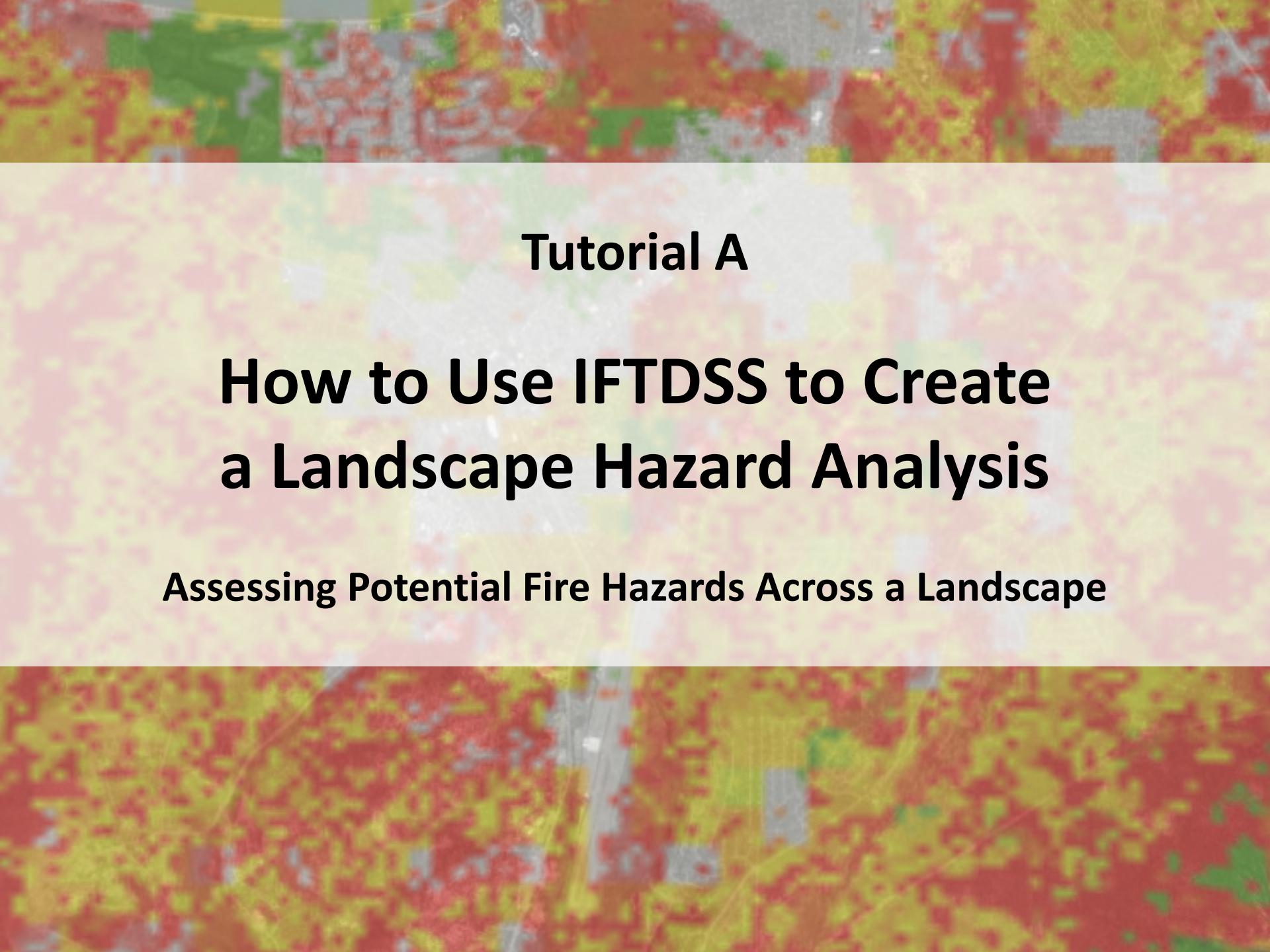


Tutorial A

How to Use IFTDSS to Create a Landscape Hazard Analysis

Assessing Potential Fire Hazards Across a Landscape

Overview

This landscape-based tutorial covers

- Acquiring LANDFIRE data and setting up a project in IFTDSS.
- Creating a run focusing on fire behavior across a landscape (IFT-FlamMap).
  - Establishing environmental parameters.
  - Reviewing spatial landscape input data and fire behavior output data.
- Examining data relative to points of interest and other geographic features using Google Earth.
- Identifying potential fire hazards across a landscape.
- Discussing hazard analysis caveats.

Introduction

The hazard analysis workflow provides tools to perform a current condition assessment of fire hazard within an area of interest.

The focus of this workflow is to identify areas that warrant further analysis based on potential fire hazard.

High fire hazard is expressed by high potential fire behavior (e.g., flame length, rate of spread, and fireline intensity) and/or undesirable fire effects (e.g., tree mortality and emissions).

In IFTDSS, you can assess potential fire behavior using a fire behavior mapping and analysis software application called *Fire behavior across a landscape (IFT-FlamMap)*.

The module uses environmental variables, along with spatial landscape data, to compute potential fire behavior characteristics (such as rate of spread, flame length, and fireline intensity) for an entire landscape.

You input constant weather and fuel moisture conditions to capture an instant in time.

The product of this analysis is a digital map of variability of fire hazard across a landscape.

Introduction

The output from a hazard analysis may be useful for

1. **Identifying areas across a landscape where further fuels treatment analysis may be warranted.**

2. Prescribed fire planning to assess the potential fire hazard in the areas within and adjacent to a planned burn unit for contingency planning.

The following tutorial focuses on assessing potential fire hazards across a landscape using the IFTDSS system.

Tutorial Objectives

- Walk step-by-step through a hazard analysis in IFTDSS.

  There are multiple ways that fire hazard can be addressed. This tutorial uses one possible set of criteria for assessing current condition fire hazard, while introducing some of the functionality within IFTDSS.

- Spatially identify high fire hazard potentials in the South Lake Tahoe Wildland Urban Interface (WUI).
  - Fire hazard analysis is an initial step in the planning process.
  - Information from this step can be used with other ecological and natural resource planning information to rapidly assess areas within the landscape that may warrant fuels treatment.

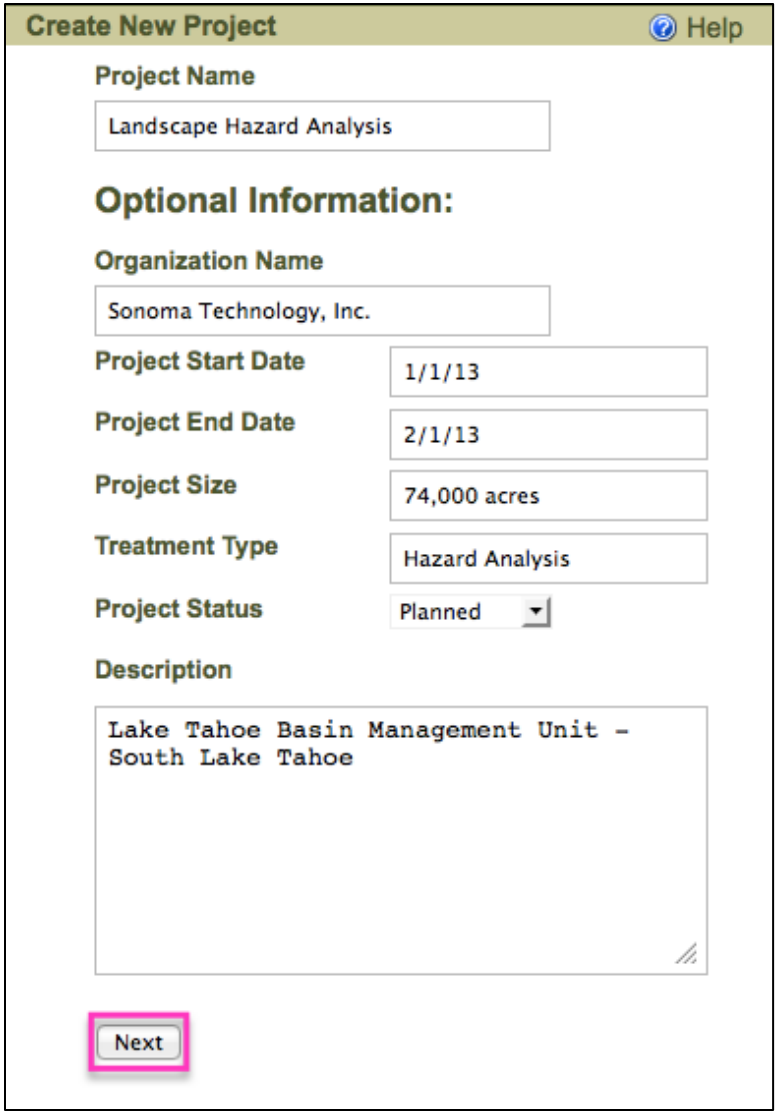
- Discuss caveats to this approach.

Getting Started

To begin, choose **Create a New Project** under the Home tab.

- Choose a descriptive project name.
- If desired, fill in the optional information.

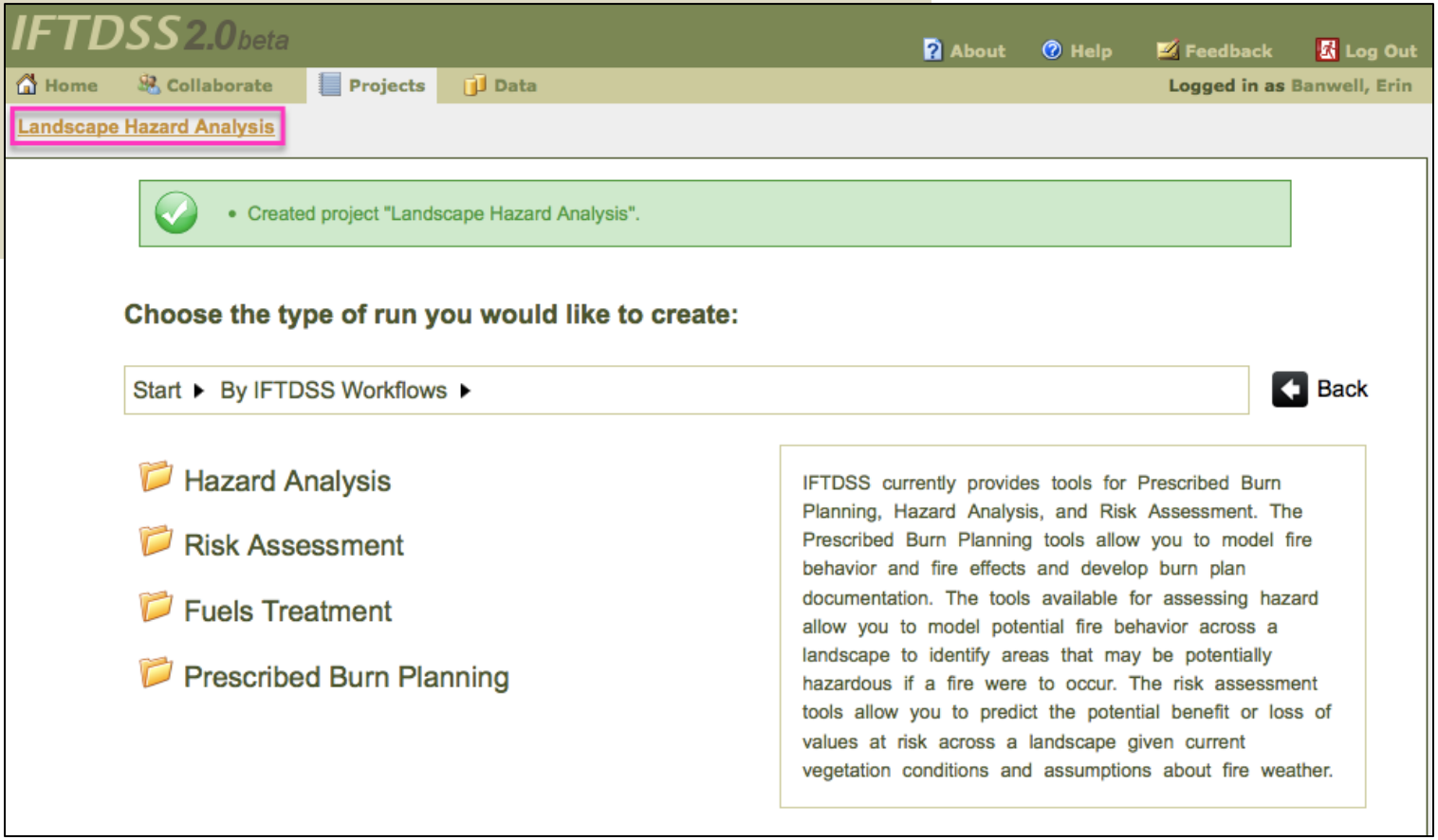
Choose **Next**.



Getting Started

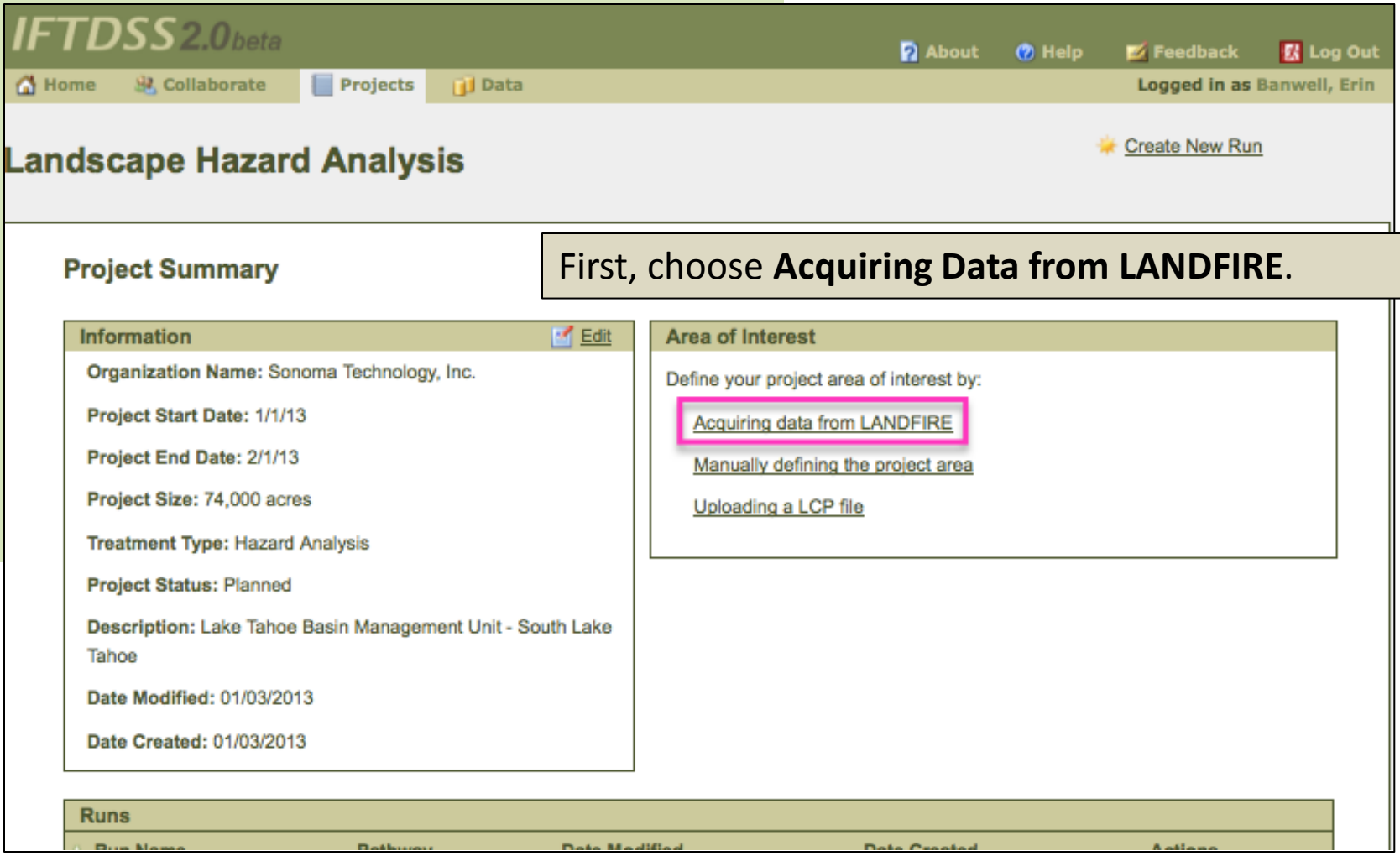
After creating a new project, you will see the page for **creating a new run**. The next step is to acquire LANDFIRE data, so we are going to navigate away from this page.

Access the project you created. In this example, we chose the **Landscape Hazard Analysis** link.



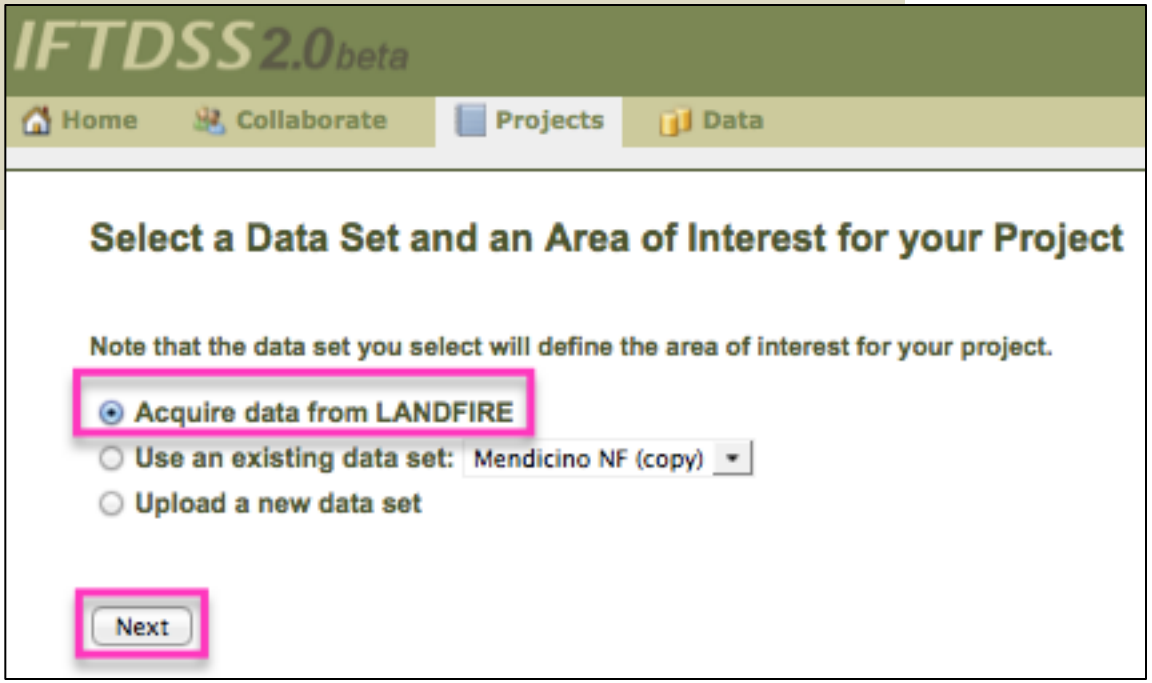
Getting Started

Now, we will acquire data from LANDFIRE.



Getting Started

Next, select **Acquire data from LANDFIRE**, then choose **Next**.



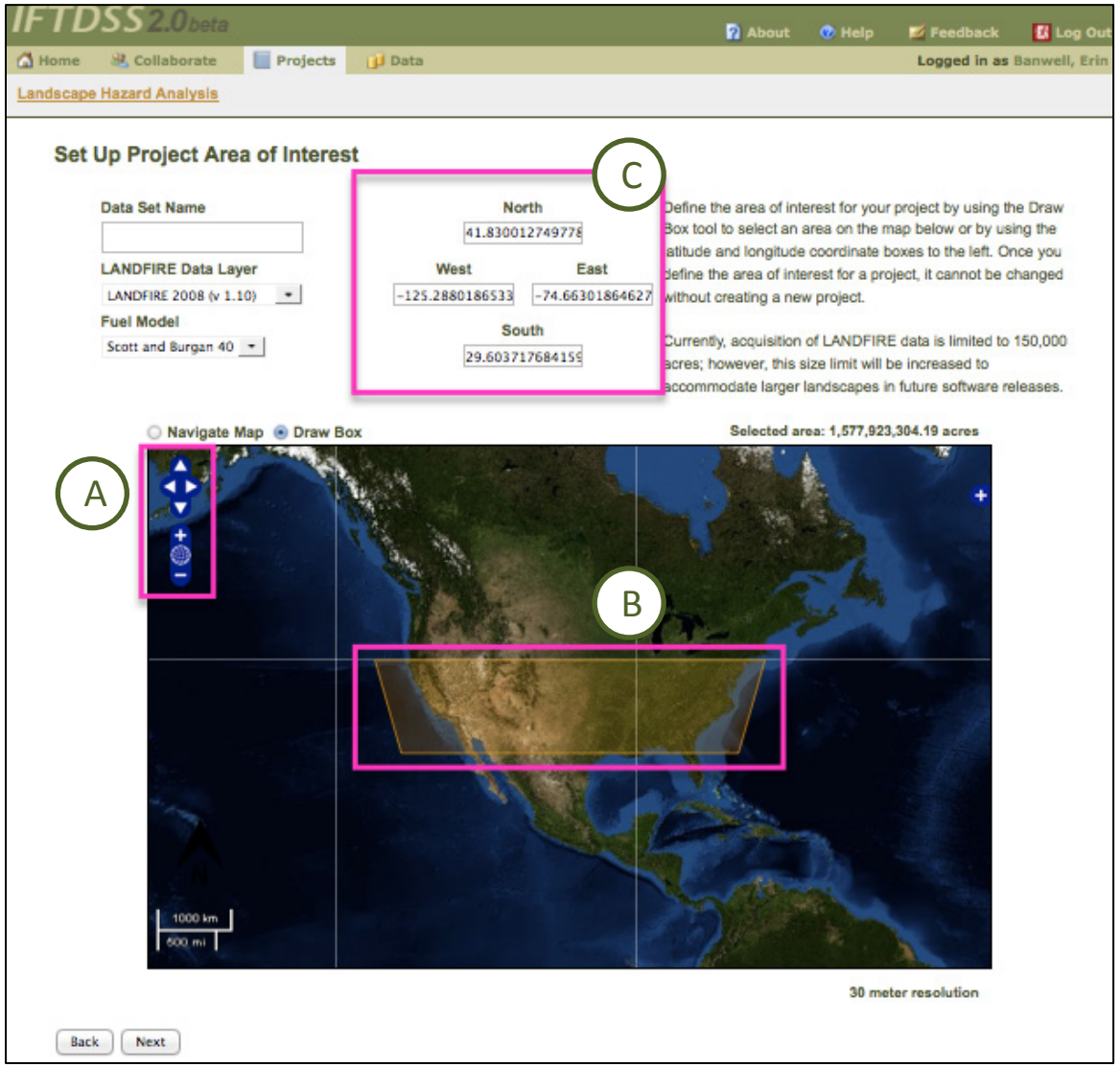
Selecting a Project Area of Interest

Navigate to your desired location using one of these methods:

A. Using the navigation tools located in the top left portion of the map.

B. Using the mouse. Click and drag to move; double-click to zoom in.

C. **Entering coordinates.**



Tip: For this example, **enter the following coordinates**

- **North:** 38.9819253922
- **East:** -119.925353355
- **South:** 38.8740237815
- **West:** -120.114867515

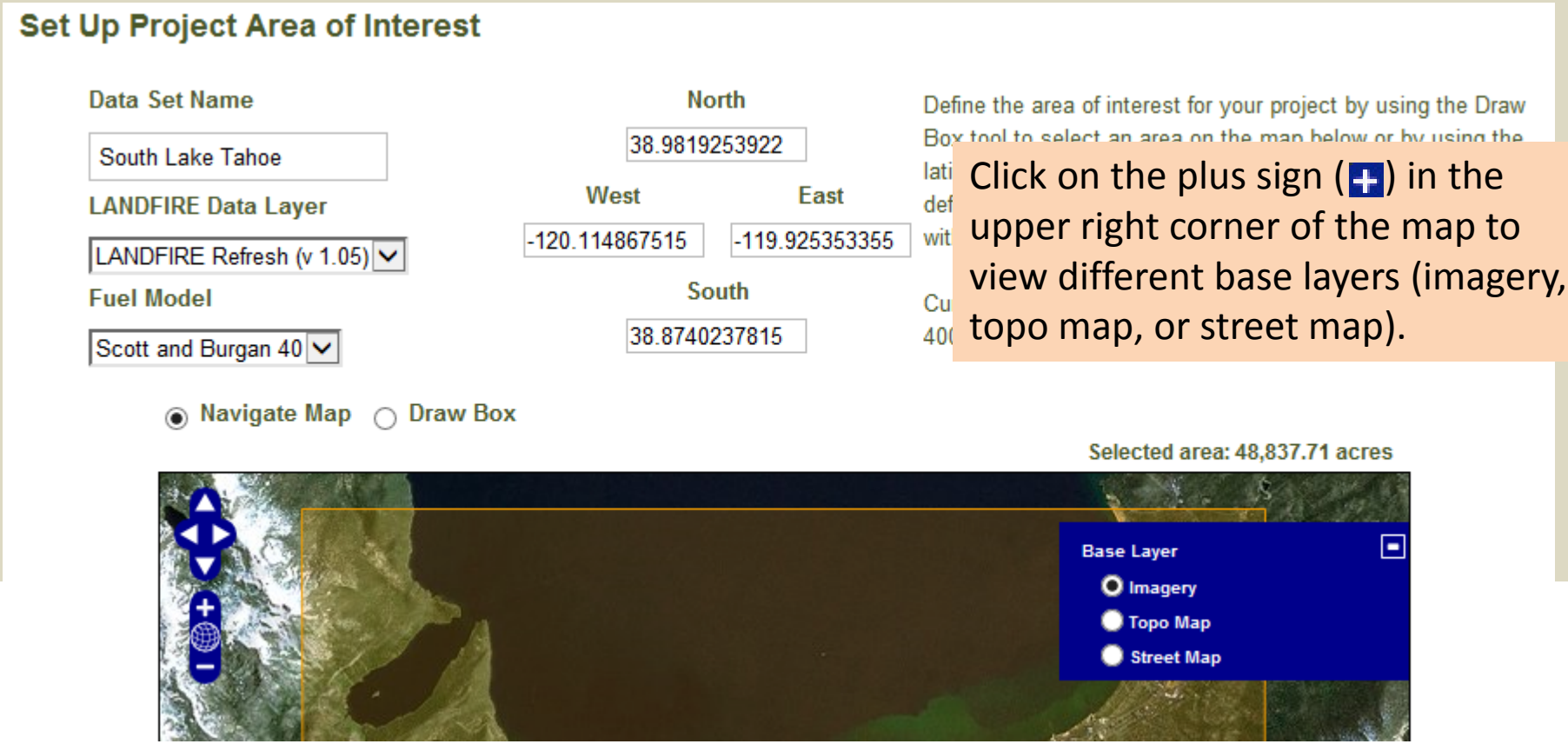
Selecting a Project Area of Interest

Name the data set.

Select a LANDFIRE data layer (LANDFIRE 2008 v 1.10 or LANDFIRE Refresh v 1.05).

For this example, choose LANDFIRE Refresh v 1.05.

Select a fuel model type (Scott and Burgan 40 or Anderson 13).



Click on the plus sign (+) in the upper right corner of the map to view different base layers (imagery, topo map, or street map).

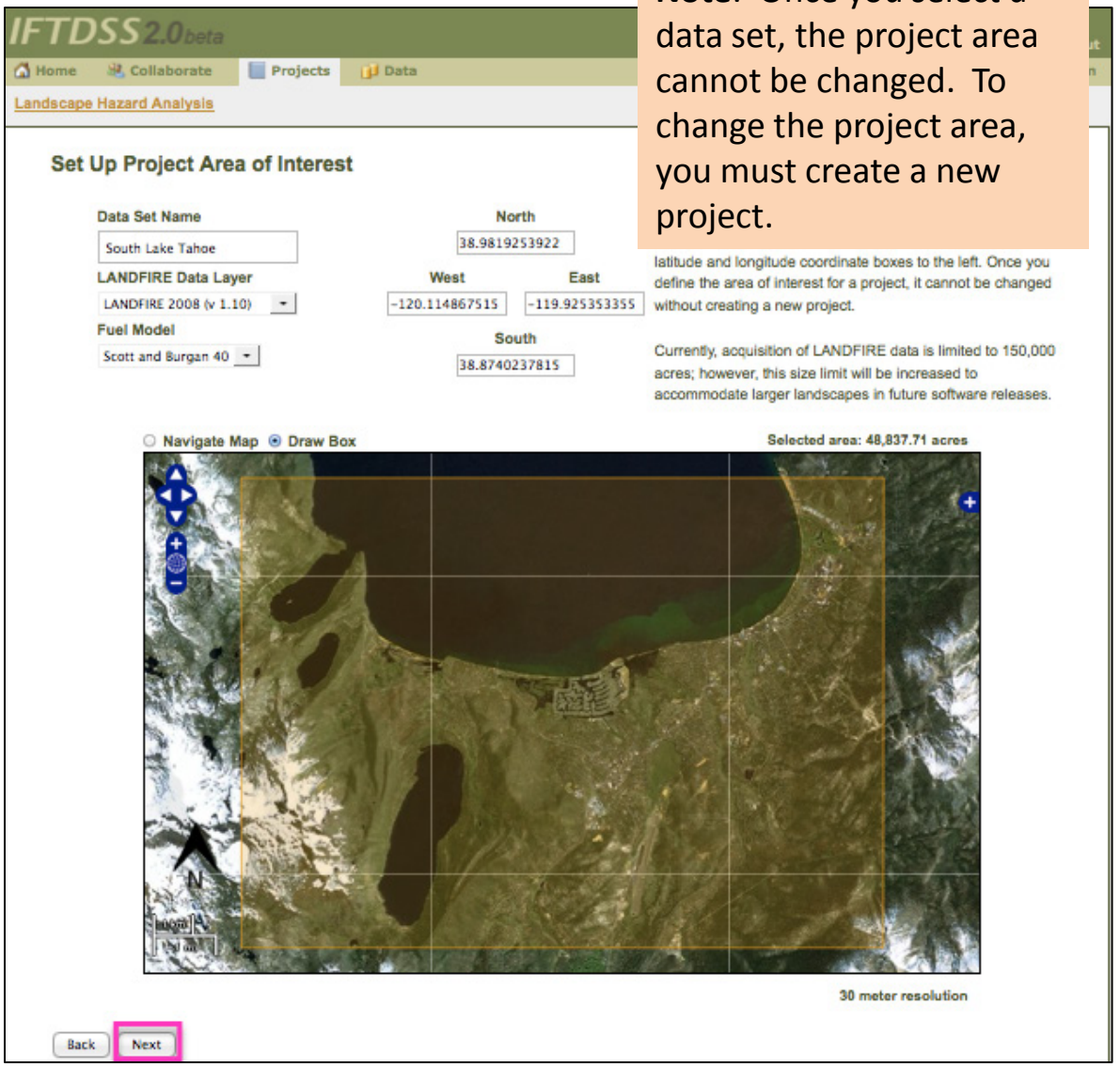
Selecting a Project Area of Interest

Choose **Next** to import LANDFIRE data.

There will be a short wait while the LANDFIRE data is imported.

Tip: In this type of hazard analysis, select a large data set area. By creating a large data set area, you can model fire behavior across a landscape to identify possible fire hazard areas.

Maximum area: Acquisition of LANDFIRE data is set to a limit of 400,000 acres.



Note: Once you select a data set, the project area cannot be changed. To change the project area, you must create a new project.

Creating a New Run

After acquiring the LANDFIRE data, you are returned to the **Project Summary** page.

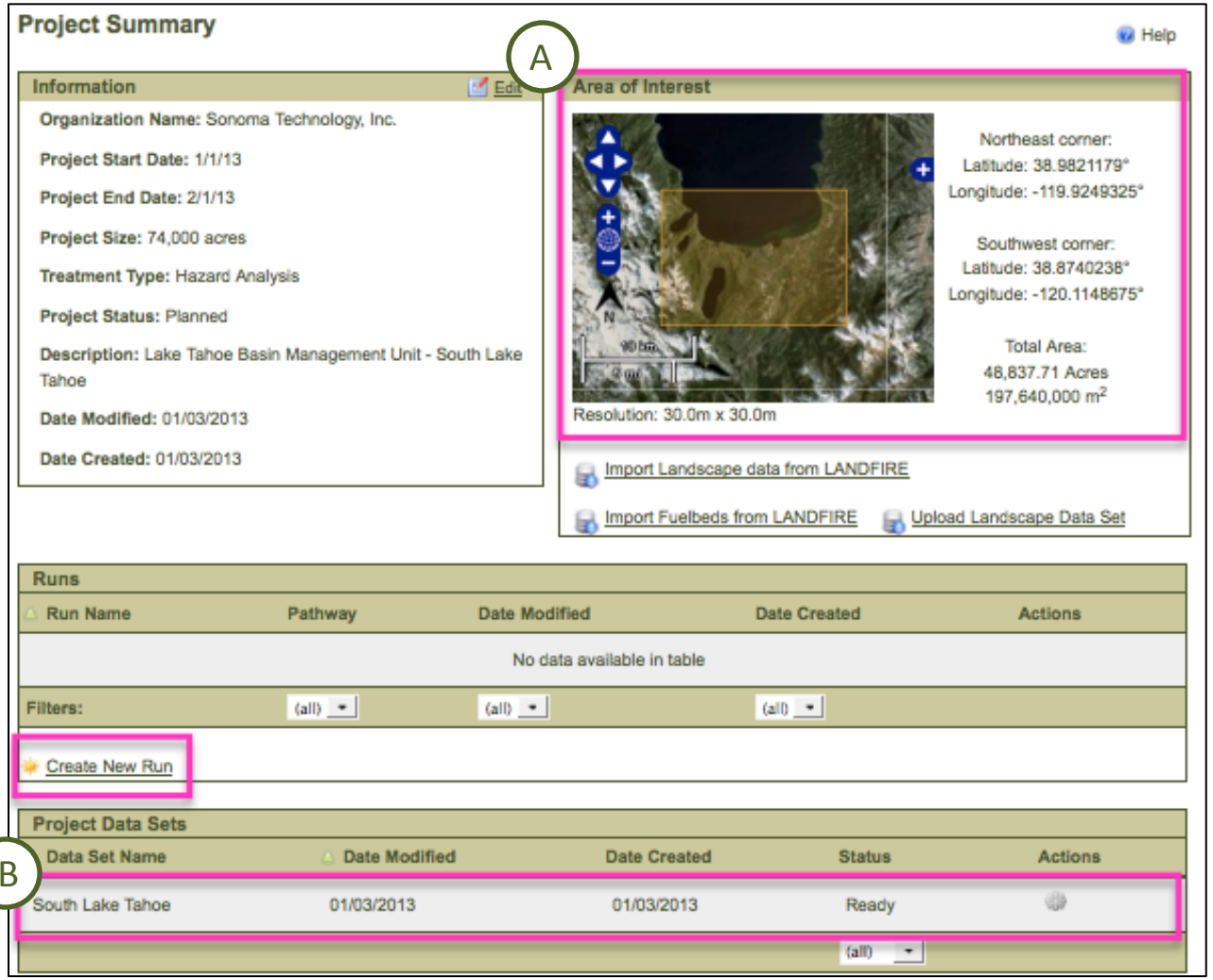
For use in spatial modules, you now have

A a Project Area of Interest

and

B a Project Data Set.

For your next step, choose **Create New Run**.



Creating a New Run

Choose the type of run you would like to create by **choosing the following links:**

Hazard Analysis

→ Fire Behavior

→ Calculate fire behavior across a landscape (IFT-FlamMap)

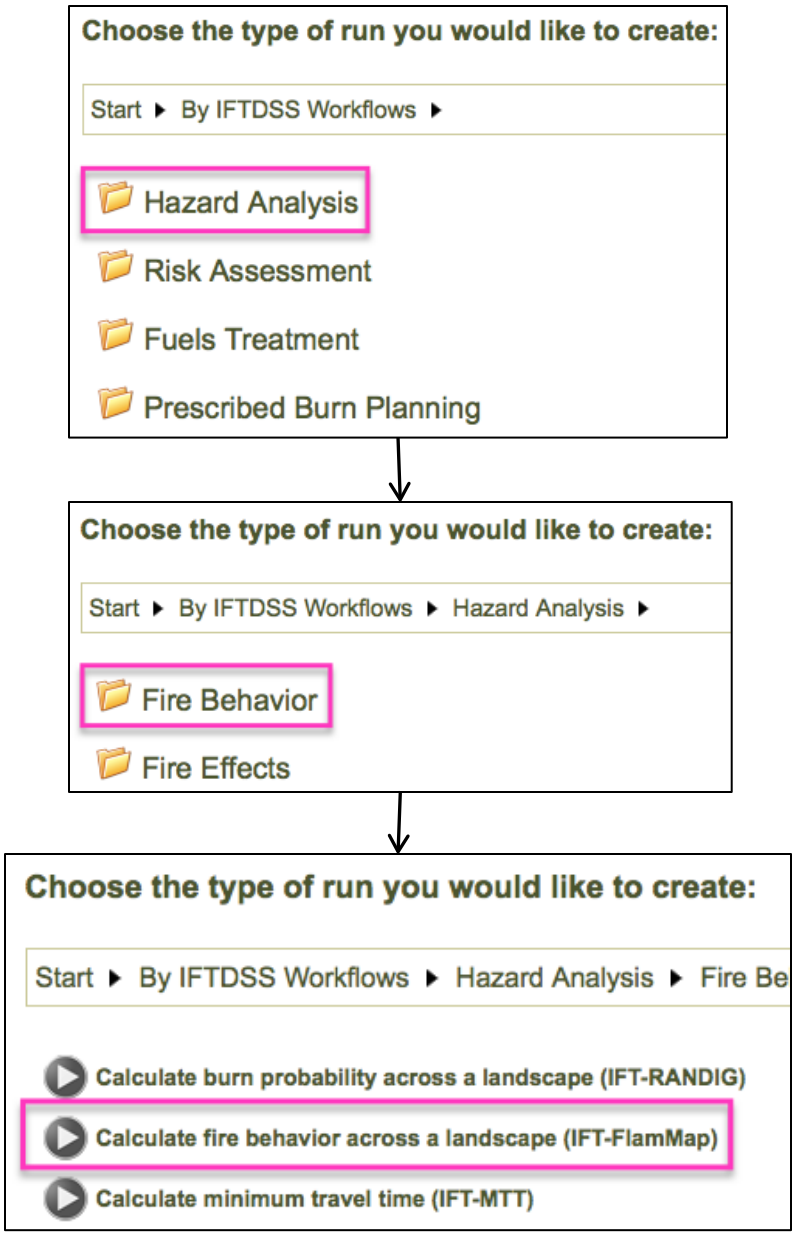
In this **run**, you will

a. Select an area of interest.

b. Input your environmental parameters.

c. Review the spatial landscape data.

d. Review the fire behavior output data.

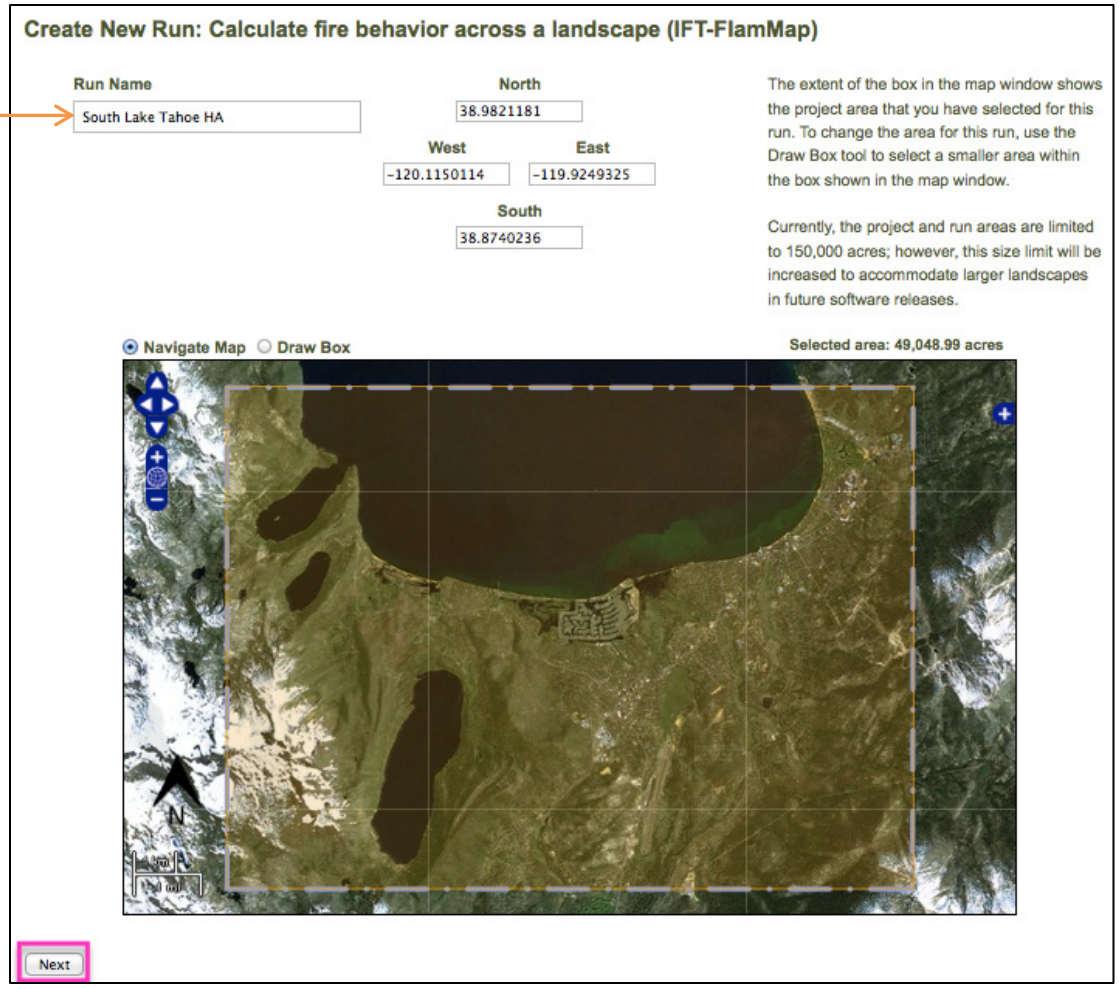


Selecting an Area of Interest

Tip: Give your runs descriptive names for future reference.

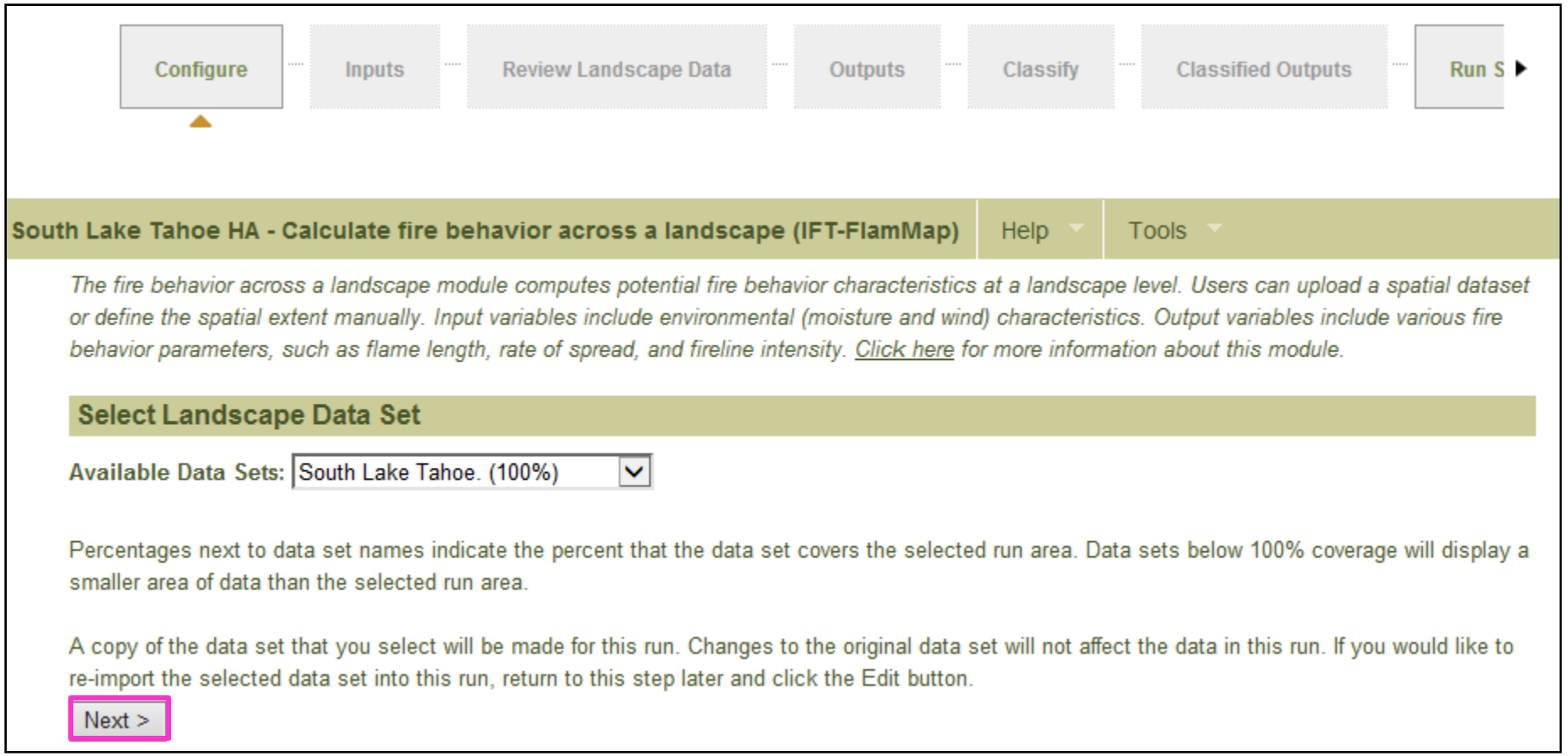
In this step, select an area of interest within the project boundary. For this example, we selected the entire project boundary. This approach is useful if you want to model fire behavior across a landscape.

After selecting an area of interest, choose **Next**.

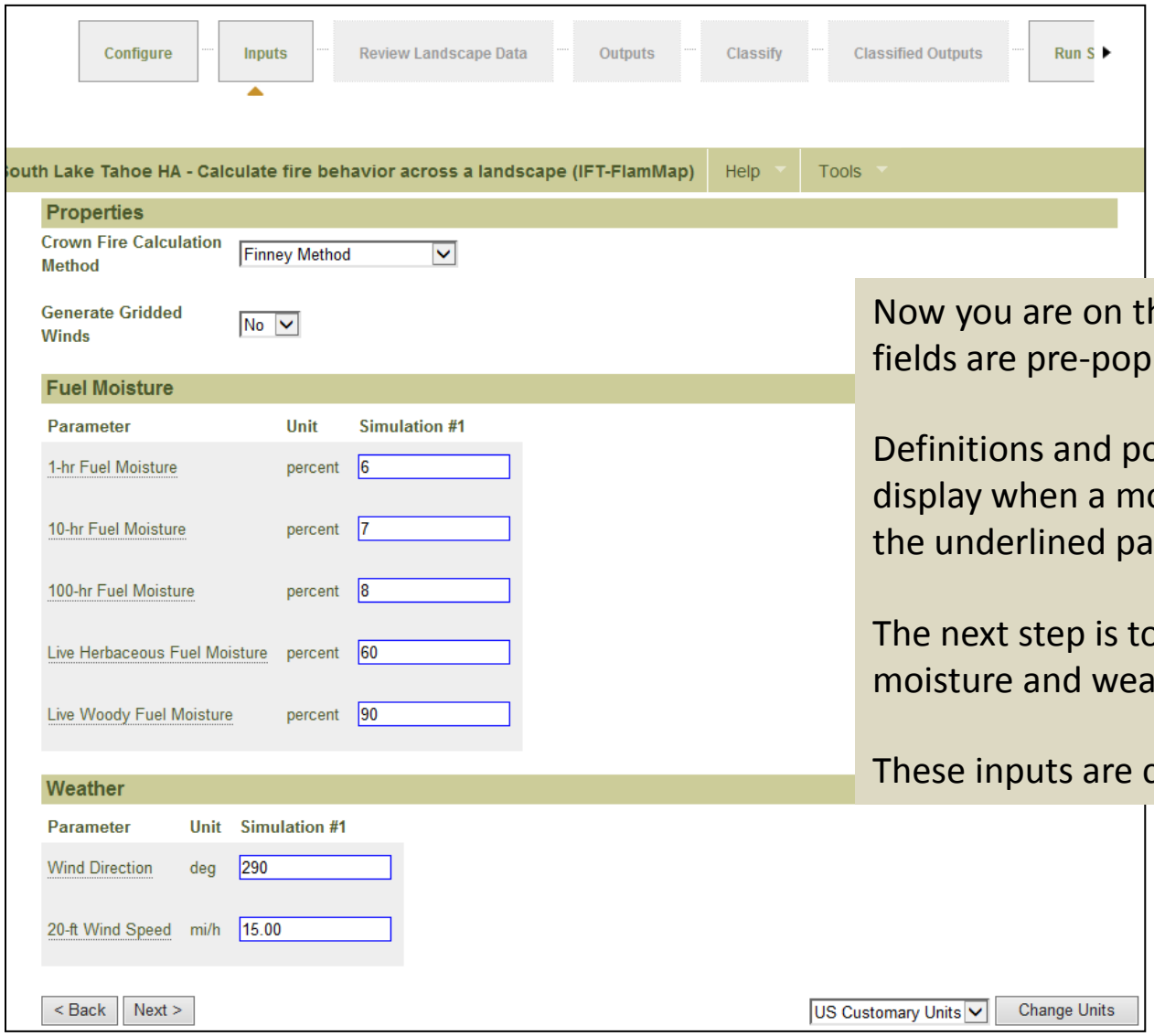


Selecting a Data Set

Select the “South Lake Tahoe (100%)” data set and choose **Next**, which takes you to the **Inputs** step.



Inputting Environmental Parameters



Now you are on the Inputs step. The input fields are pre-populated with default values.

Definitions and possible value ranges will display when a mouse cursor is hovered over the underlined parameters.

The next step is to input custom fuel moisture and weather information.

These inputs are covered on the next page.

Inputting Environmental Parameters

Now, select the crown fire calculation method and input dead and live fuel moisture, wind speed, and wind direction.

Tip: When assessing fire hazard across large landscapes, especially in mountainous terrain, weather conditions can vary across diverse topographic settings.

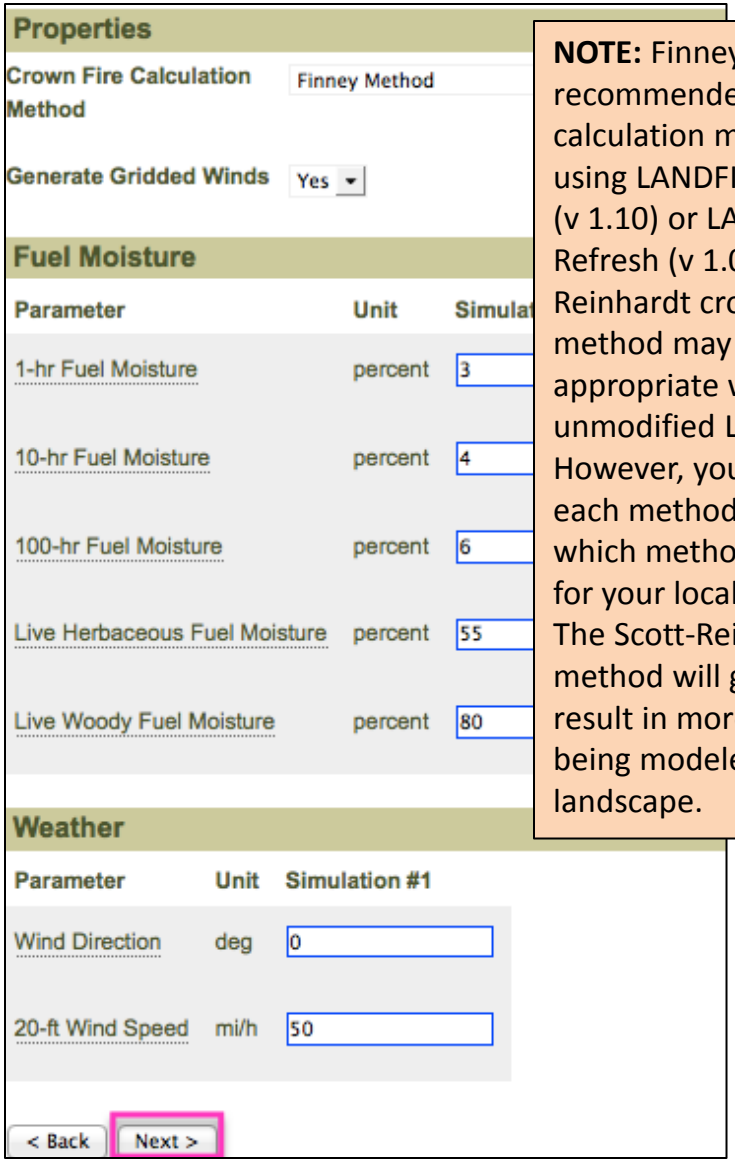
Create multiple runs to test different weather scenarios that can produce

- Low fire behavior
- High fire behavior
- Extreme fire behavior

For this example, we input "red-flag warning" weather conditions that occur in this region.

Red-flag warning conditions often include low fuel moisture and relative humidity, high/erratic winds, and lightning activity.

Choose **Next**, which takes you to the Review Landscape Data step.



NOTE: Finney is the recommended crown fire calculation method when using LANDFIRE 2008 (v 1.10) or LANDFIRE Refresh (v 1.05). The Scott-Reinhardt crown fire method may be more appropriate when using unmodified LANDFIRE data. However, you should test each method to determine which method works best for your local vegetation. The Scott-Reinhardt method will generally result in more crown fire being modeled across the landscape.

Introducing the Map Toolbar

Pan
Zoom to initial extent
Zoom in
Zoom out
Go back to previous pan/zoom
Go forward to next pan/zoom
Draw polygon
Modify polygon
Polygon advanced edit
Point edit
Advanced edit
Save map image

Now you are on the Review Landscape Data step.

The map toolbar, located at the top of the map, provides tools for viewing and editing data.

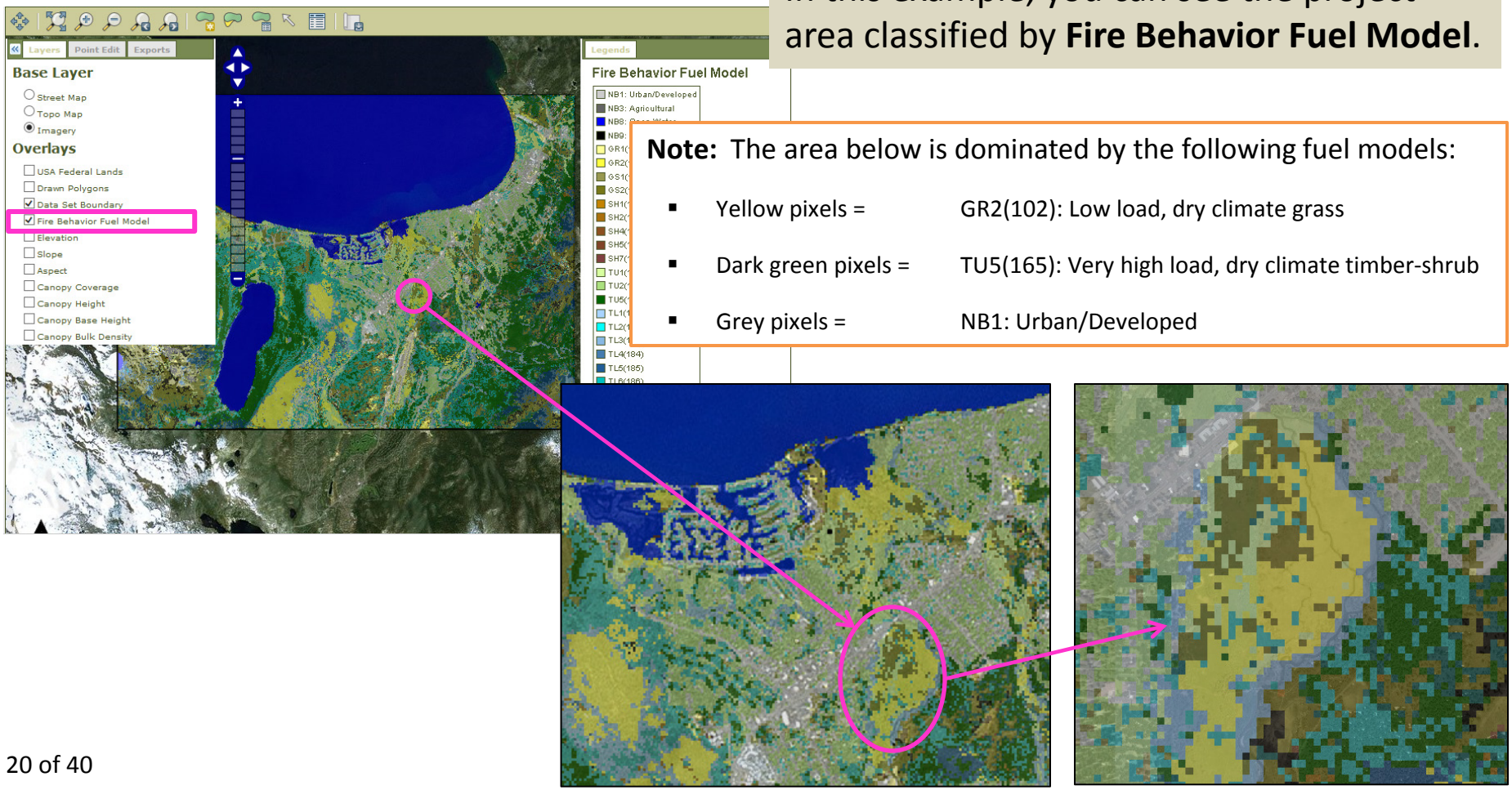
Hover your cursor over each tool for a brief description of that tool.

Tip: Click on **Fuel Models** under the **Help** dropdown menu to read a description of the environment and fuels for each fuel model.

Reviewing Spatial Landscape Data

Now you can review your spatial landscape data using the map.

In this example, you can see the project area classified by **Fire Behavior Fuel Model**.



Note: The area below is dominated by the following fuel models:

- Yellow pixels = GR2(102): Low load, dry climate grass
- Dark green pixels = TU5(165): Very high load, dry climate timber-shrub
- Grey pixels = NB1: Urban/Developed

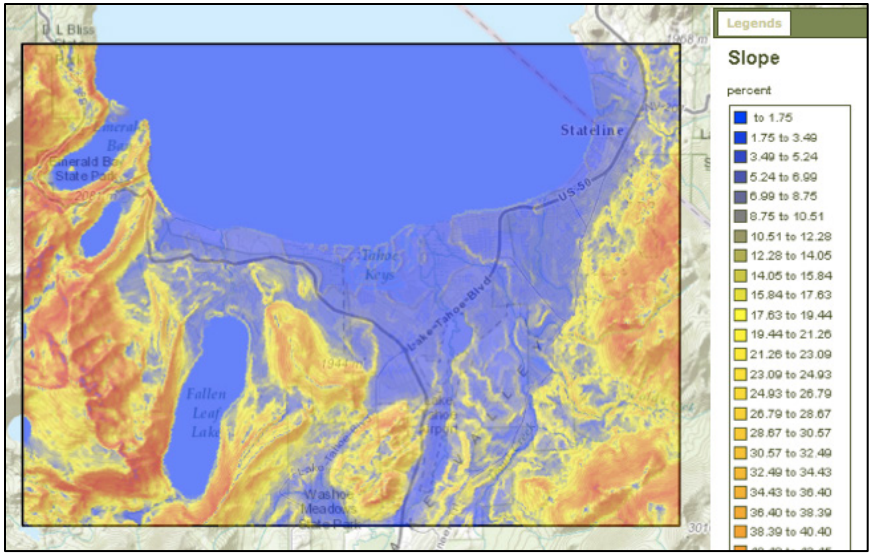
Reviewing Spatial Landscape Data

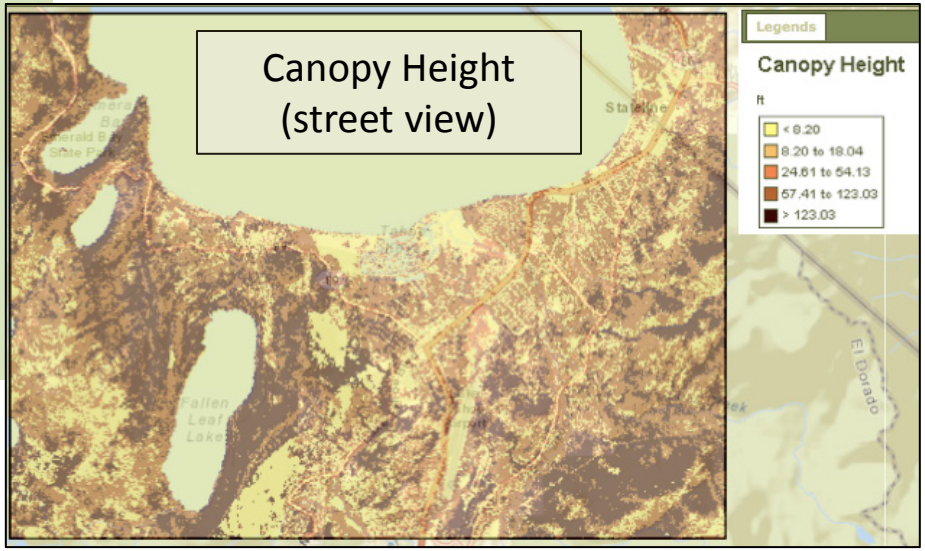
You can view the project area by the following LANDFIRE data layers:

- Fuel Model
- Elevation
- Slope
- Aspect
- Canopy Coverage
- Canopy Height
- Canopy Base Height
- Canopy Bulk Density

You can also view the project area using imagery, topography, or street maps within IFTDSS. Toggle between these layers under the Base Layer section on the Layers tab.

Slope (topography view)





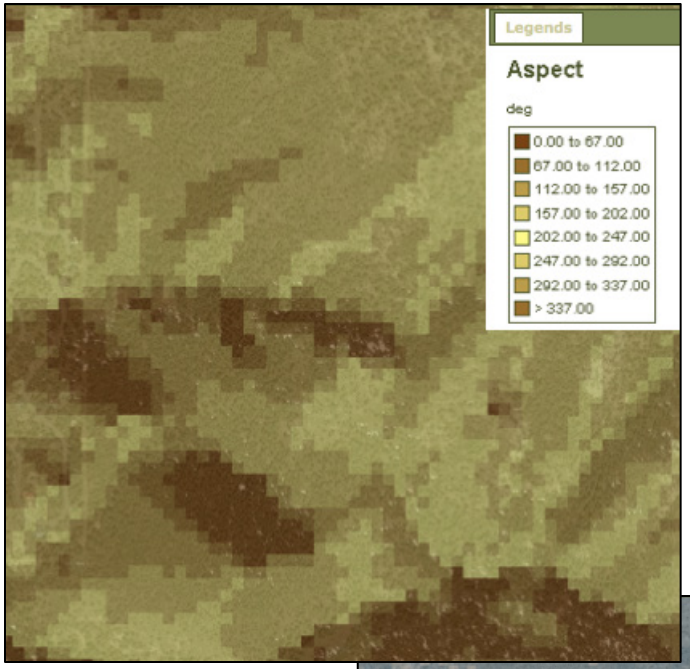
Reviewing Spatial Landscape Data

Note: Fire hazard efforts tend to concentrate on stand-level fuels and their characteristics without recognizing the spatial influence of **topography**, **winds**, and **adjacent fuels.**

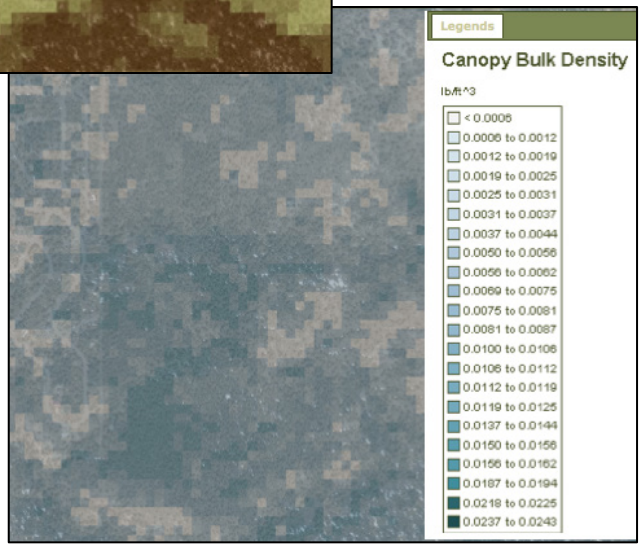
Recognizing the spatial influence of these variables is important to fire hazard analysis because spatial patterns of landscape composition and structure influence fire spread and intensity.

Consider reviewing a number of fire related descriptors (aspect, slope, etc.), rather than approximating fire hazard based on a single variable (e.g., flame length).

Aspect



Canopy Bulk Density



Tip: Navigate to Landscape Data Parameters on the **Help** dropdown menu to read a description of each parameter.

Editing Spatial Landscape Data (One Grid at a Time)

If land use changes or fires have occurred since the data layer was developed, you may need to edit the spatial landscape data. There are three editing tools on the map toolbar.

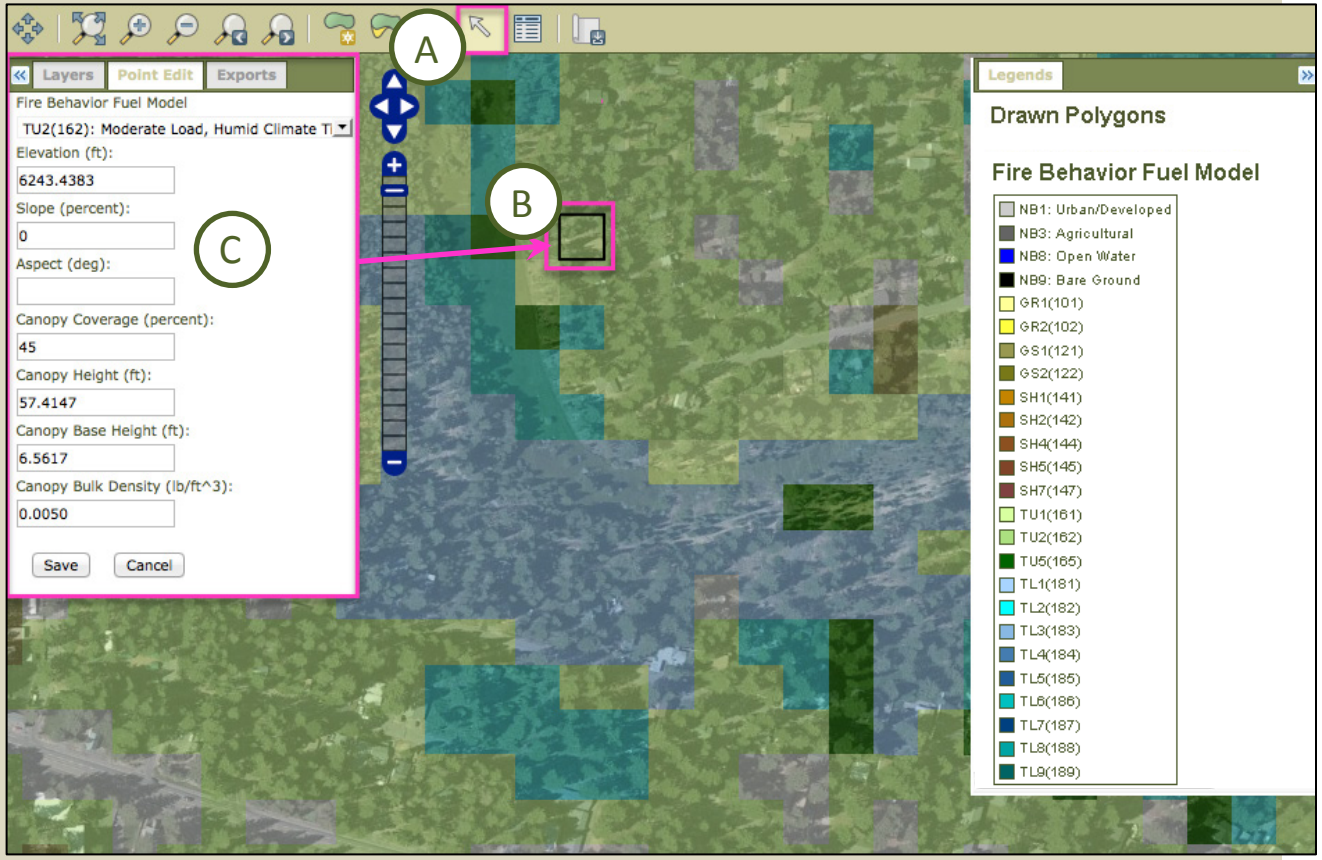
- **Point Edit**: edit one grid cell at a time
- **Advanced Edit**: edit grid cells across the entire run area.
- **Polygon Advanced Edit**: edit all pixels within a user-drawn polygon

In order to edit one grid at a time:

A. Select the **Point Edit** tool.

B. Click on the grid cell you would like to edit, and the **Point Edit** panel appears.

C. Edit the grid cell data and choose **Save**.



The next page shows how to edit the spatial landscape data using the **Advanced Edit** tool.

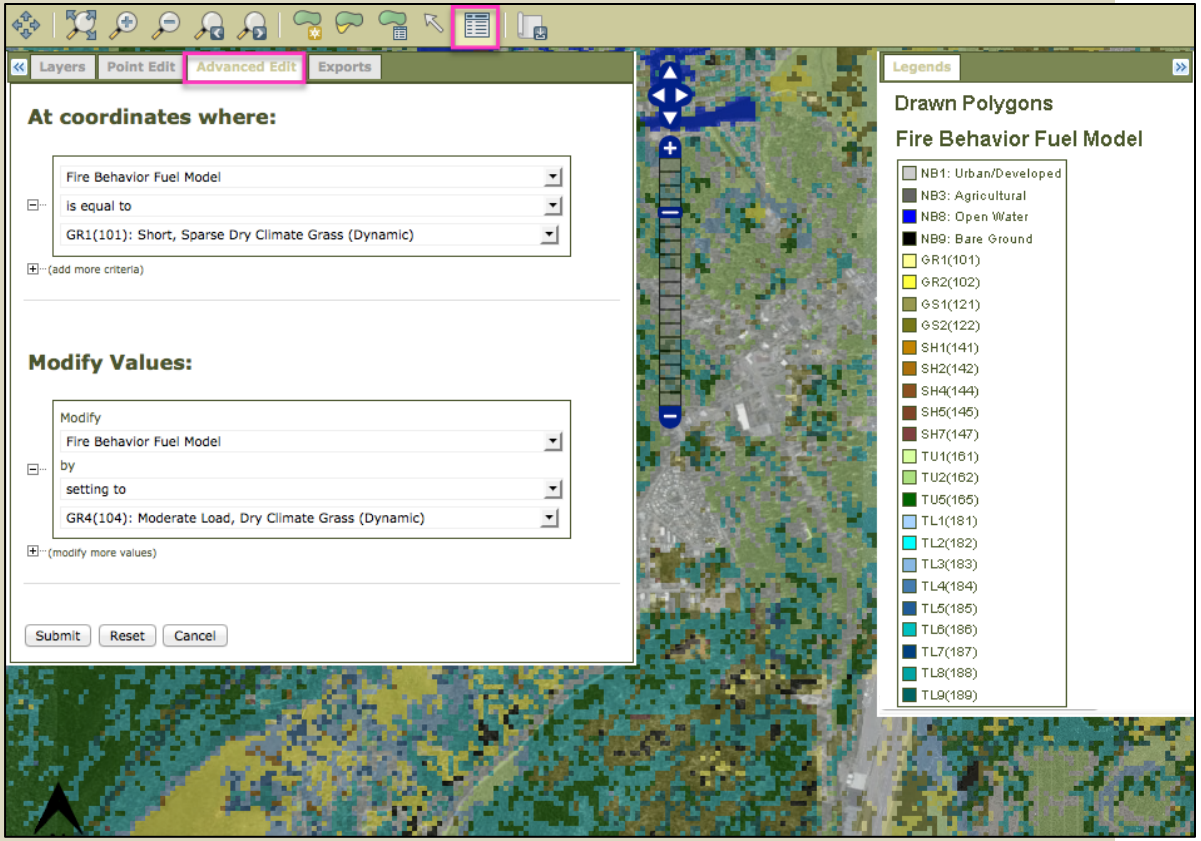
Editing Spatial Landscape Data (Multiple Grids Across the Run Area)

In the previous example, we showed how to edit grid cells one at a time. You can also use the **Advanced Edit** tool to edit multiple cells at once.

To get started, select the **Advanced Edit tool**. The **Advanced Edit** panel appears.

In this panel, you can modify any of the spatial data in query format so that multiple cells can be changed at once.

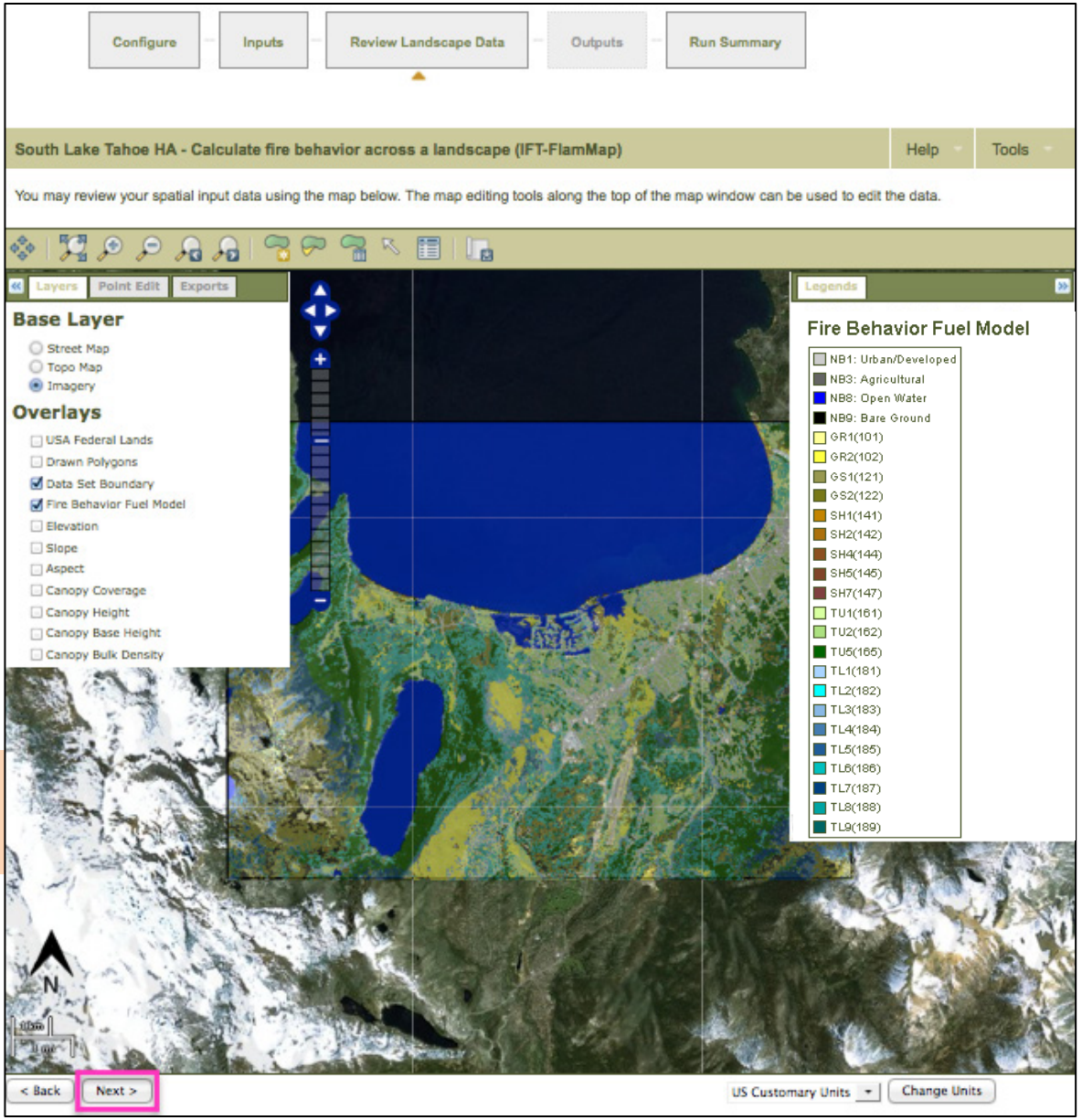
To learn how to edit pixels using the polygon advanced edit tool, see the tutorial, **How to Use IFTDSS to Acquire and Edit Spatial LANDFIRE Data**.



Reviewing Spatial Landscape Data

After reviewing and editing the spatial landscape data, choose **Next**. This takes you to the fire behavior **Outputs** step.

There will be a short wait while the IFT-FlamMap module runs.



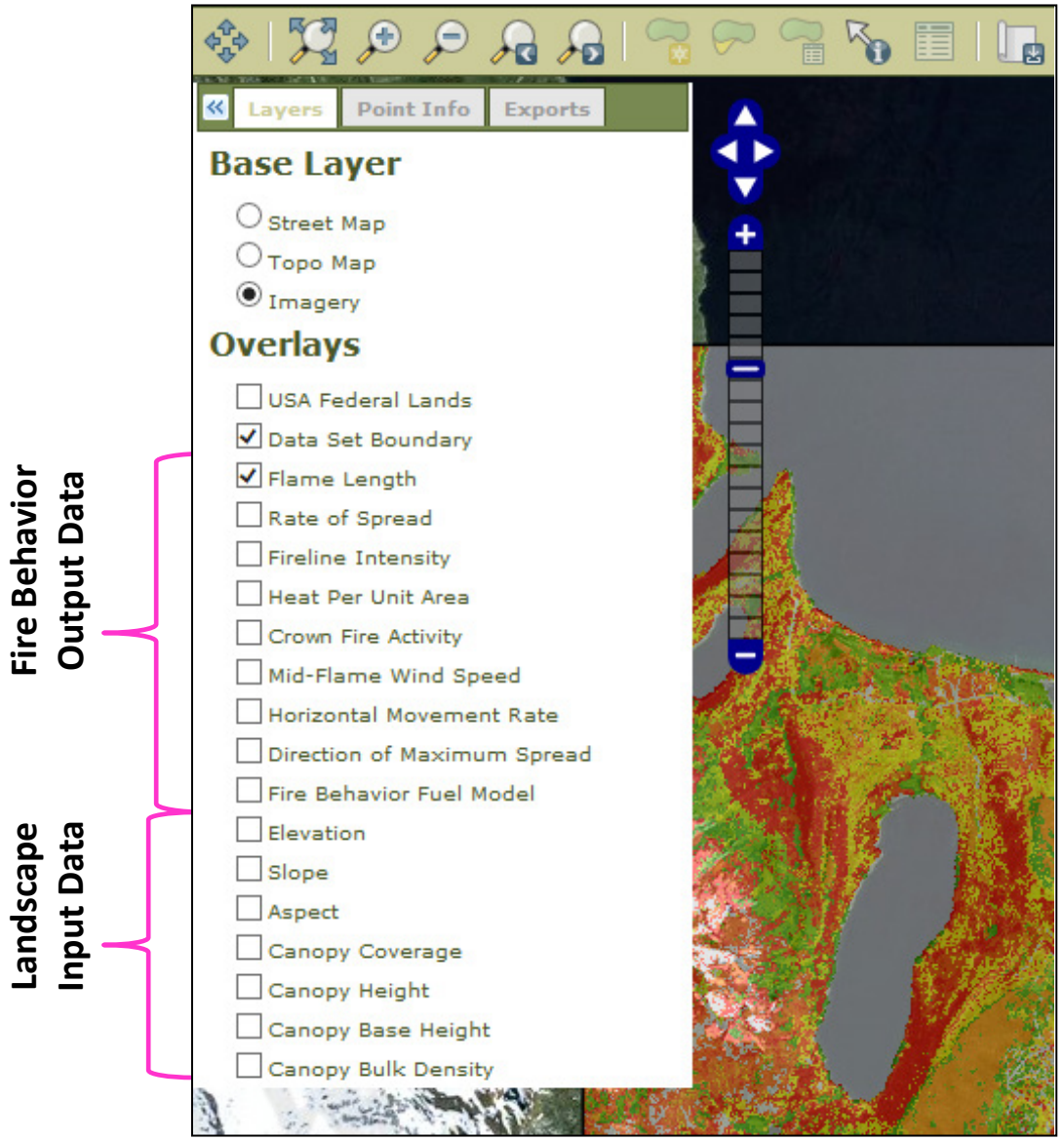
Reviewing Fire Behavior Output Data

After running the module, you can review your fire behavior output variables using the map.

On this page, you can view both your spatial landscape input data and your spatial fire behavior output data.

Fire behavior output variables include

- Flame Length
- Rate of Spread
- Fireline Intensity
- Heat per Unit Area
- Crown Fire Activity
- Mid-flame Wind Speed
- Horizontal Movement Rate
- Direction of Maximum Spread

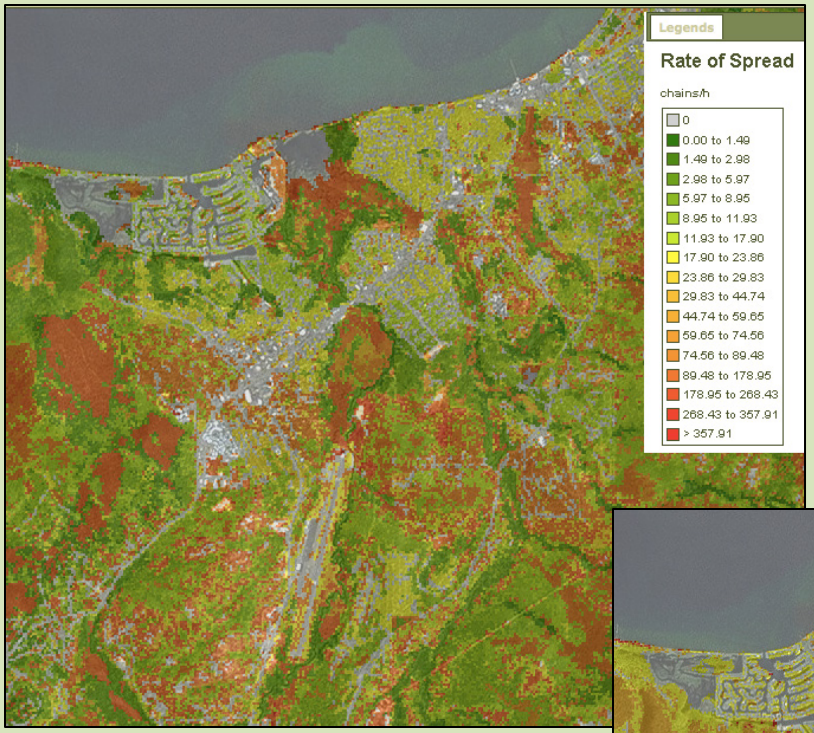


Reviewing Fire Behavior Output Data

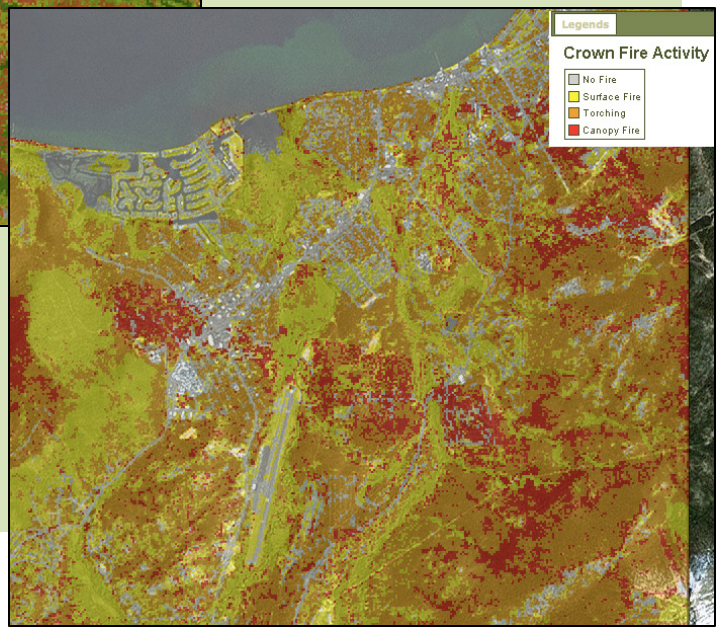
Potential high fire hazard areas can be identified across a landscape using the modeled fire behavior with landscape data.

In this analysis, we are especially interested in fire hazards within the Wildland Urban Interface.

Rate of Spread



Crown Fire Activity



Next, we discuss how the output data for each of the fire behavior parameters can be classified, or binned, for further analysis.

Classifying Outputs

On this page, you can determine how you want to group, or classify, your outputs into more meaningful bins for analysis and display. For example, you might want to bin potential flame lengths using the fire suppression techniques commonly referred to as the haul in chart, which classifies fire behavior parameters by potential fire suppression tactics (Table below; IFTDSS defaults). IFTDSS provides the ability to classify four fire behavior outputs: flame length, rate of spread, fireline intensity, and heat per unit area.

The default classification thresholds can be changed by entering the **minimum** values for each parameter class. The Low class for each parameter is not directly editable. It is determined by the value you enter for the Medium class. In the flame length example provided (right), flame lengths would be binned into the following classes: low (0 to 4 ft), medium (4 to 8 ft), high (8 to 11 ft), and very high (>11 ft).

Once you have set all minimum values, you have defined the range of each of your fire parameter bins.

Flame Length Class	Flame Length	Fire Suppression Interpretations
Low	< 4 feet	Fires can generally be attacked at the head or flanks by persons using hand tools. Handline should hold fire.
Medium	4 to 8 feet	Fires are too intense for direct attack on the head by persons using hand tools. Handline cannot be relied on to hold the fire. Bulldozers, engines, and retardant drops can be effective.
High	8 to 11 feet	Fires may present serious control problems: torching, crowning, and spotting. Control efforts at the head will probably be ineffective.
Very High	> 11 feet	Crowning, spotting, and major fire runs are probable. Control efforts at the head of the fire are ineffective.

Classify Parameters

Parameter	Unit	Simulation #1
Medium Flame Length	ft	4.00
High Flame Length	ft	8.00
Very High Flame Length	ft	11.00
Medium Rate of Spread	chains/hr	20.00
High Rate of Spread	chains/hr	90.00
Very High Rate of Spread	chains/hr	150.00
Medium Fireline Intensity	Btu/ft/s	100.00
High Fireline Intensity	Btu/ft/s	500.00
Very High Fireline Intensity	Btu/ft/s	1,000.00
Medium Heat Per Unit Area	Btu/ft²	100.00
High Heat Per Unit Area	Btu/ft²	500.00
Very High Heat Per Unit Area	Btu/ft²	1,000.00

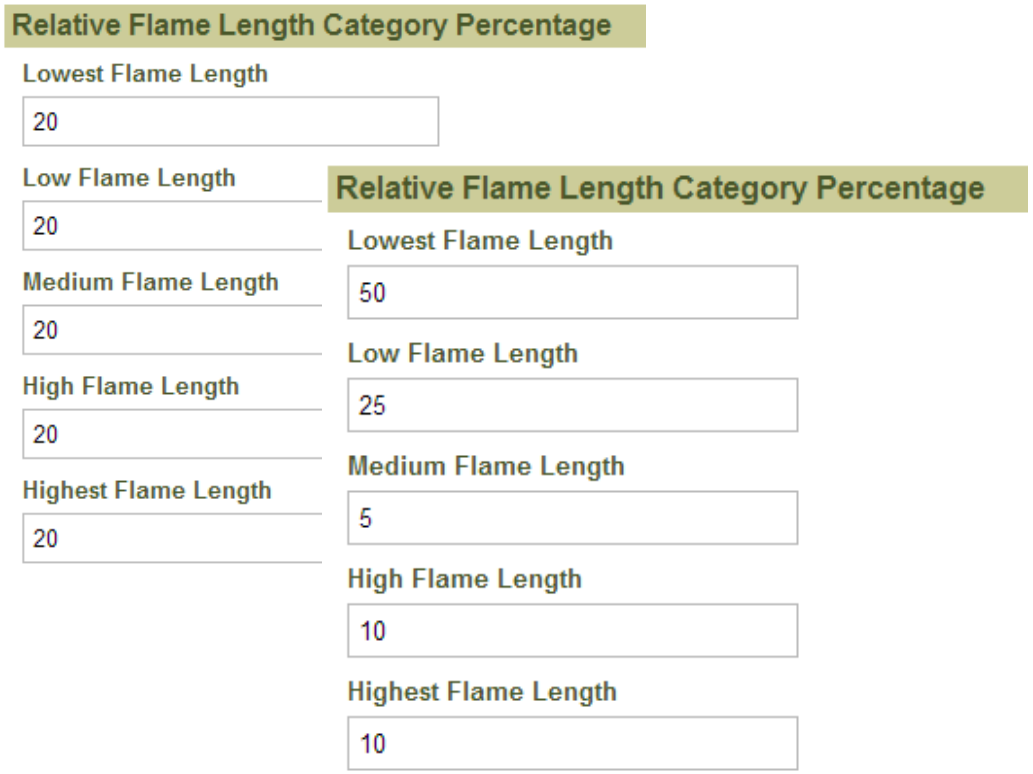
(Table modified from the National Wildfire Coordinating Group, 2004.)

Classifying Outputs

In the **Classify** step, you can also group the fire behavior parameter output into five classes based on relative percentages.

Using this functionality, you can narrow your search of high risk areas to areas with the highest flame length, rate of spread, fireline intensity, or heat per unit area.

In this example (right), we will reduce the output range for the Highest category of each parameter from 20% to 10%, the High category from 20% to 10%, and adjust the remaining categories as shown.



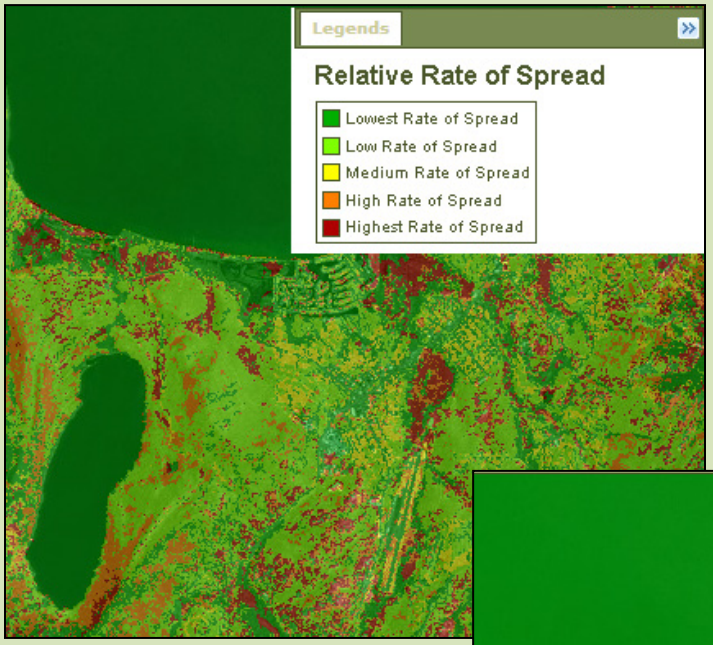
Note: The sum of all five weights *must* be 100%.

To view the fire behavior parameters grouped into the user classifications, choose **Next**.

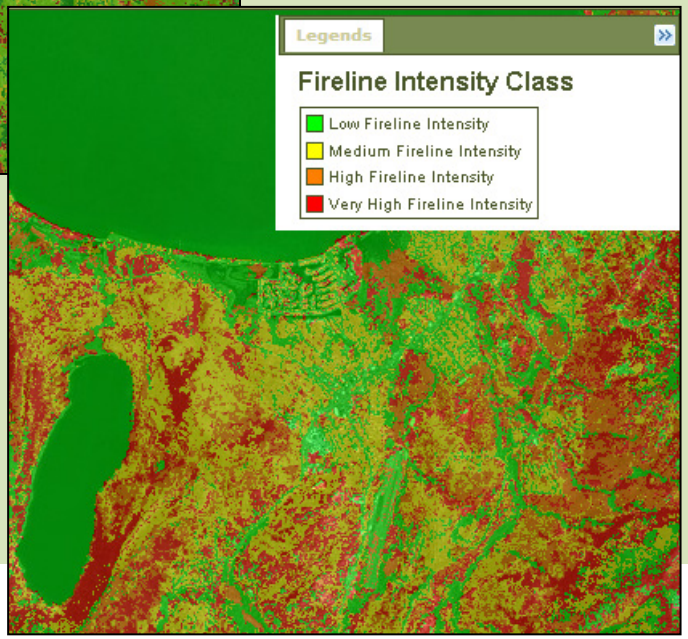
Reviewing Classified Fire Output Data

Now that fire behavior data have been categorized into bins, potential high fire hazard areas can be more easily identified across a landscape.

Relative Rate of Spread



Fireline Intensity Class



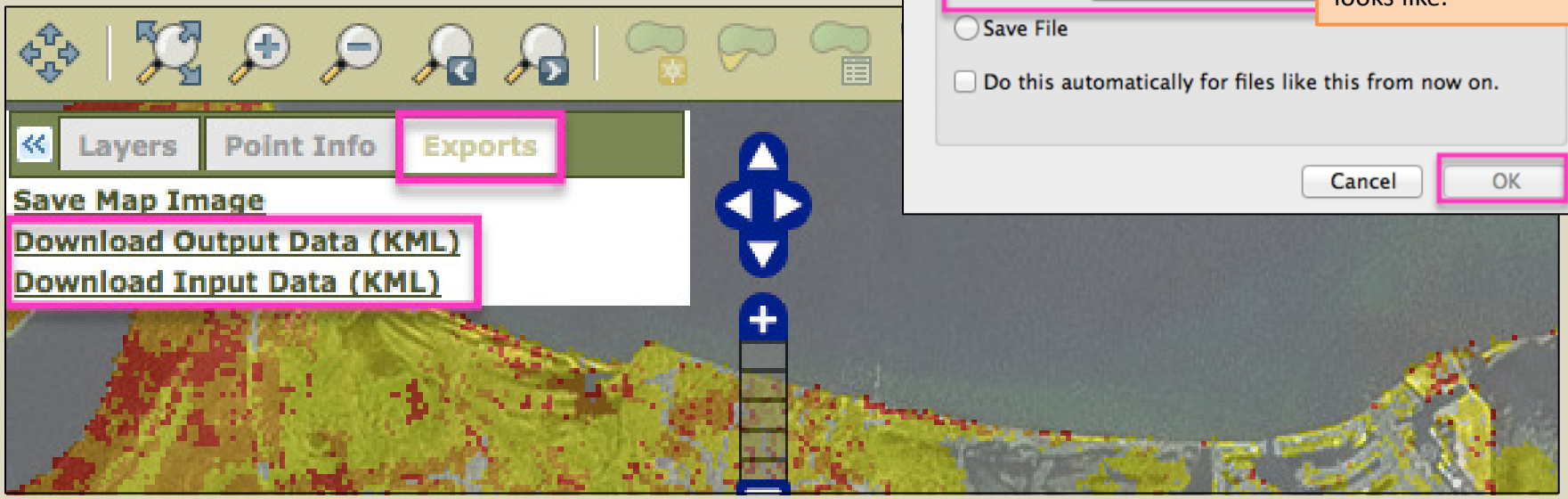
For further analysis, you can export IFTDSS inputs and outputs to Google Earth as outlined in the following slides.

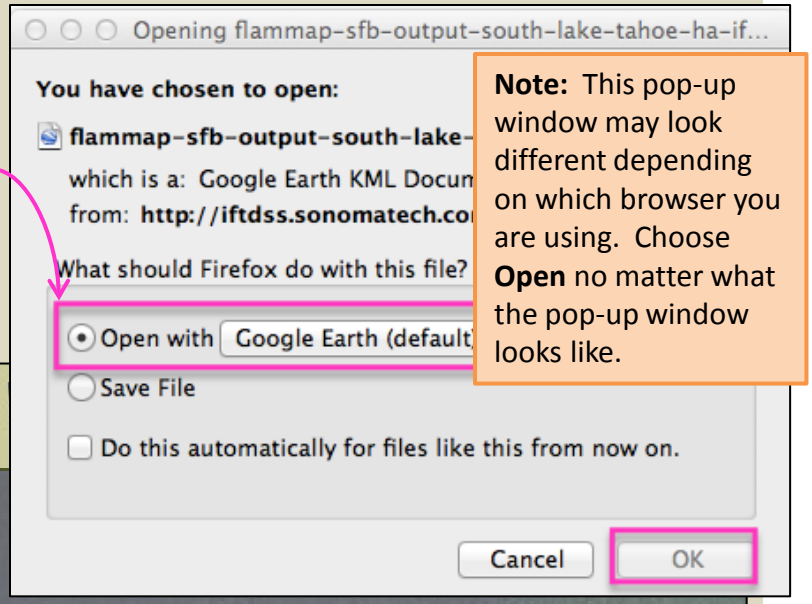
Exporting to Google Earth

1. Access the **Exports** tab (located in the upper left panel).
2. Select **Download Output Data (KML)**.
3. Select **Open with Google Earth** in the pop-up window.
4. Repeat these steps to **Download Input Data (KML)**.

You are now leaving IFTDSS. Your data will automatically be displayed in Google Earth. To view the landscape before the 2006 Angora Fire you should choose a pre-2006 Google image.

Note: To download Google Earth, follow this link: http://www.google.com/earth/download/ge/agree.html

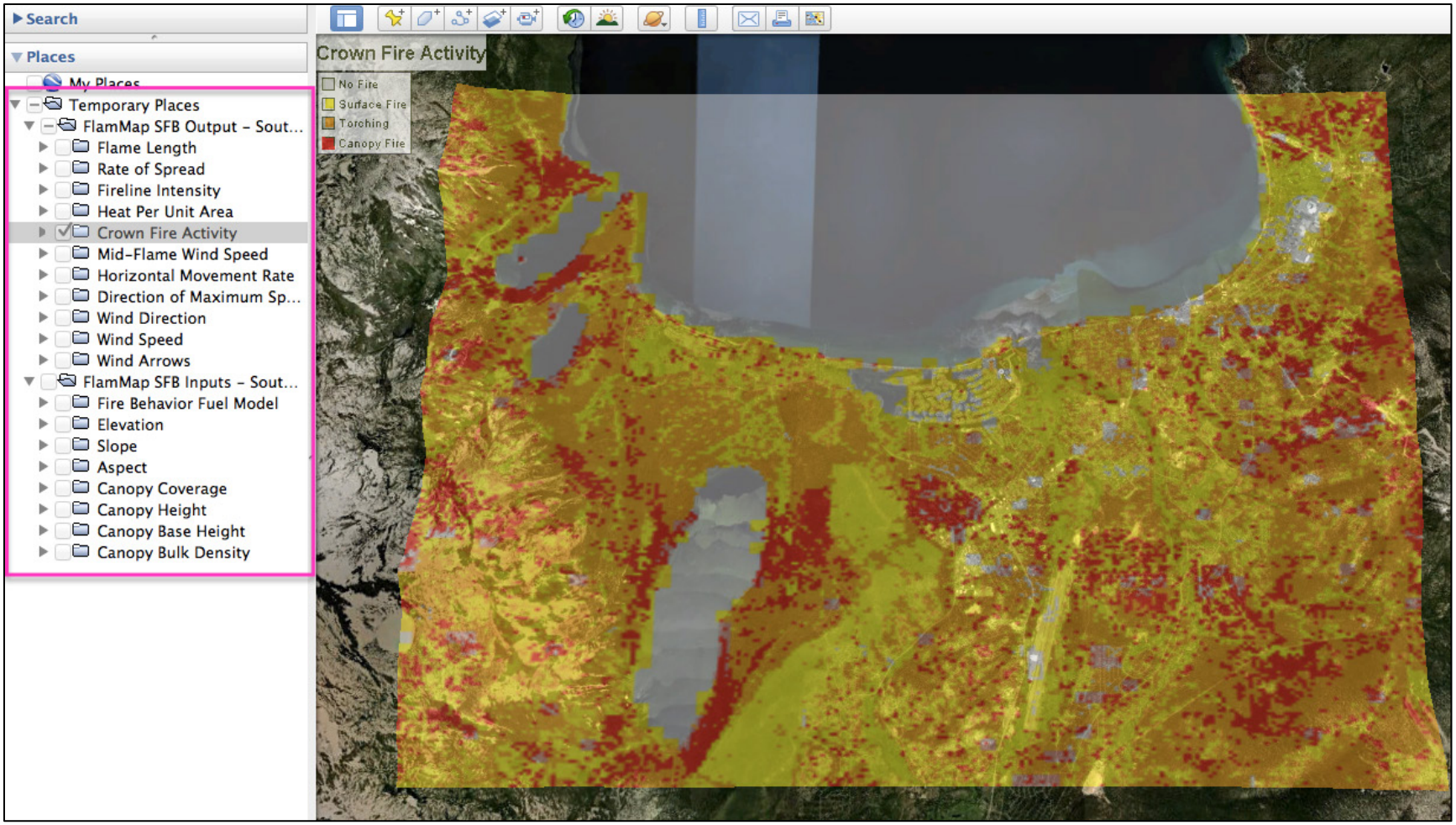




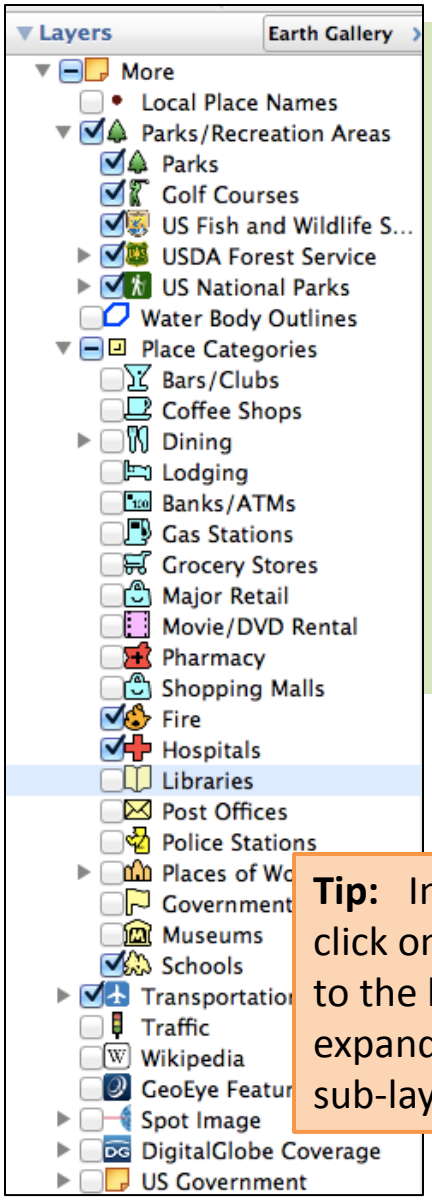
Note: This pop-up window may look different depending on which browser you are using. Choose **Open** no matter what the pop-up window looks like.

Evaluating Results in Google Earth

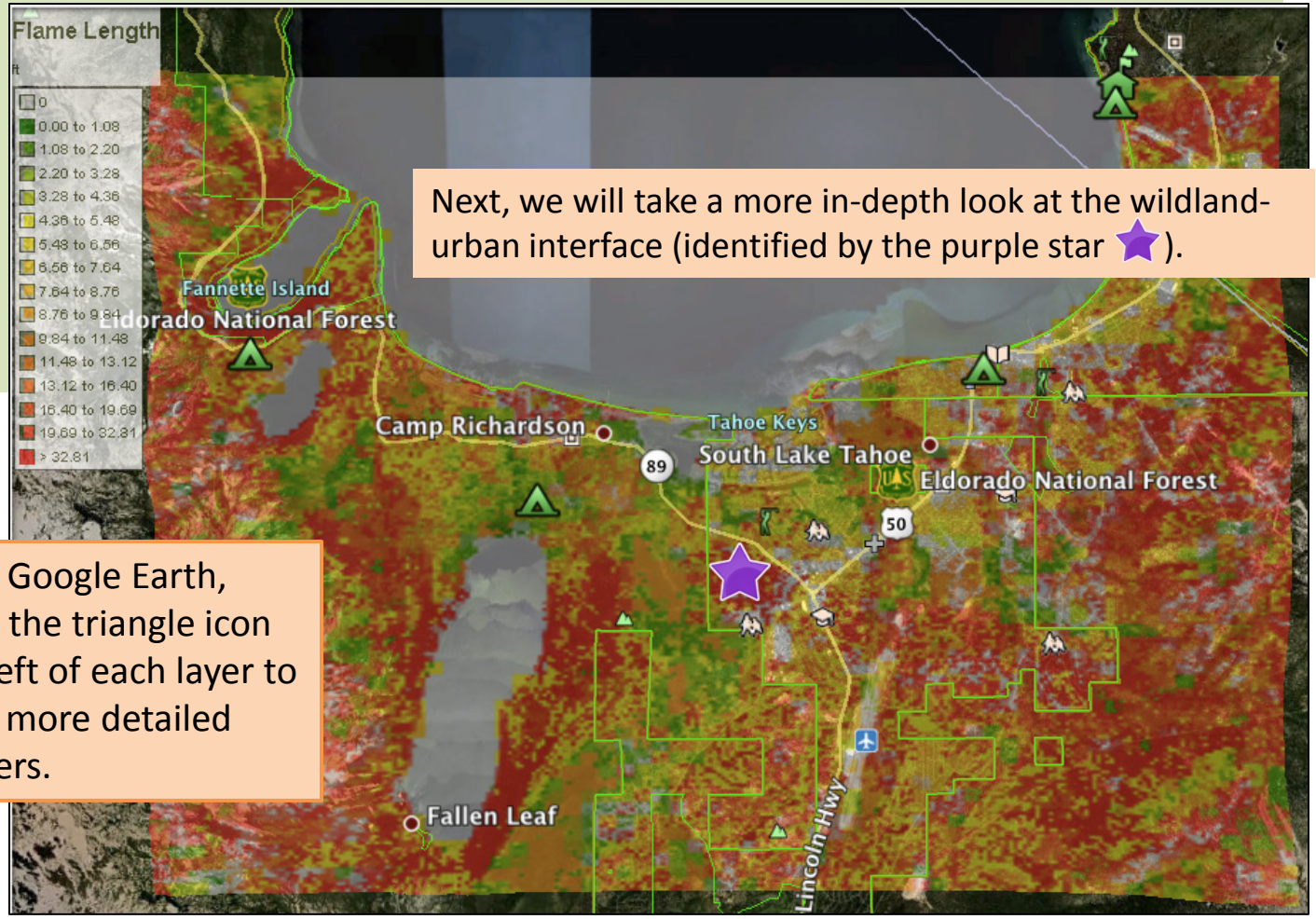
The input and output variables are now stored as layers in the “Temporary Places” folder within Google Earth. Unselect **Fuel Model** and **Flame Length**, and select **Crown Fire Activity**.



Adding Map Details in Google Earth



Using the **Layers** tab in Google Earth, you can add such things as park and recreation areas, water body outlines, schools, airports, and roads to your map.

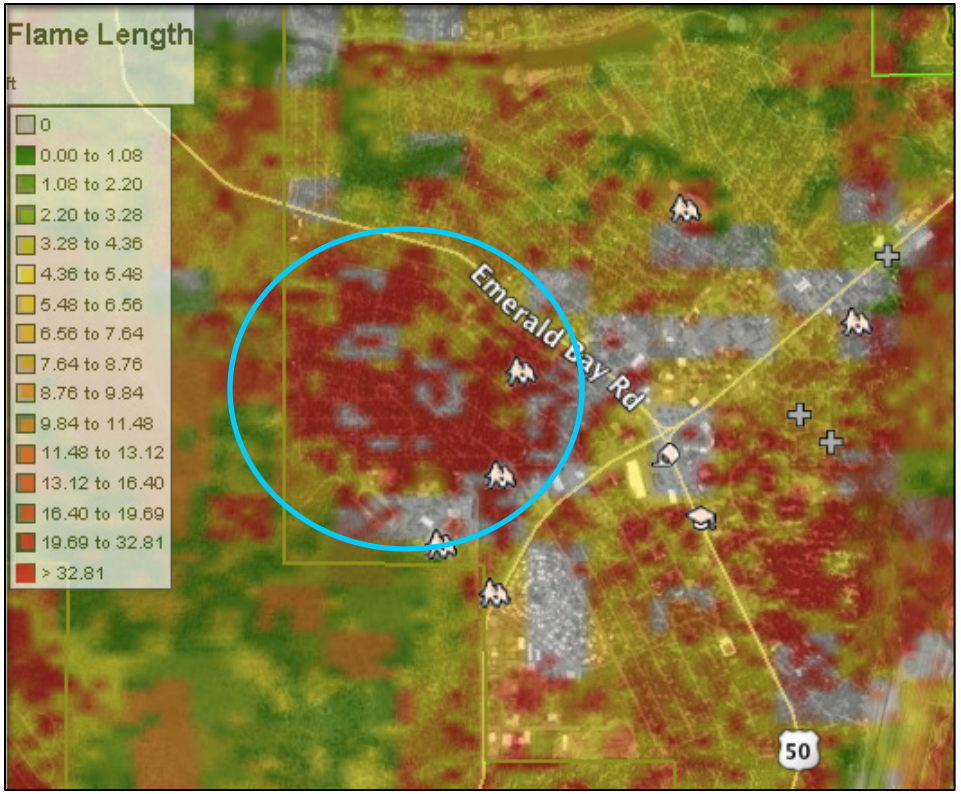


Next, we will take a more in-depth look at the wildland-urban interface (identified by the purple star ★).

Tip: In Google Earth, click on the triangle icon to the left of each layer to expand more detailed sub-layers.

Identifying Potential Fire Hazards

Using information derived from the modeled fire behavior, as well as the spatial landscape data, you can identify potential fire hazard areas within South Lake Tahoe's Wildland Urban Interface.



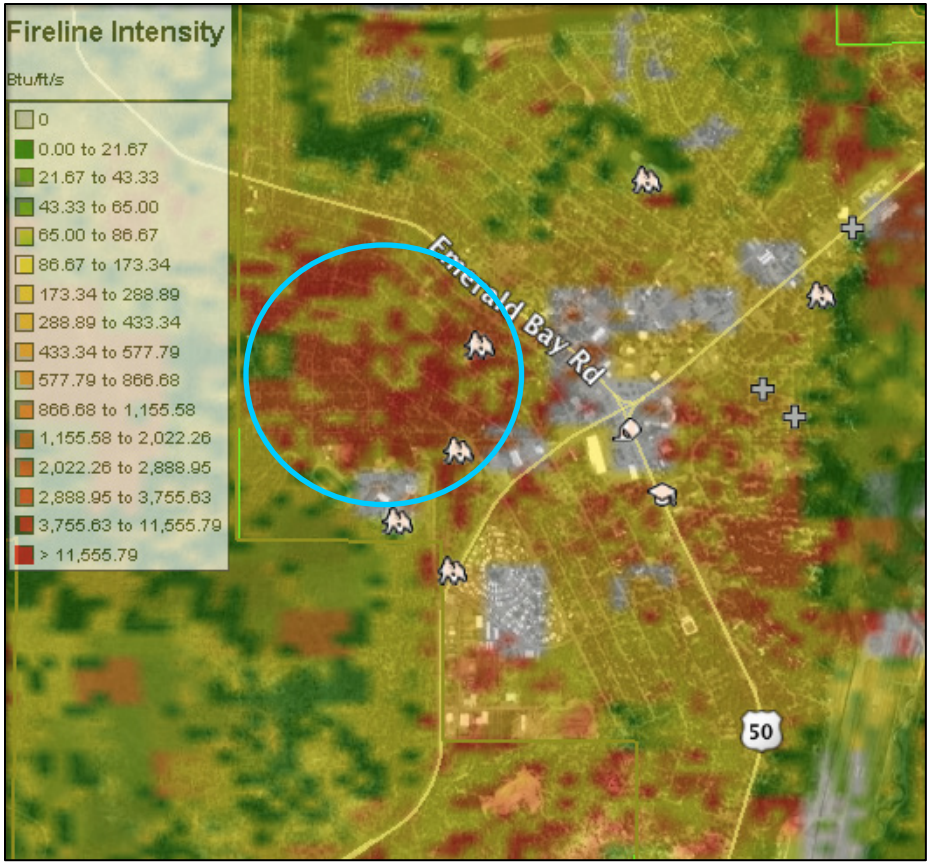
In this example, we focus on a number of fire-related descriptors to identify an area where further fuels treatment analysis may be warranted.

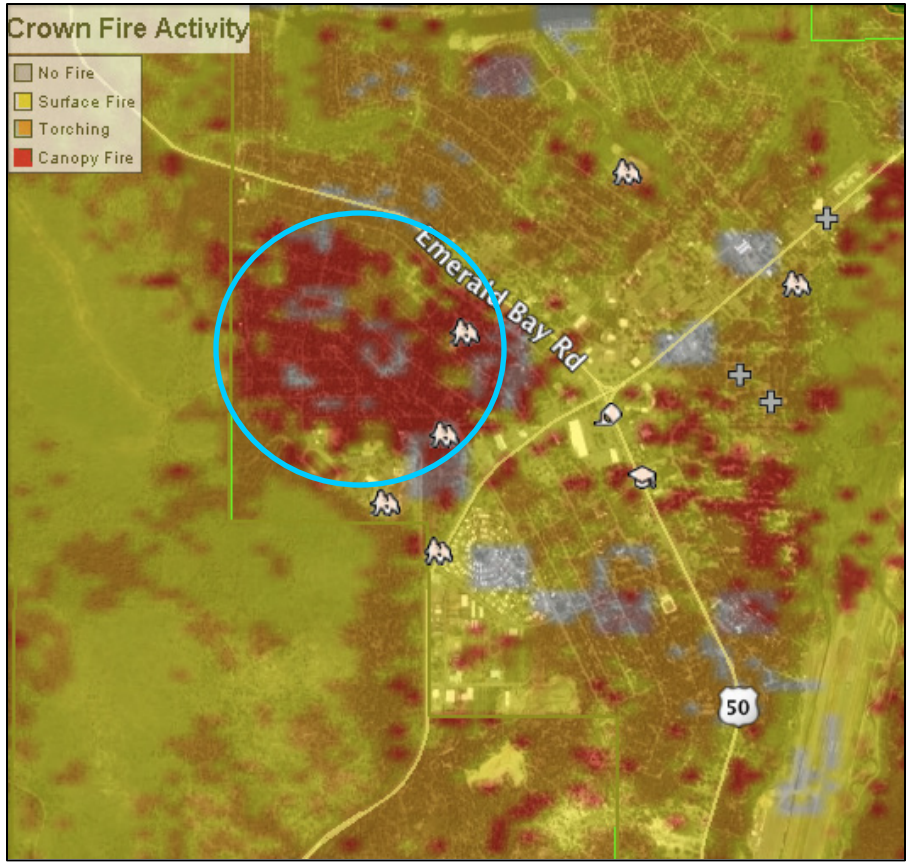
The forest adjacent to South Tahoe High School (circled on map) is at risk for high flame lengths during red-flag warning weather conditions. Be sure you have pre-2006 Google imagery selected so you can view the pre-fire vegetation. Then switch to post-2006 imagery to view the difference.

Identifying Potential Fire Hazards

Using multiple fire behavior descriptors, it is clear that this forest is at risk for high flame lengths, high fireline intensity, and canopy fire.

Next, we will review some environmental parameters.

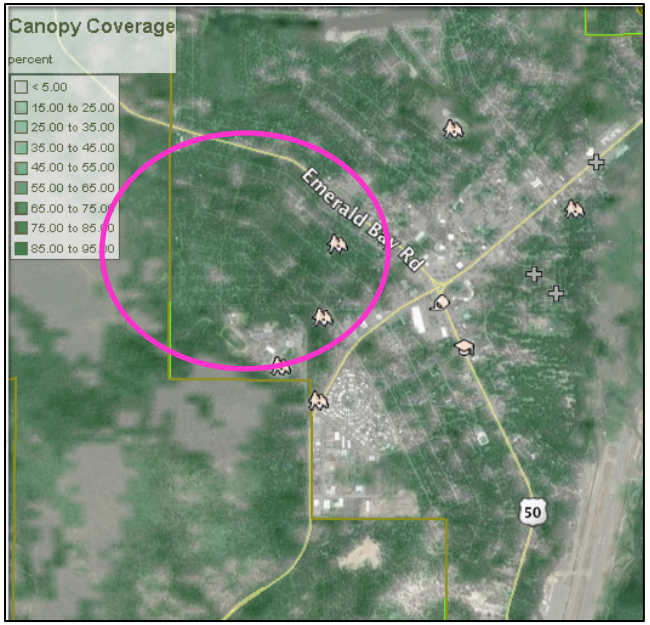


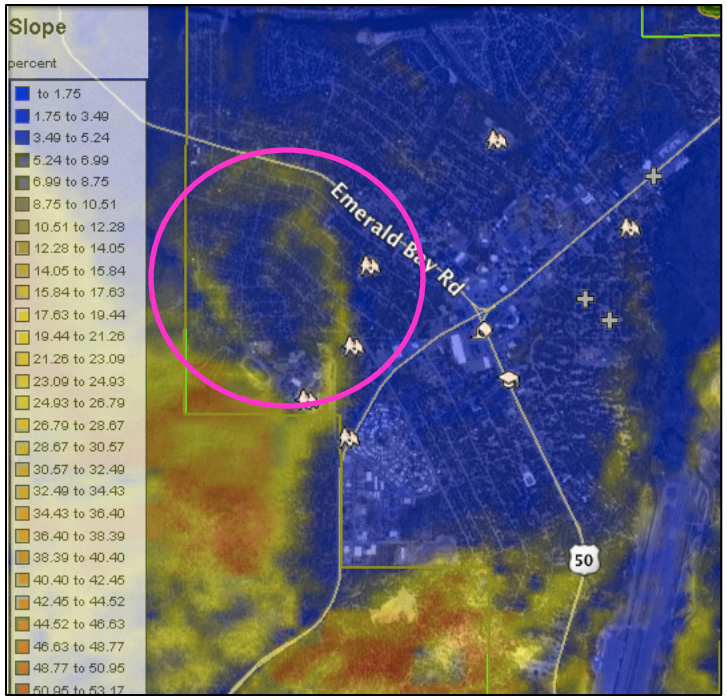


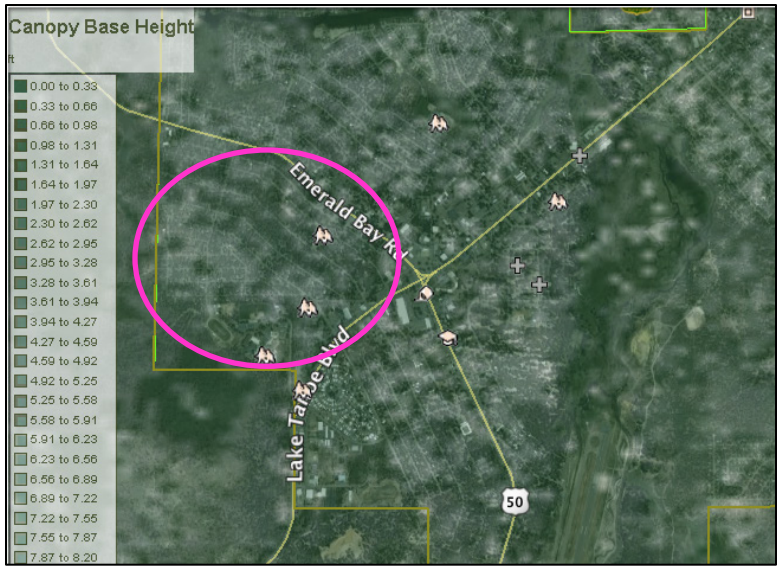
Identifying Potential Fire Hazards

The circled area is at risk for high flame lengths, high fireline intensity, and canopy fire. This location also has moderate slopes, high canopy coverage, and low canopy base heights.

After reviewing the modeled fire behavior and spatial landscape data, this is an area that warrants further analysis and may require a site visit and/or fuels treatment.







Next Steps: Assessing Further Needs

The information from this hazard analysis can be used with other ecological and natural resource planning information to rapidly assess areas within the landscape that may warrant fuels treatment.

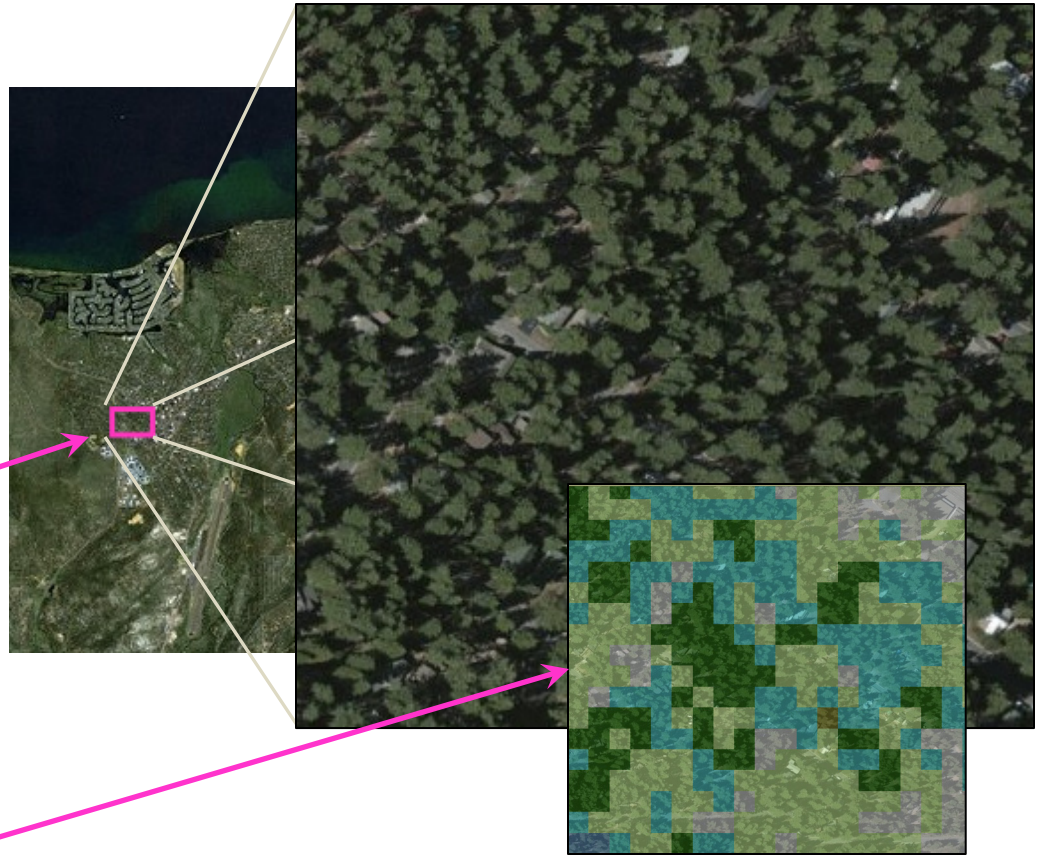
Next steps:

- Review aerial photography

  In this example, an aerial photograph shows that the land directly adjacent to the high school is a heavily forested wildland urban interface.

- Make a site visit
- Conduct additional fuels treatment analyses
- Review the fire behavior fuel model layer

  Although some of this neighborhood is assigned the **Non-burnable 1: Urban/Developed** fuel model, it is clear from the aerial photography that this neighborhood has the potential to burn in a fire.



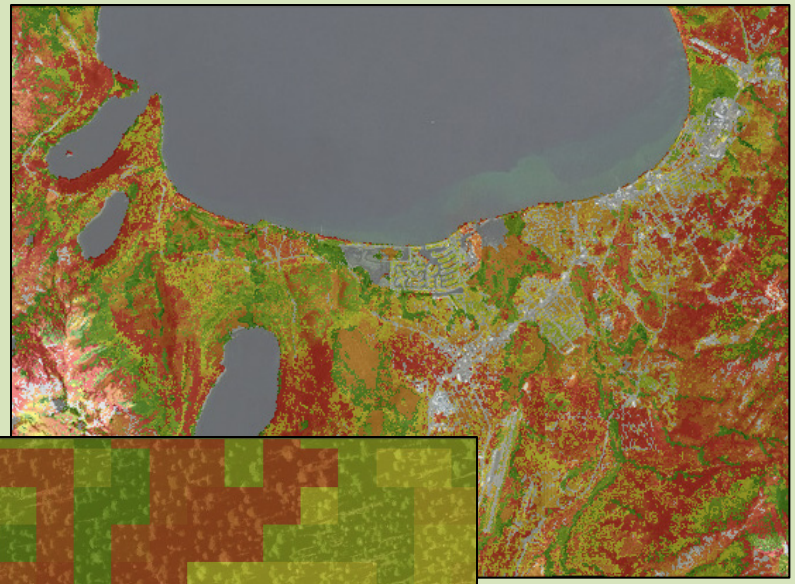
After reviewing the aerial photography and the fire behavior fuel model layer, the LANDFIRE data may need to be edited; return to the editing spatial landscape data step to edit your fuel models (pages 23 and 24). Then rerun the module to see differences in the fire behavior outputs.

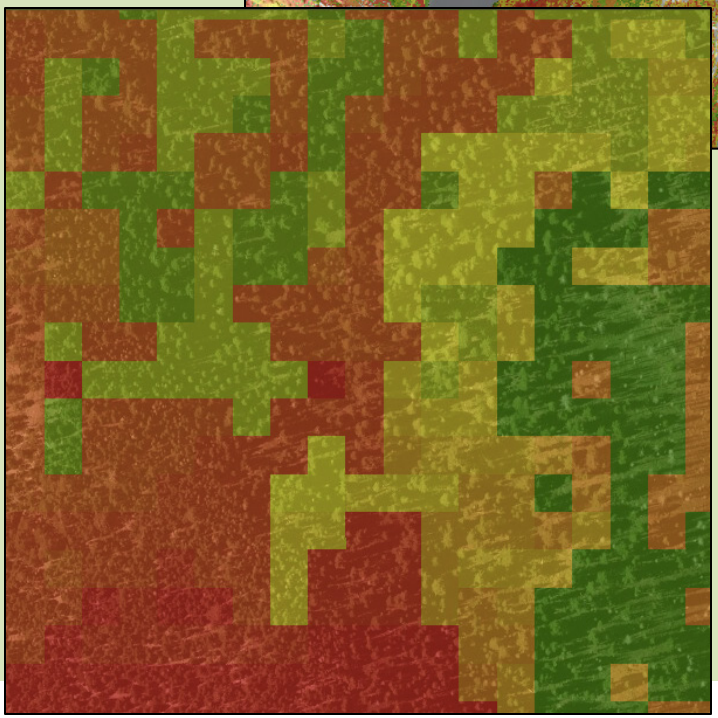
Things You Need to Know

Fire behavior values are calculated pixel-by-pixel and are **simulated independently** with respect to the surrounding pixels in the landscape input file.

Fire behavior in adjacent locations, roads, or hazardous fuel types in proximity to the area under assessment **do not** affect the burning potential of the pixel, or point location, being assessed.

The LANDFIRE data resolution is coarse (30 x 30 m spatial resolution), which affects data interpretation.





Review

Using the Hazard Analysis work flow in IFTDSS, we were able to

- Acquire LANDFIRE data and set up a project in IFTDSS.
- Create a run focused on fire behavior across a landscape (IFT-FlamMap) .
  - We established environmental parameters.
  - Review spatial landscape data and fire behavior output data.
- Examine data relative to points of interest and other geographic features using Google Earth.
- Identify potential fire hazards across a landscape.

Additional Help

To navigate to additional tutorials in the IFTDSS online help content,

1. Click the **Help** button.
2. Then select **Getting Started (Tutorials and Videos)** from the side menu.

On that page, you'll find links to tutorials and videos on such topics as hazard analysis, precribed burn planning, fuels treatment, spatial analysis across a landscape, and many more.