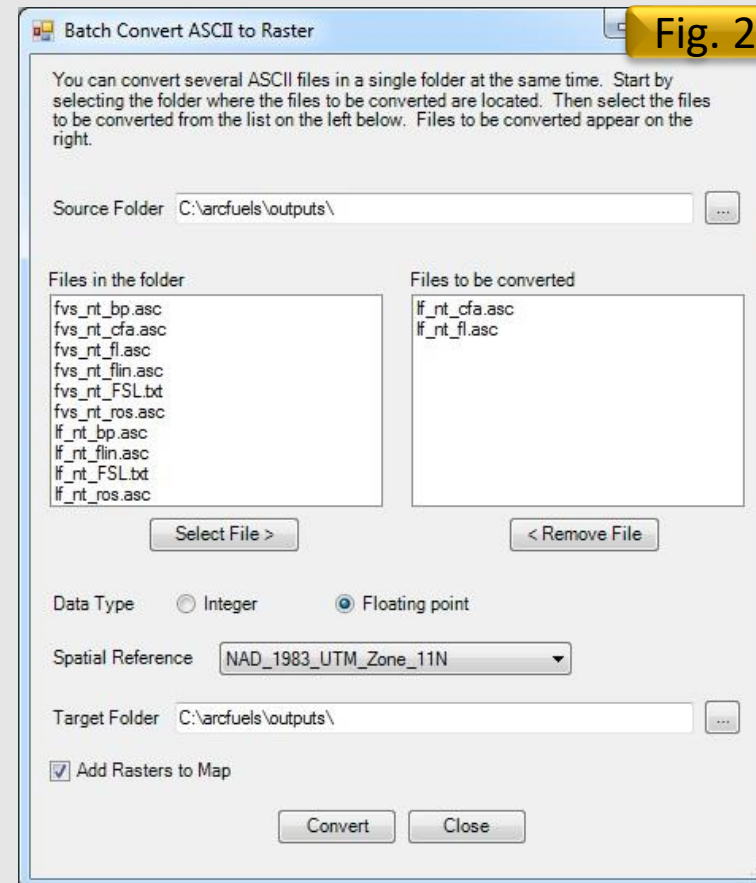
| Flame length (ft) | Description |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <4 | Fires can generally be attacked at the head or flanks by persons using hand tools. Hand line should hold the fire. |
| 4-8 | Fires are too intense for direct attack on the head by persons using hand tools. Hand line cannot be relied on to hold fire. Equipment such as dozers, pumpers, and fire-retardant aircraft can be effective. |
| 8-11 | Fires may present serious control problems—torching out, crowning, and spotting. Control efforts at the fire head will probably be ineffective. |
| >11 | Crowning, spotting, and major fire runs are probable. Control efforts at head of fire are ineffective. |

Hauling category table adapted from Rothermel (1983), which related flame length to fire suppression effectiveness.

Step 1: Convert flame length into hauling chart categories

1.1 – Batch convert ASCII to raster

- Open a new ArcMap project
- Add one of the layers from your LCP file to provide your project with spatial reference.
- Arc Fuels Toolbar >> Tools>> batch convert ASCII to raster (figure 1)
- Source folder:* your project **output** folder (figure 2)
- Files to be converted:* flame length (fl) and crown fire activity (cfa) files from FlamMap
- Spatial Reference:* make sure the spatial reference for your LANDFIRE data is selected
- Target folder:* your project **output** folder
- Check **Add Rasters to Map**
- Click **Convert**
- A progress meter will open, then close after the shapefiles have been created. A window will open indicating how many of the files were converted; click the OK button to close it.
- Click the Close button got close the Batch Convert ASCII to Raster form.

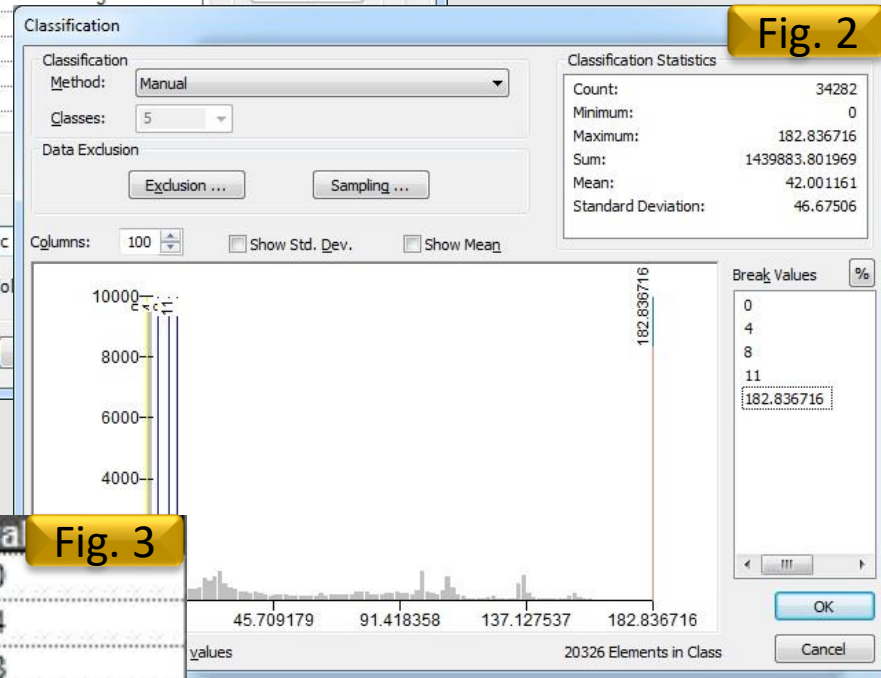
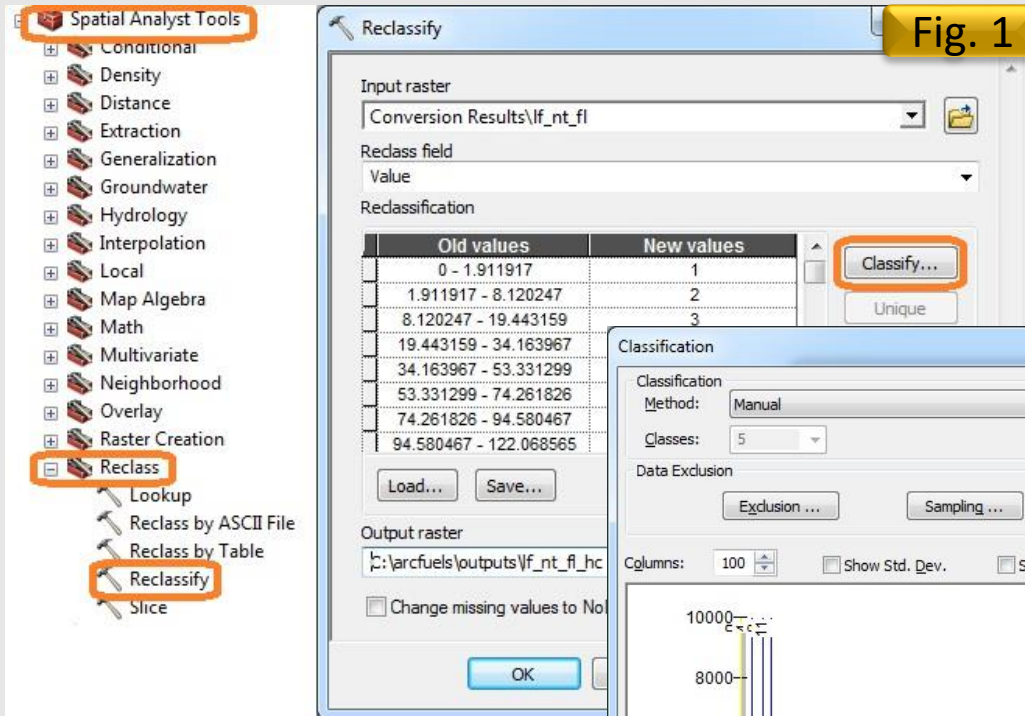


The crown fire activity and flame length files from FlamMap are needed to build the hazard raster. Before they can be used in ArcMap they must be converted to rasters.

Step 2: Reclassify modeled flame length into hauling chart categories

2.1 - Reclassify a raster

- a. Arc Toolbox>> Spatial Analyst Tools >> Reclass >> Reclassify
- b. *Input raster: flame length layer*
- c. *Reclass field: Value*
- d. *Output raster: filename_hc* (indicating it is based on the hauling chart)
 - a. If you do not wish to keep your original flame length layer you could simply reclassify from the properties area of the layer.
- e. Click **Classify** to define the classes (figure 1)
- f. **Method: Equal Interval**
- g. **Classes: 5**
- h. **Break values:** highlight each of the classes and replace them with "0", "4", "8", "11", and leave the highest class as the default value. After you change the values the Method will automatically be changed to Manual this is fine. (figure 2)
- i. Update the *New values* to be the high end of the *Old values* classes. (figure 3)
- j. Click **OK** to create your raster



| Old values | New values |
|-----------------|------------|
| 0 | 0 |
| 0 - 4 | 4 |
| 4 - 8 | 8 |
| 8 - 11 | 11 |
| 11 - 182.836716 | 182 |
| NoData | NoData |

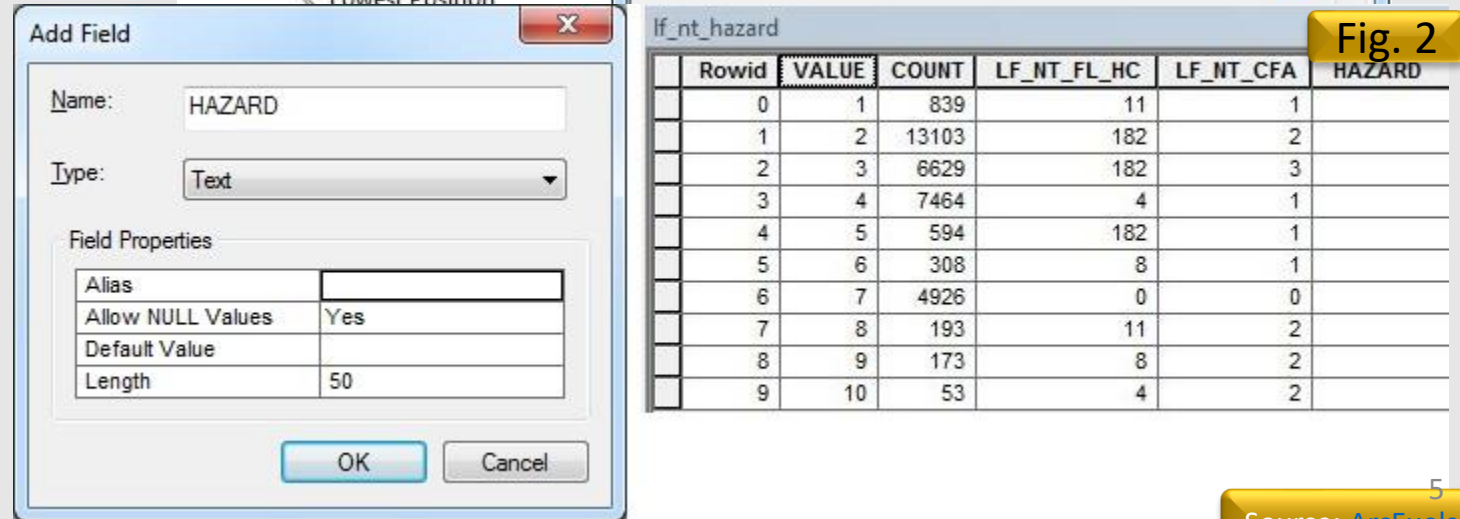
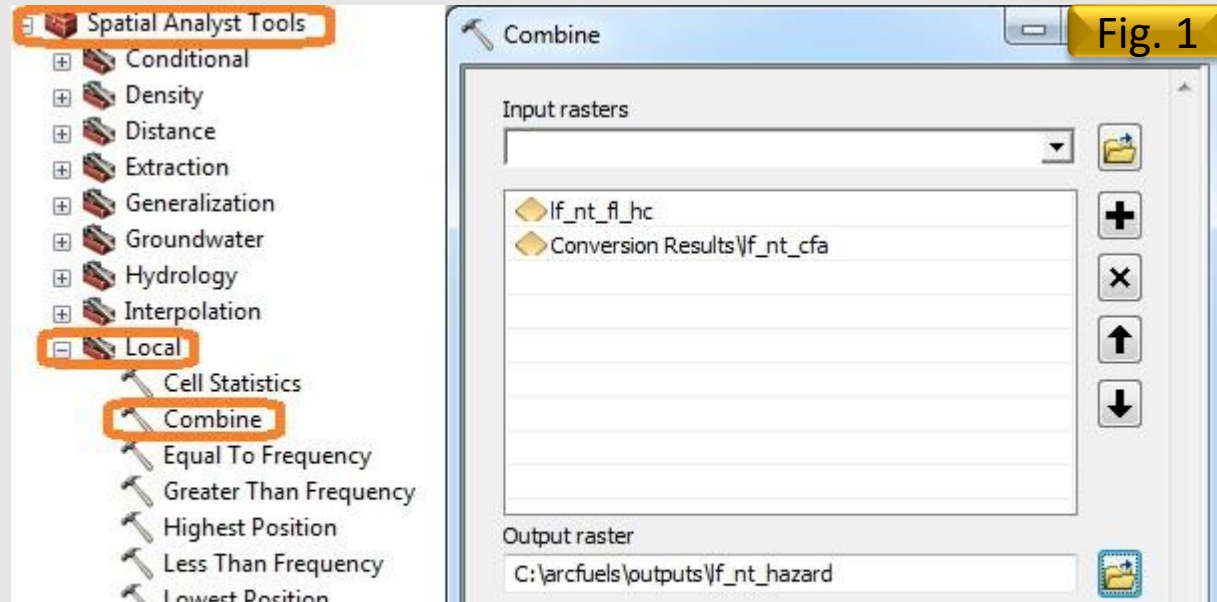
Step 3: Combine the reclassified flame length and crown fire activity rasters to make the hazard rasters

3.1 - Combine rasters

- ArcToolbox >>Spatial Analyst Tools >>Local >> Combine
- Input rasters:
 - Flamlength_hc AND cfa
- Output raster: filename_hazard – save it in an outputs folder for your project (figure 1)
- Click **OK**

3.2 - Create new column

- Open the attributes table for your new hazard layer
- Add a new text field
 - Attribute table >>Options >>Add field
- Name it **Hazard**
- Change the type to **Text** (figure 2)



Step 3: Combine the reclassified flame length and crown fire activity rasters to make the hazard rasters

3.3 – Using field calculator to load python script

- a. You can either manually type in the hazard value based on the combination of FL and CFA (must start editor session) or you can use the following python script (ArcGIS coding language)
 - a. Start an editing session - Right-click on hazard layer >>Edit features >> start editing
- b. Right-click on your *Hazard* column and select **Field Calculator**
- c. Select **Yes** if you are outside of an editor session
- d. For *Parser* select **Python** (figure 1 (1))
- e. Click **Load (2)** and select **WildfireHazardClassificationScript.cal**
 - a. This is some coding that is a series of if/then statements. IF there is a 2 value in the CFA column AND a FL >11 ft THEN the Hazard is Extreme (figure 2)
- f. In the equation for HAZARD = change the names of the columns from “NT_97_CFA” to the name of your CFA column (3)
- g. Click **OK**
- h. In *Properties* select **Unique values** and use **Hazard** as the *Value Field*

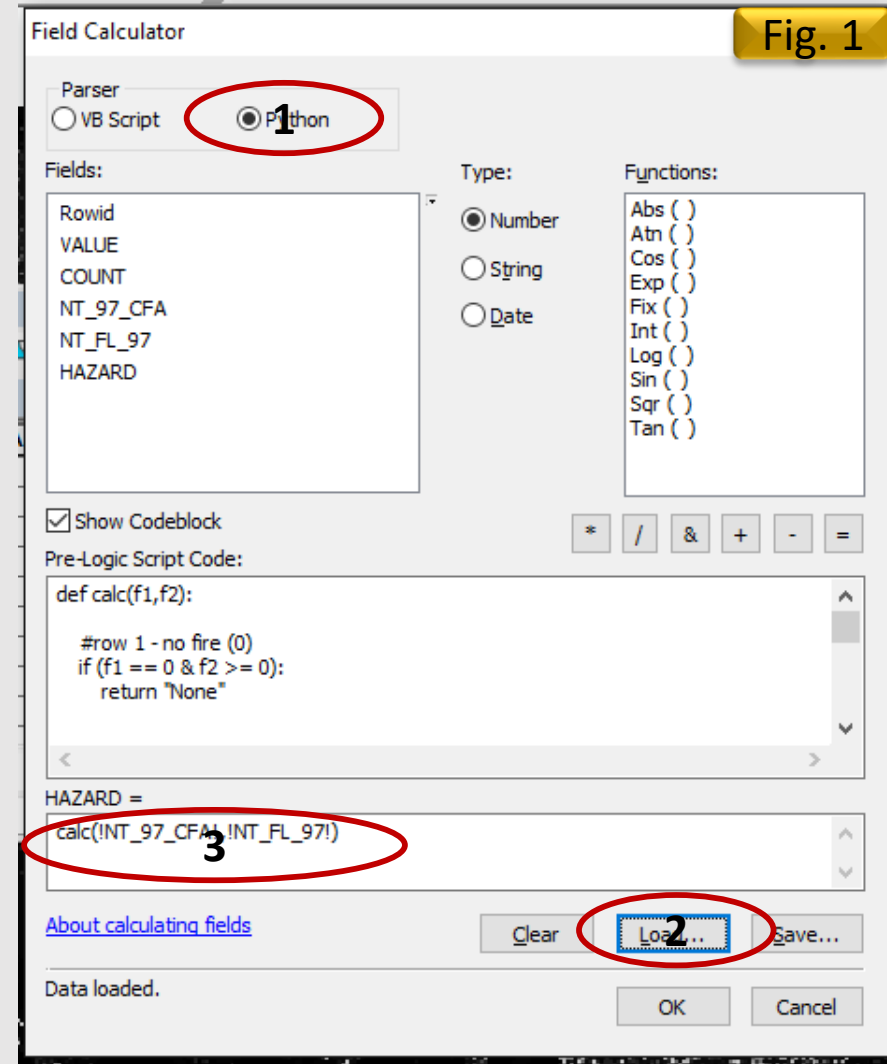


Fig. 1

| Crown Fire Activity | Flame length (ft) | | | | |
|------------------------|-------------------|--------|--------|--------|------|
| | 0 | >0 - 4 | >4 - 8 | >8 -11 | > 11 |
| No fire (0) | None | None | None | None | None |
| Surface fire (1) | None | Low | Low | Mod | High |
| Passive crown fire (2) | None | Low | Mod | High | Extr |
| Active crown fire (3) | None | High | Extr | Extr | Extr |

Fig. 2

Step 3: Combine the reclassified flame length and crown fire activity rasters to make the hazard rasters

3.4 – Reclassify raster

- Input raster: layer with the hazard column
- Reclass field: HAZARD
- Change *Mod* to **2** and *Low* to **1** – this will put the values in the correct order (figure 1)
- Output raster: filename_cl for classified
- Click **OK**

TIP: To see the status of your processing go to *Geoprocessing >> Results*. You can see if task is still being processed or if there was an error message

- Change the colors in the new layer to correspond to the fire hazard. (figure 2)
 - One way to do this is to right click on the fire hazard (ex. Low) and select a color) Choosing a color ramp will limit your ability to adjust color.

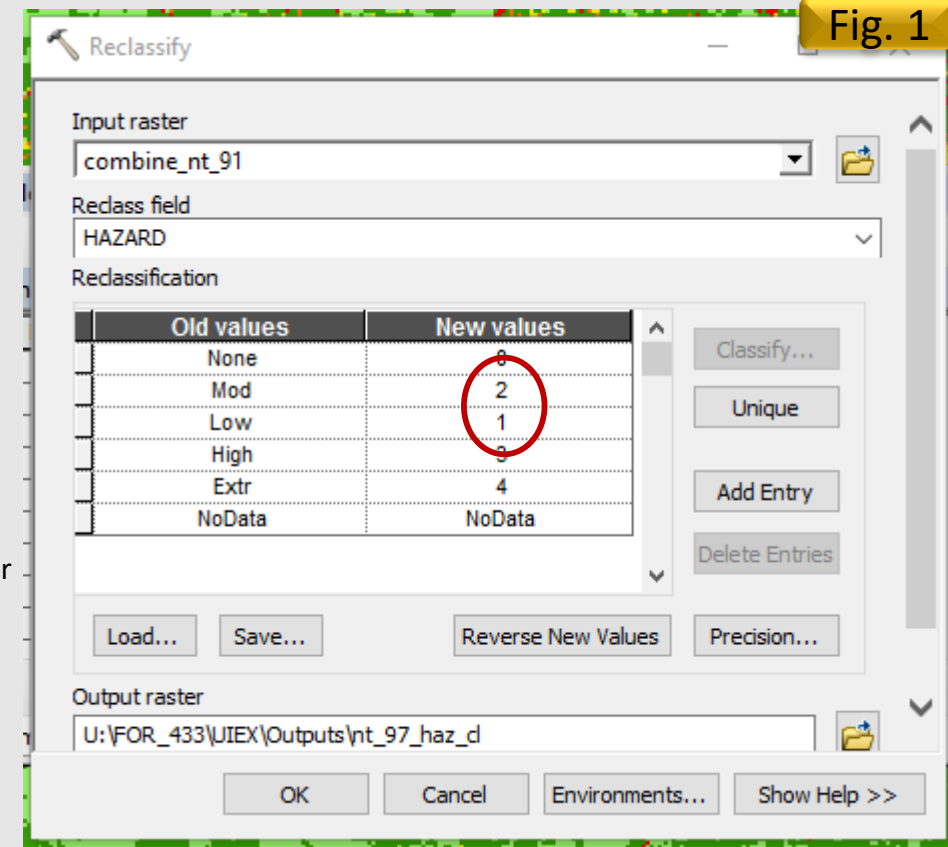


Fig. 1

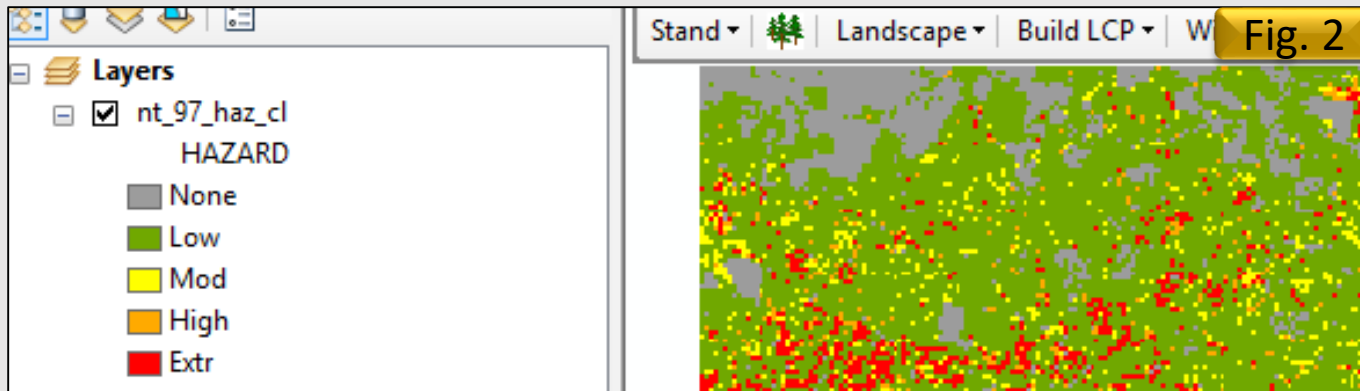


Fig. 2