Tutorial B

How to Use Hazard Analysis Tools in IFTDSS for Prescribed Fire Planning

Assessing Potential Fire Hazard Within and Adjacent to a Prescribed Burn Unit

Overview

This prescribed fire planning tutorial covers

- Acquiring LANDFIRE data and setting up a project in IFTDSS.
  - Reviewing and editing spatial landscape data.
- Creating a run focused 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.
  - Establishing a potential burn unit based on modeled fire behavior characteristics.
- Identifying potential fire hazard outside of a burn unit to help develop holding and contingency plans.

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.

In IFTDSS, the user can assess potential fire behavior using a fire behavior mapping and analysis software application called **Calculate 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.

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).

This tutorial walks through the steps needed to assess potential fire hazards within and adjacent to a burn unit using the IFTDSS.

Introduction

The output from a hazard analysis can 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.

This tutorial focuses on assessing potential fire hazards within and adjacent to a prescribed burn unit using the IFTDSS system.

Tutorial Objectives

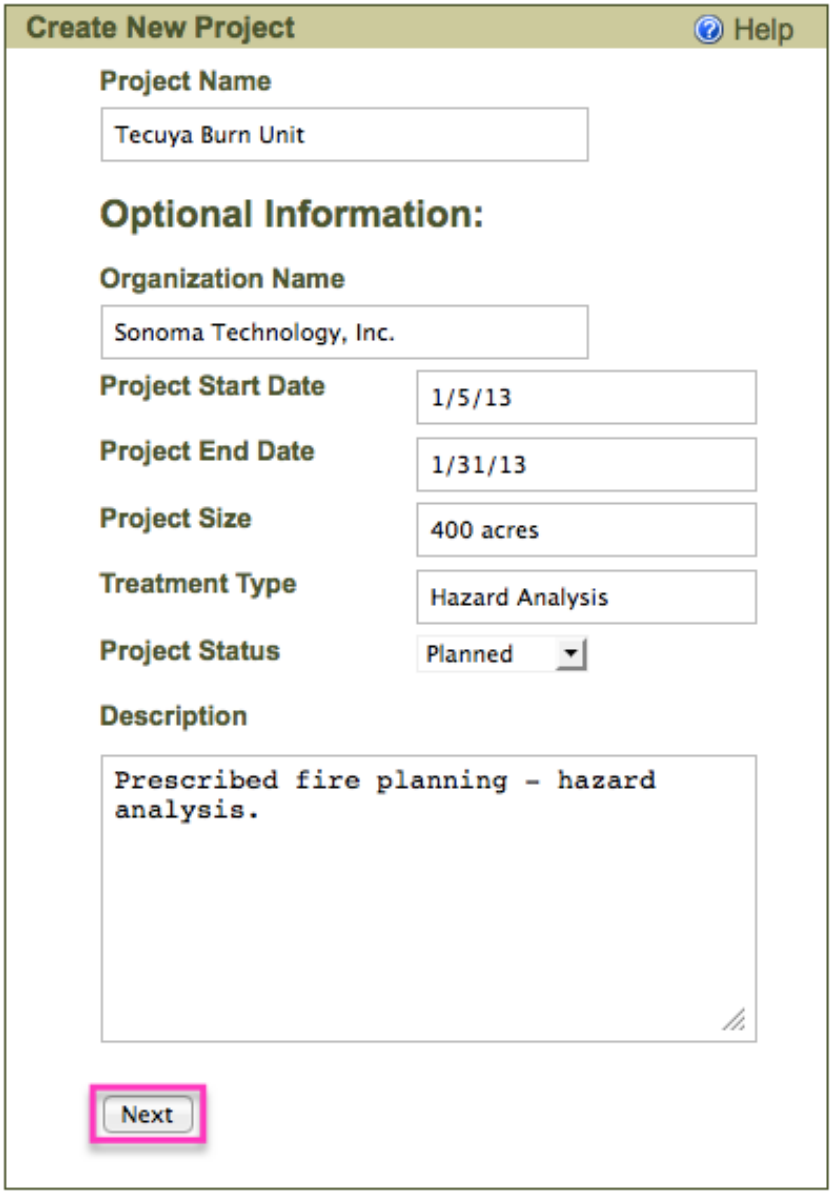
- Walk step-by-step through a tutorial on hazard analysis for prescribed fire planning using IFTDSS.
- Review and edit spatial landscape input data as needed.
- Model a weather prescription that would produce high fire behavior (i.e., high limits) for the environmental parameters required to meet our Prescribed Fire Plan objectives.
- Provide information to help establish burn unit boundaries using
  - modeled fire behavior characteristics using the fire behavior across a landscape module (IFT-FlamMap).
  - fire behavior parameters.
- Identify potential fire hazards outside a burn unit to help develop holding and contingency plans.

Getting Started

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

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

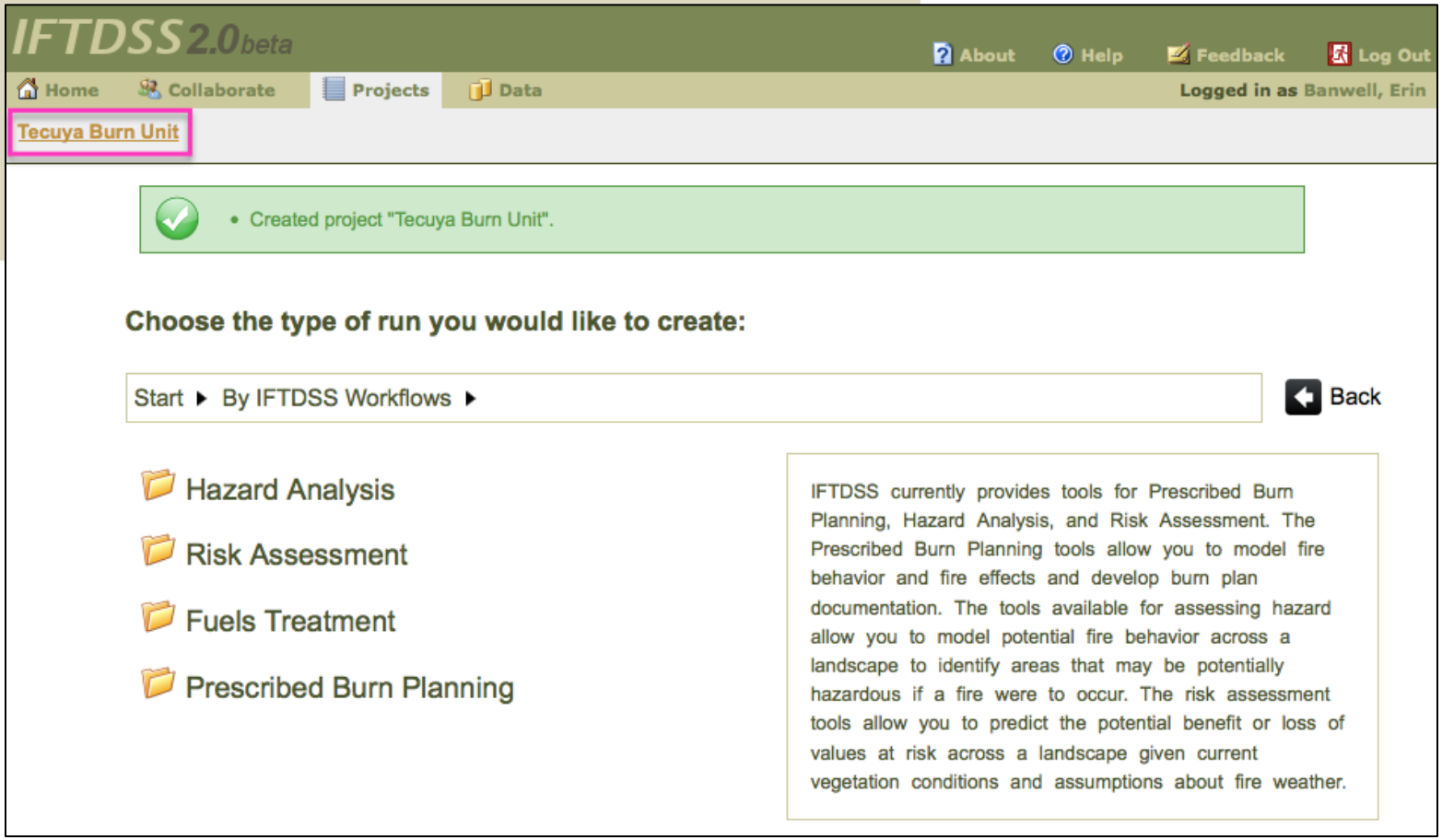
Choose **Next**.



Getting Started

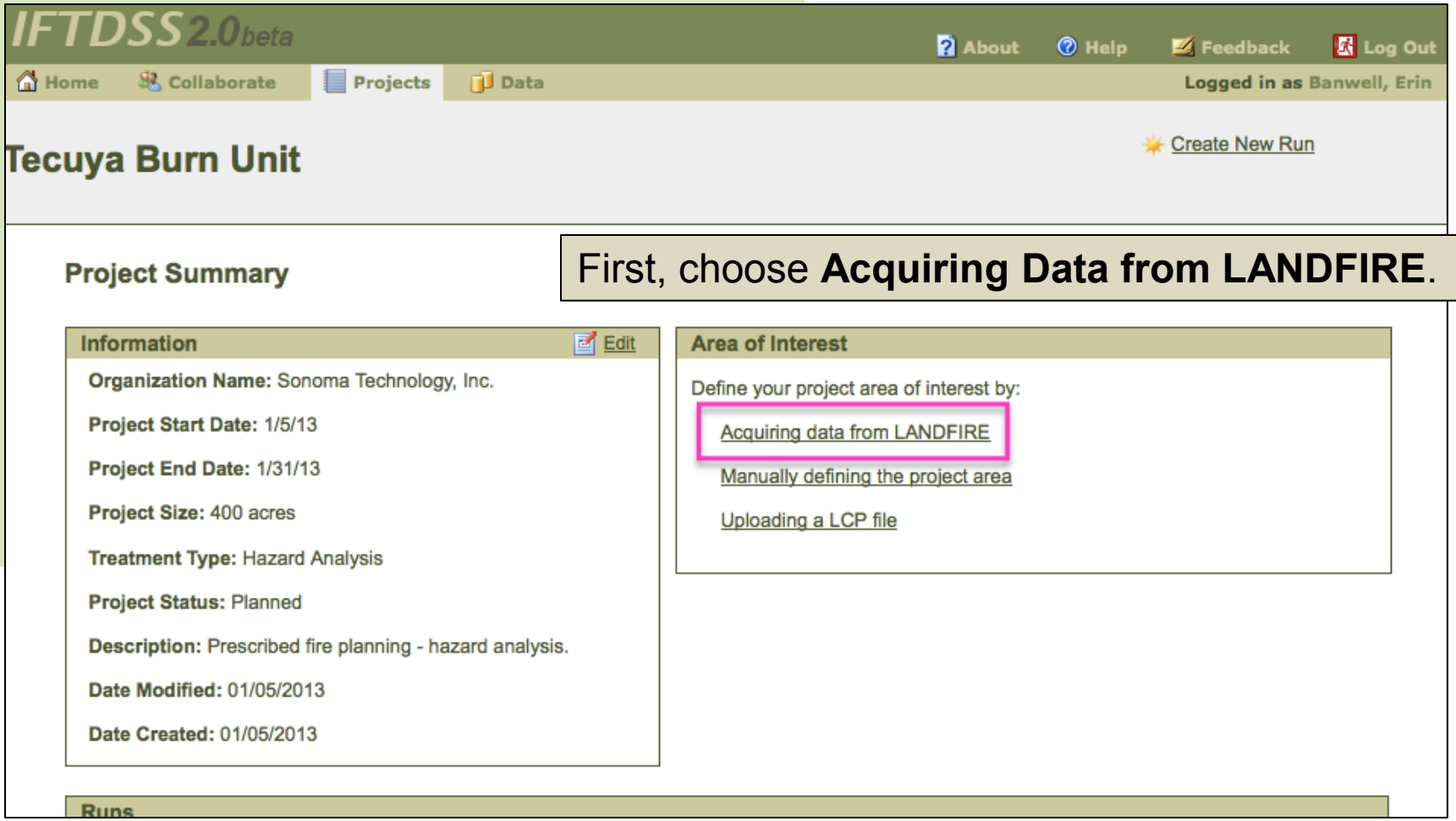
After creating a new project, you will see the page for **creating a new run**. The next step is to acquire LANDFIRE data, so we are going to navigate away from this page.

Access the project you created. In this example, we chose the **Tecuya Burn Unit** link.



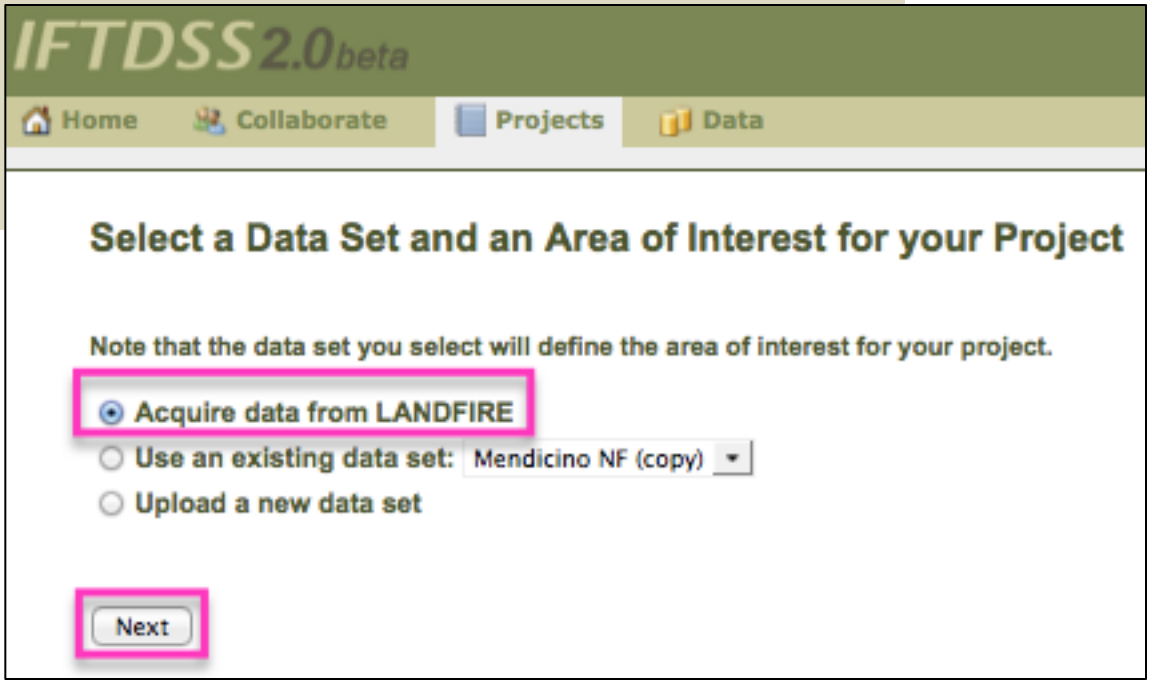
Getting Started

Now, we will acquire data from LANDFIRE.



Getting Started

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



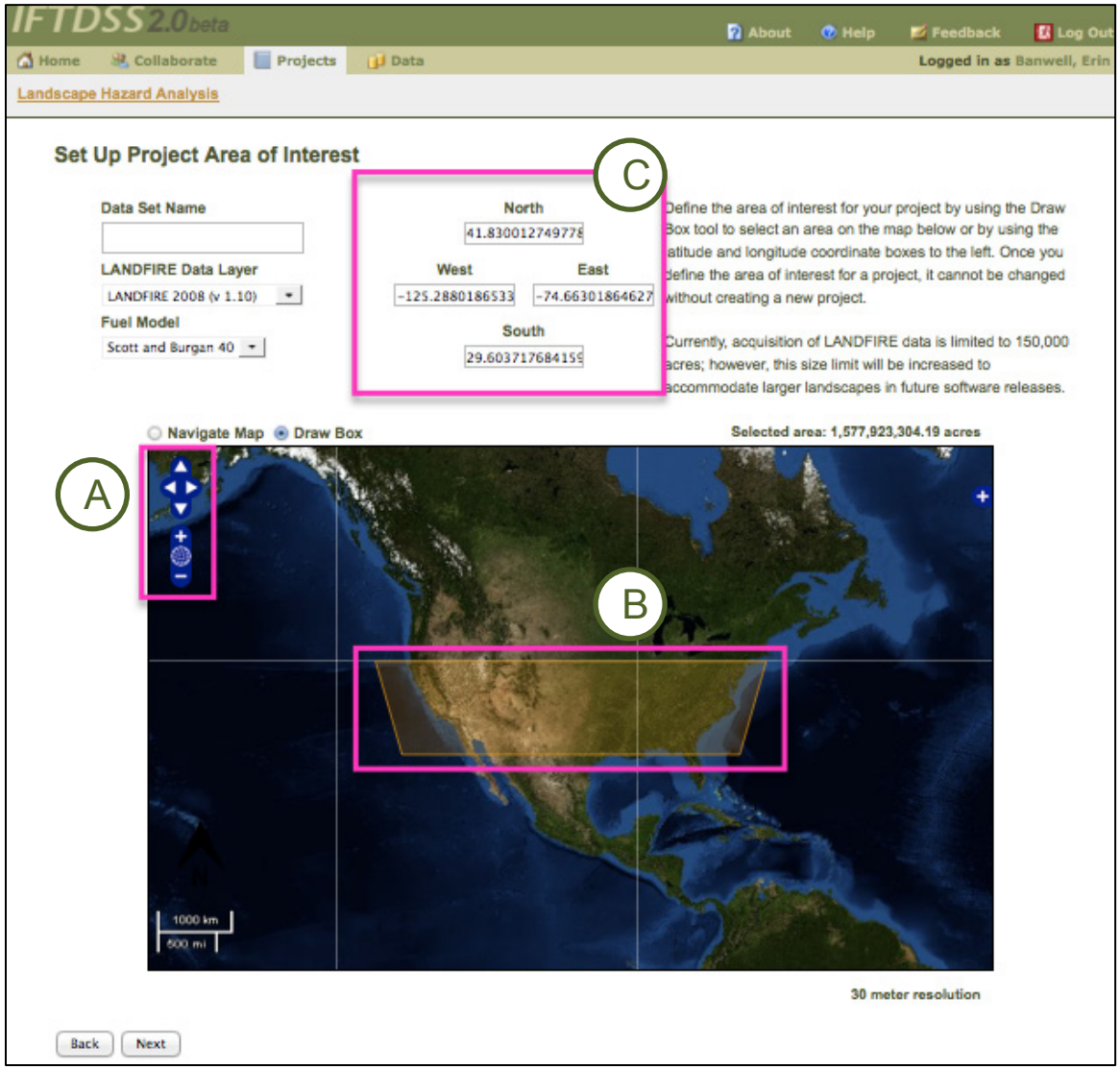
Selecting a Project Area of Interest

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, the coordinates are:

- **North:** 34.8462701863
- **East:** -119.084138535
- **South:** 34.8401768816
- **West:** -119.091562889

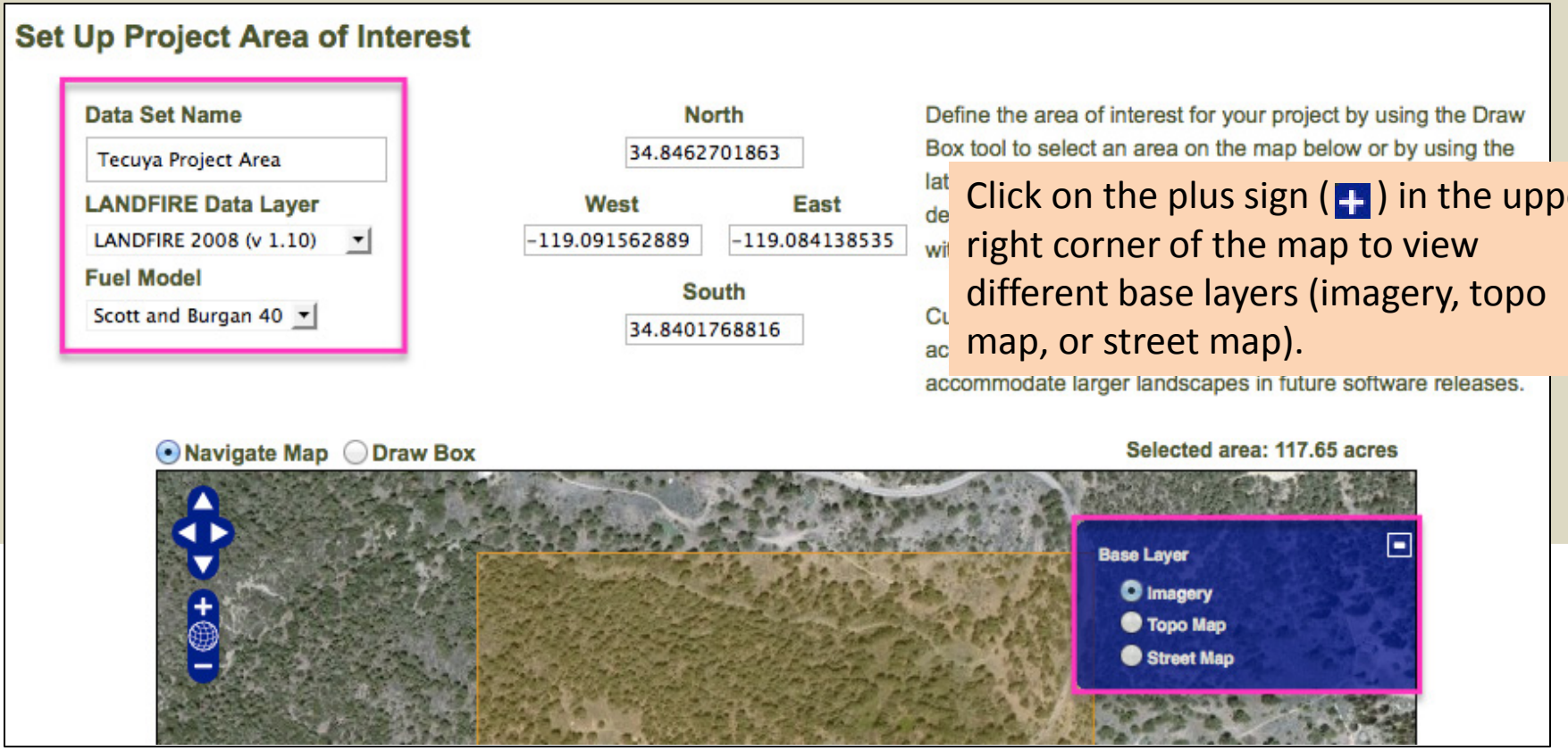


Selecting a Project Area of Interest

Name the data set.

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

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

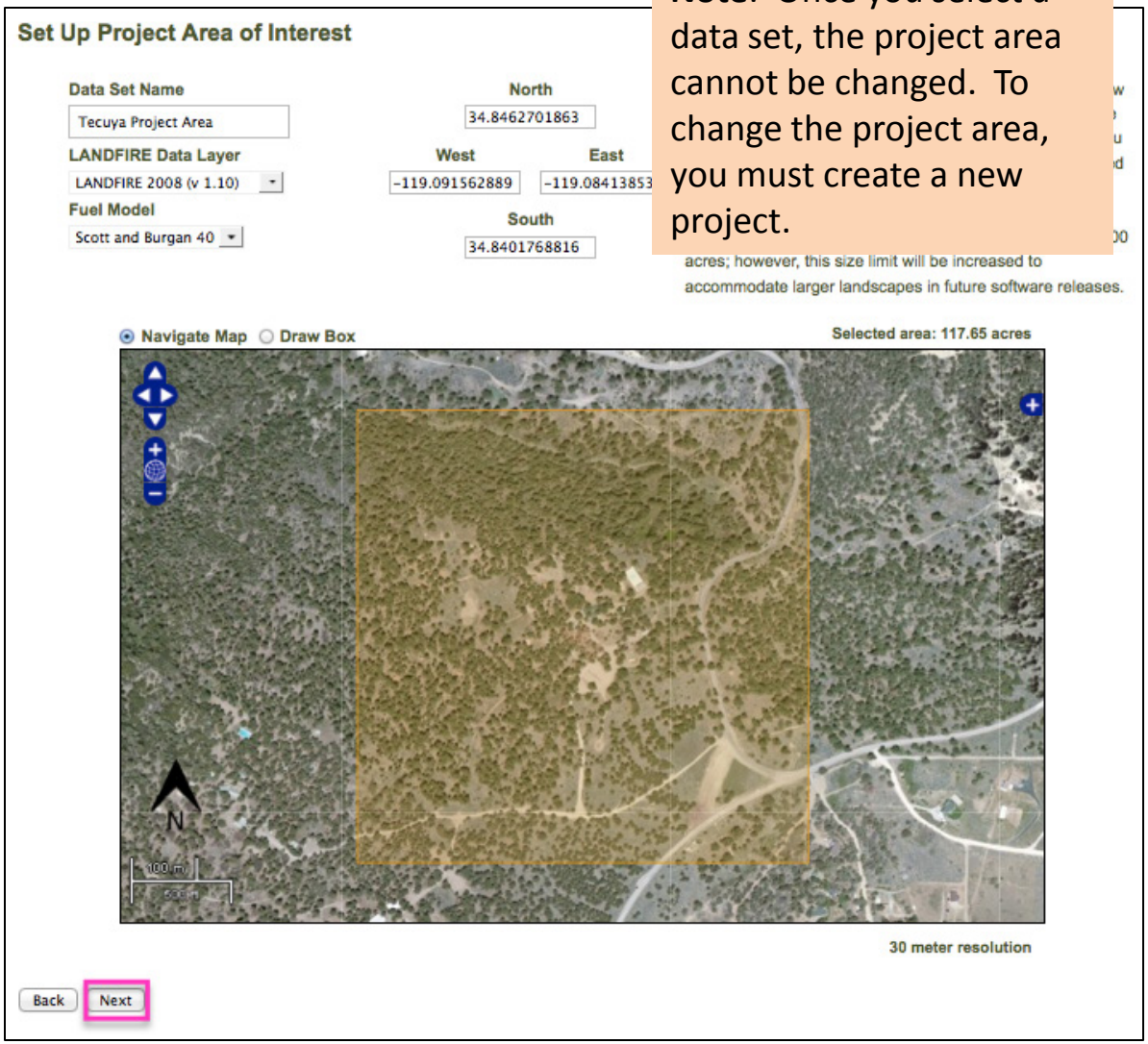
Choose **Next** to import LANDFIRE data.

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

Tip: Select a large data set area. By creating a large project area, you can view landscape data, and model fire behavior and effects, inside and outside the burn unit.

Maximum area: Currently, 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.

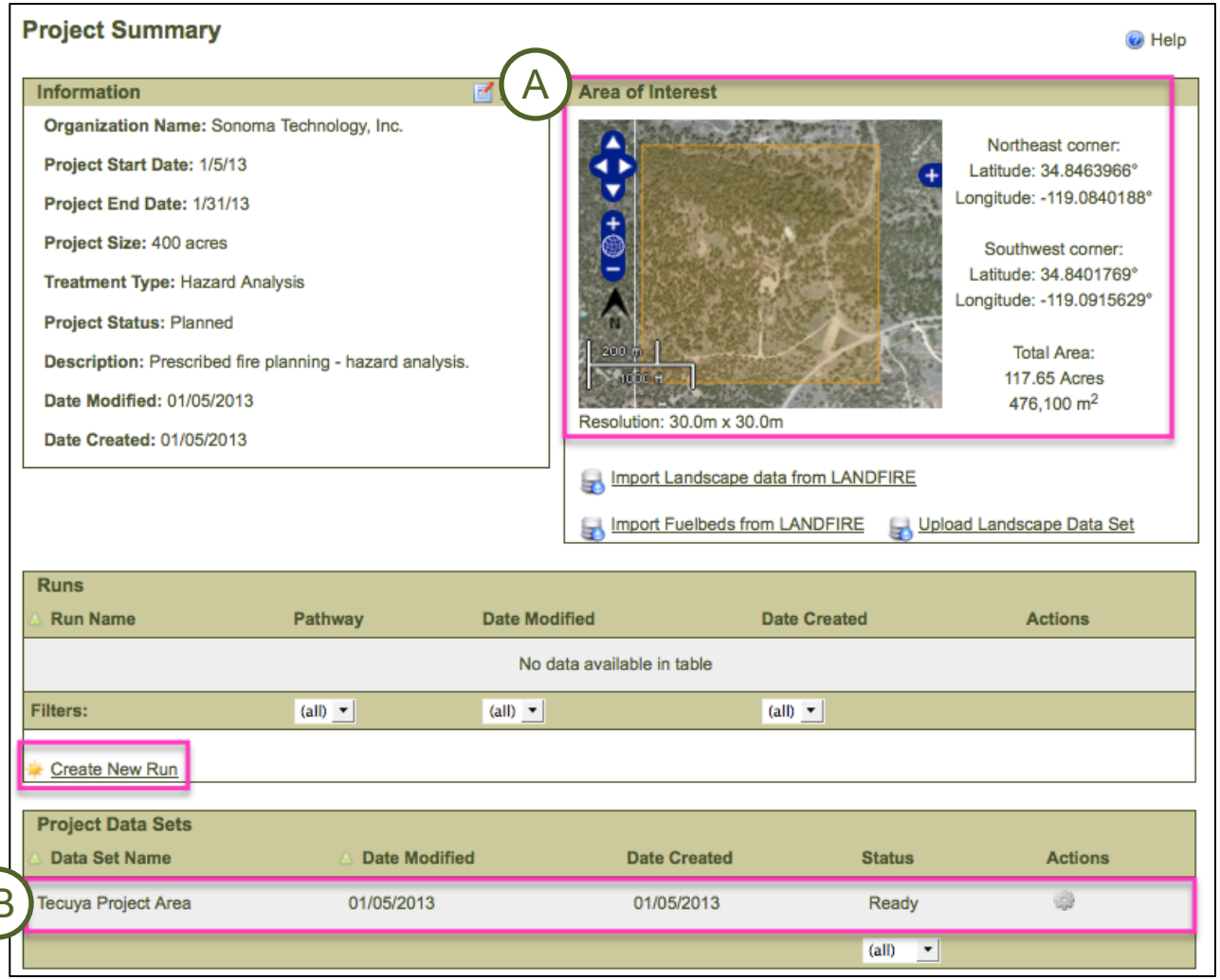
For use in spatial modules, you now have

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)

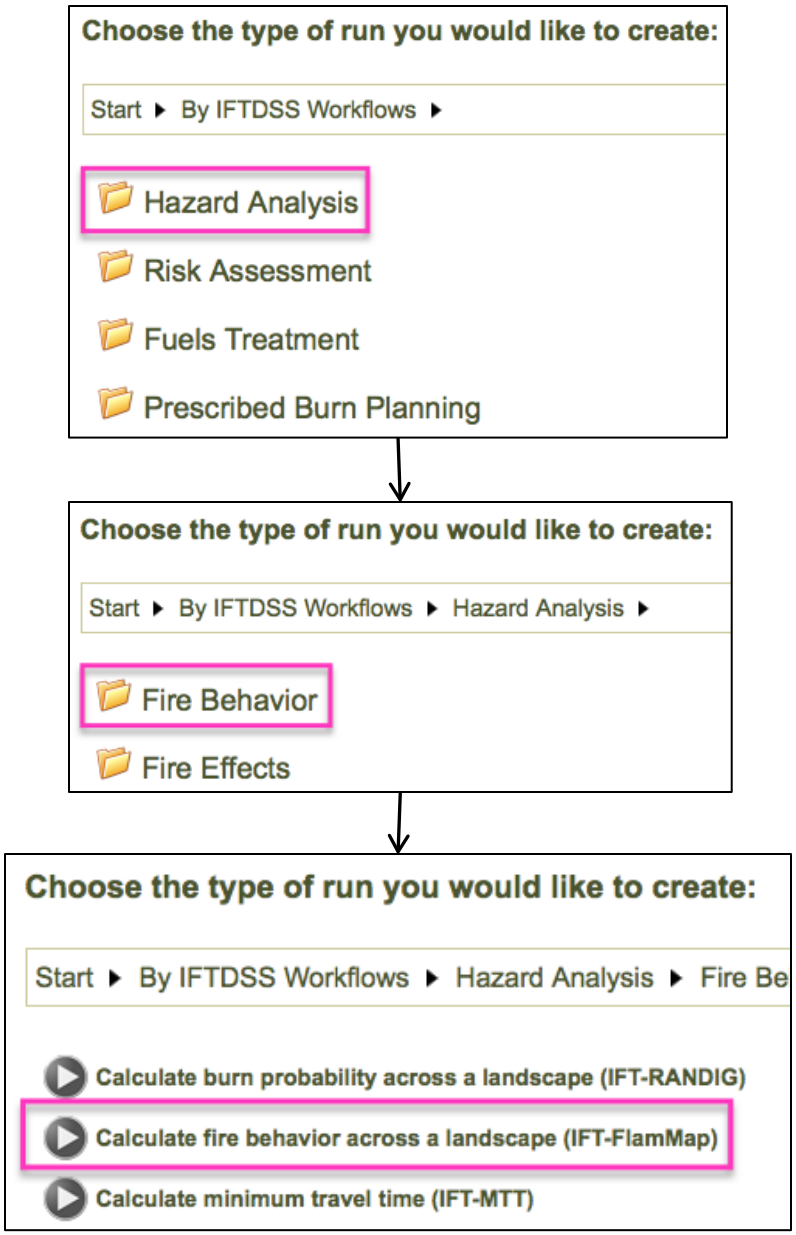
In this **run**, you will

a. Select an area of interest.

b. Input your environmental parameters.

c. Review the spatial landscape data.

d. Review the fire behavior output data.



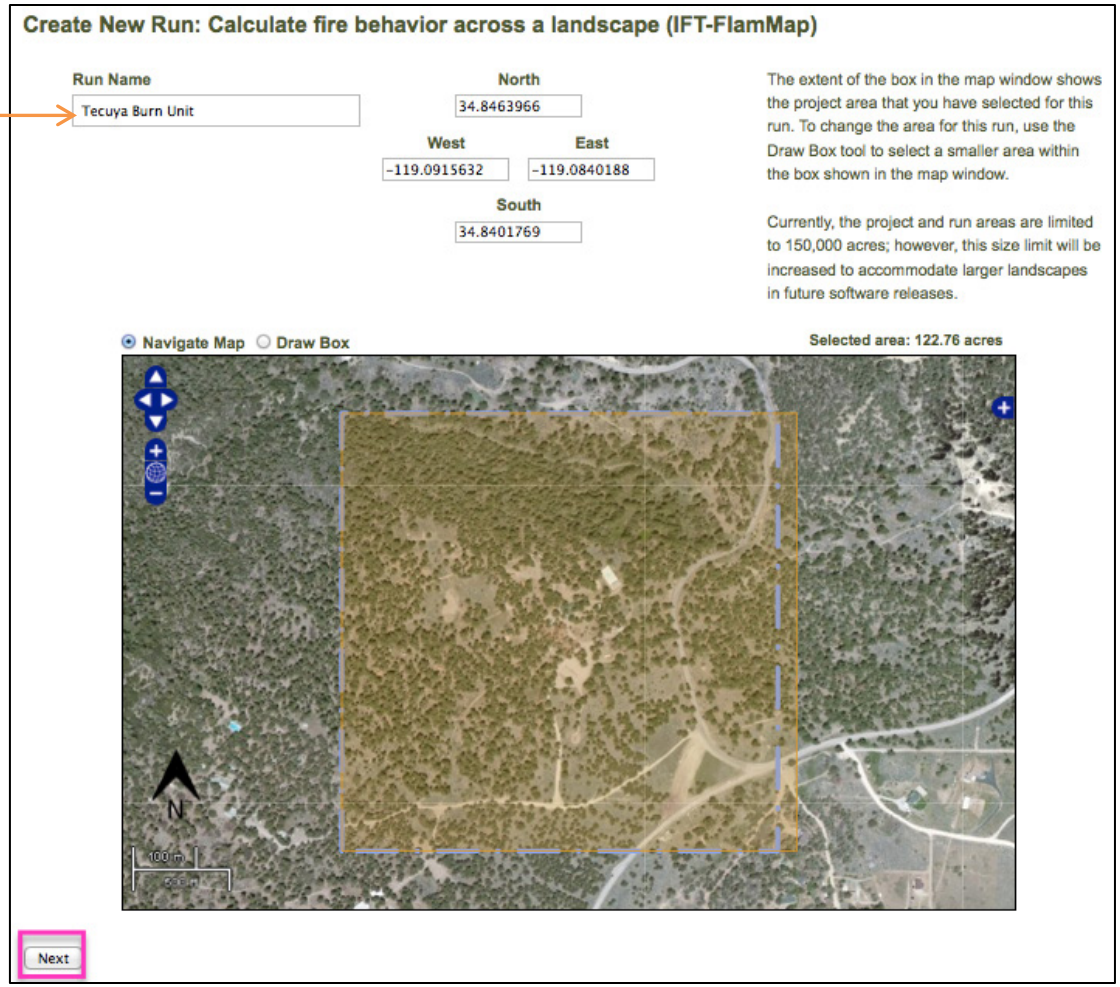
Selecting an Area of Interest

Tip: Give your runs descriptive names for future reference.

The next step is to select an area of interest within the project boundary. In this example, we selected the entire project boundary.

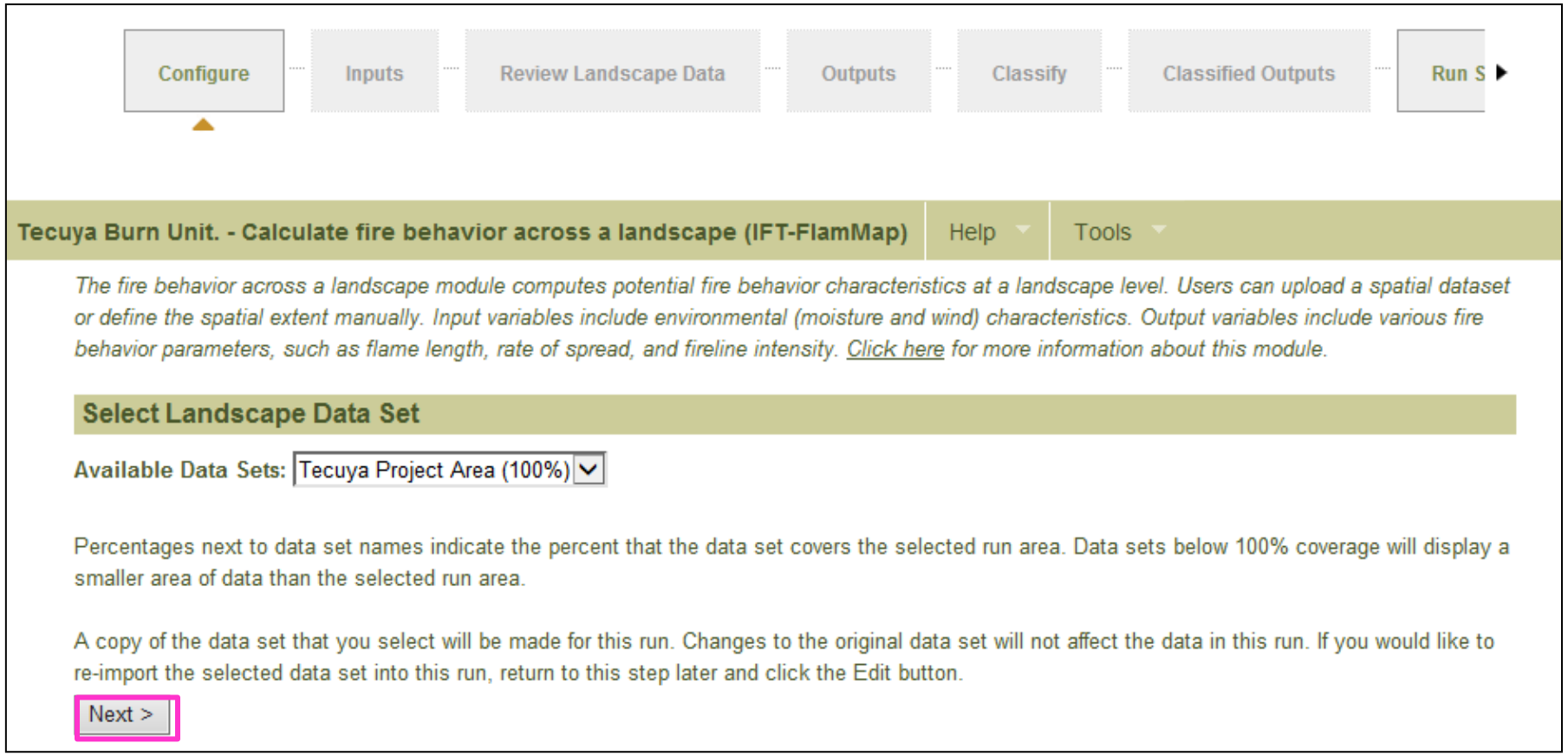
Selecting the entire project boundary is useful if you want to model fire behavior before defining a burn unit, and/or you want to model fire behavior for an entire project area.

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

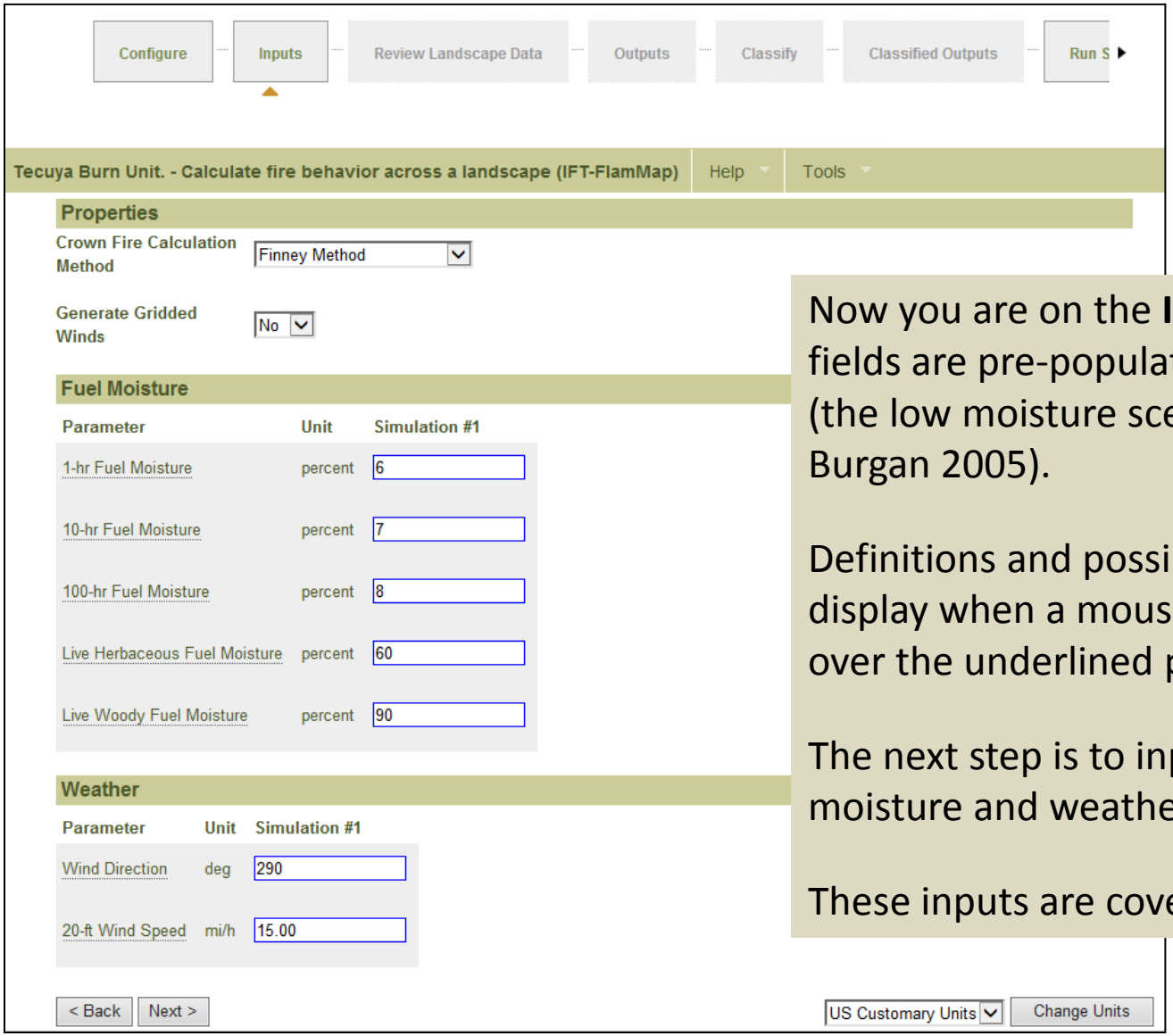


Selecting a Data Set

Select the “Tecuya Project Area (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 (the low moisture scenario from Scott and Burgan 2005).

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

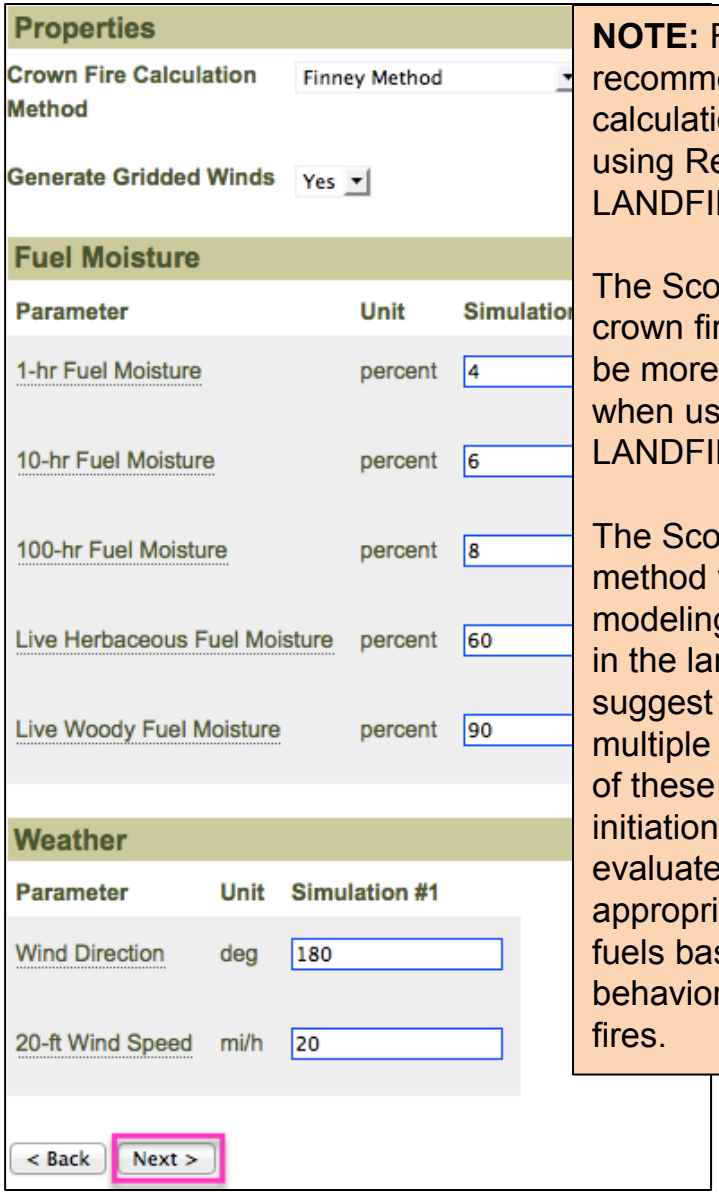
Select the crown fire calculation method and input dead and live fuel moisture, and wind speed and direction.

Tip: Create multiple runs to test different weather prescriptions that can produce

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

For this example, we are interested in modeling a weather prescription that would produce high fire behavior (i.e., high limits) for the environmental parameters required to meet our Prescribed Fire Plan objectives.

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



NOTE: Finney is the recommended crown fire calculation method when using Refresh LANDFIRE data layers.

The Scott-Reinhardt crown fire method may be more appropriate when using unmodified LANDFIRE data.

The Scott-Reinhardt method will result in modeling more crown fire in the landscape. We suggest you make multiple runs using each of these crown fire initiation methods and evaluate which is more appropriate for your local fuels based on fire behavior from historic fires.

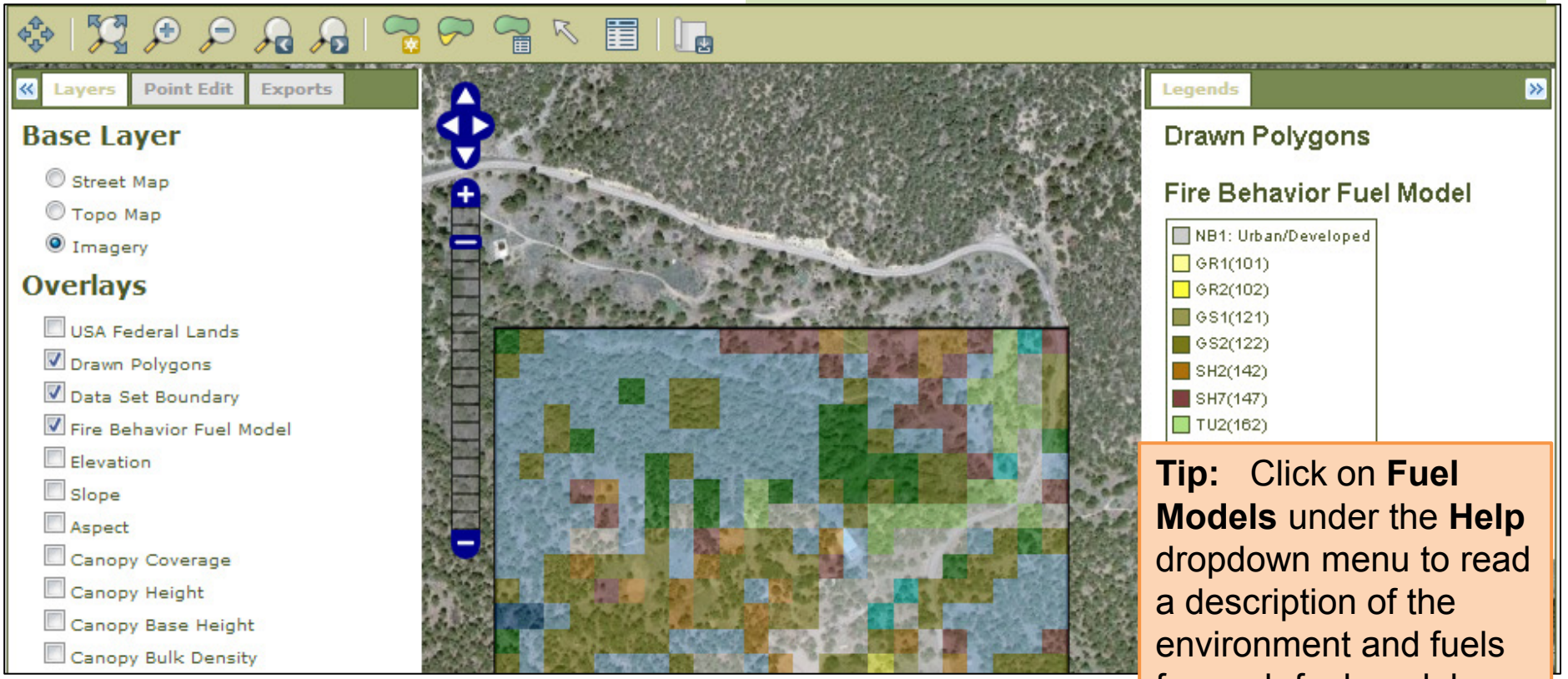
Introducing the Map Toolbar

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.

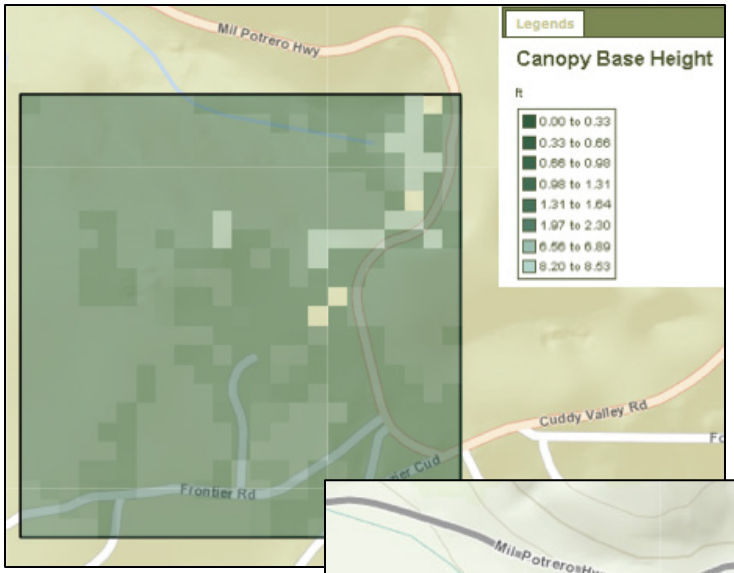
Reviewing Spatial Landscape Data

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

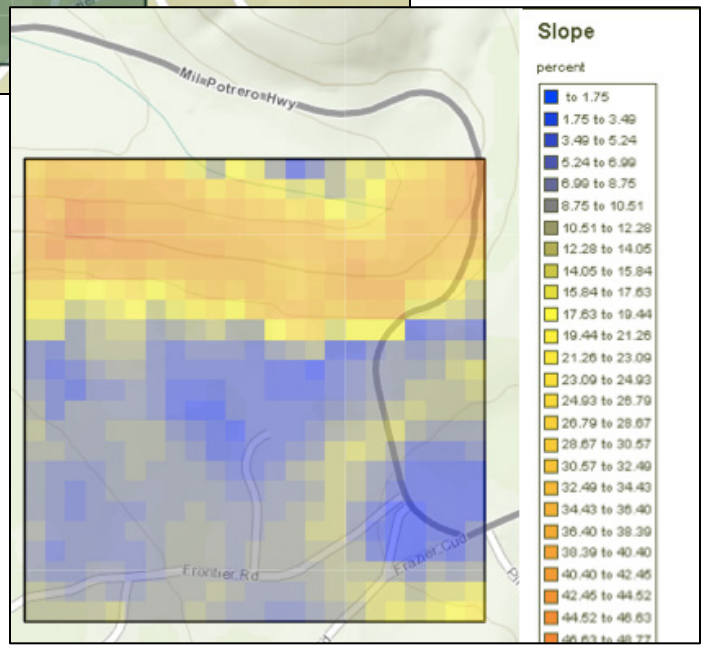
- Fuel Model
- Elevation
- Slope
- Aspect
- Canopy Coverage
- Canopy Height
- Canopy Base Height
- Canopy Bulk Density

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.

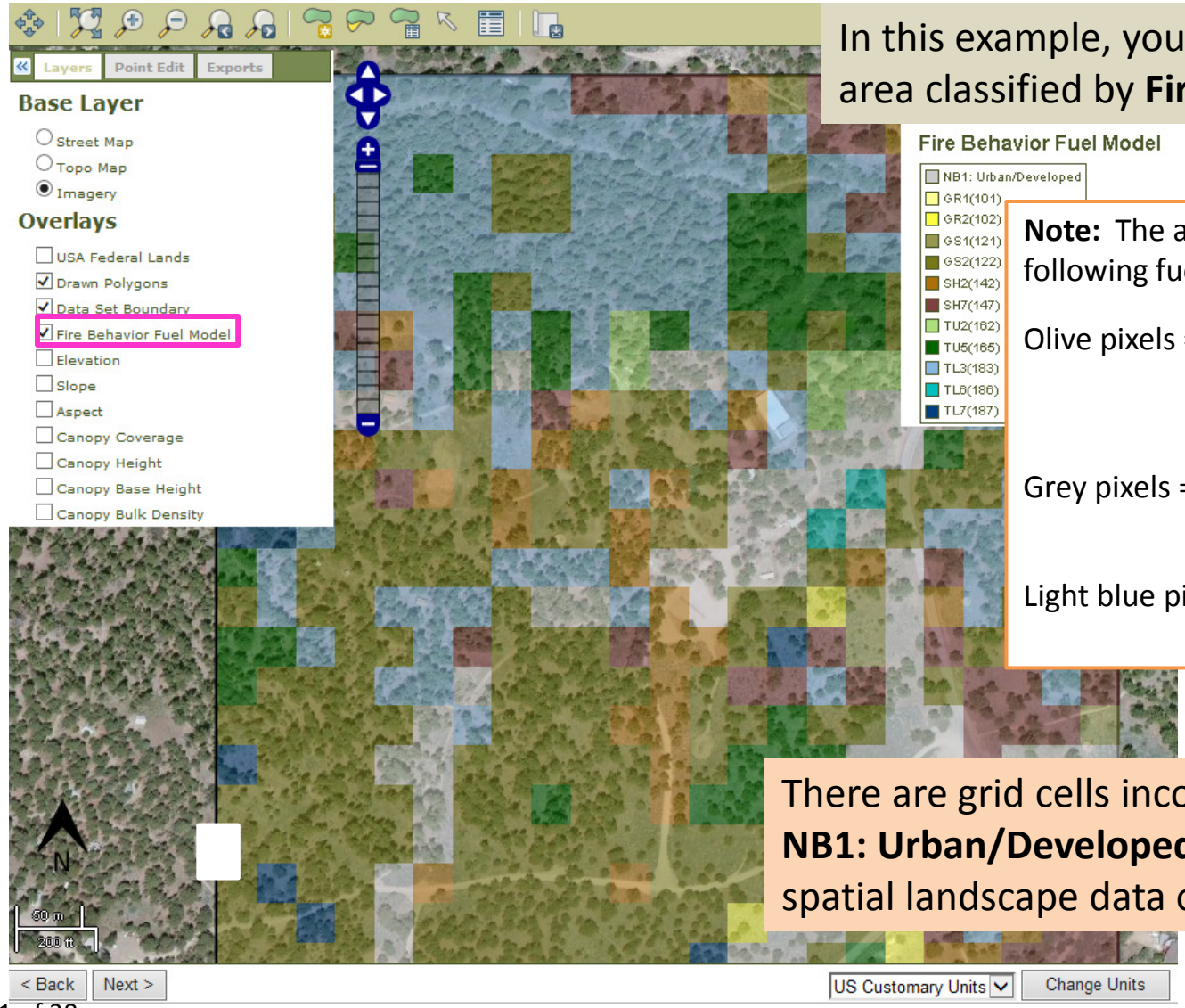
Canopy Base Height (street view)



Slope (topo view)



Reviewing Spatial Landscape Data



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:

Olive pixels =	GS2(122): Moderate load dry climate grass-shrub
Grey pixels =	NB1: Urban/ Developed
Light blue pixels =	TL3(183): Moderate load conifer litter

There are grid cells incorrectly classified as **NB1: Urban/Developed**. We will edit the spatial landscape data on the next page.

Editing Spatial Landscape Data (One Grid at a Time)

After reviewing our data, we found grid cells incorrectly labeled as **NB1: Urban/Developed**. There are three editing tools on the map toolbar.

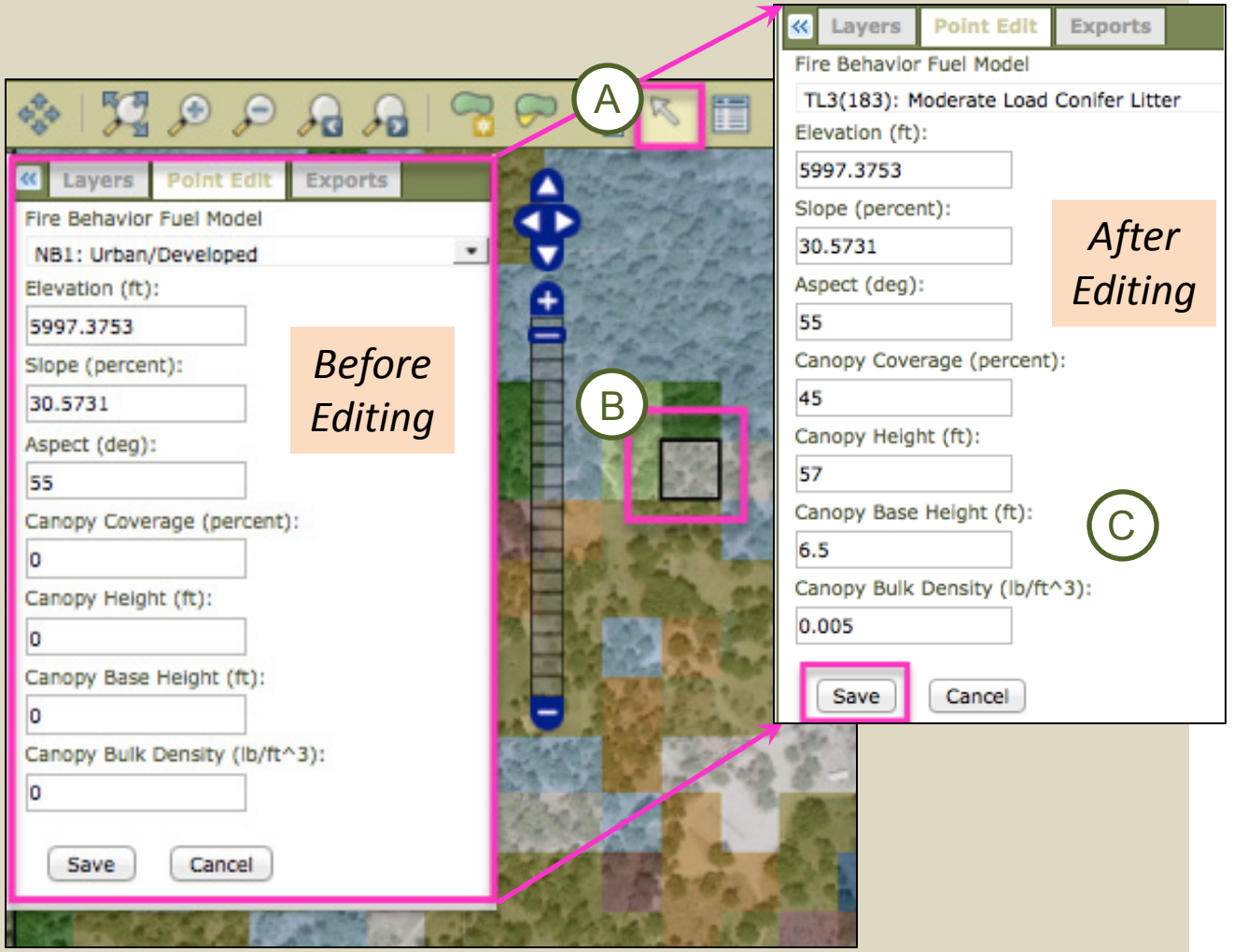
- **Point Edit**: edit one grid cell at a time
- **Advanced Edit**: edit grid cells across the entire run area.
- **Polygon Advanced Edit**: edit all pixels within a user-drawn polygon

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.

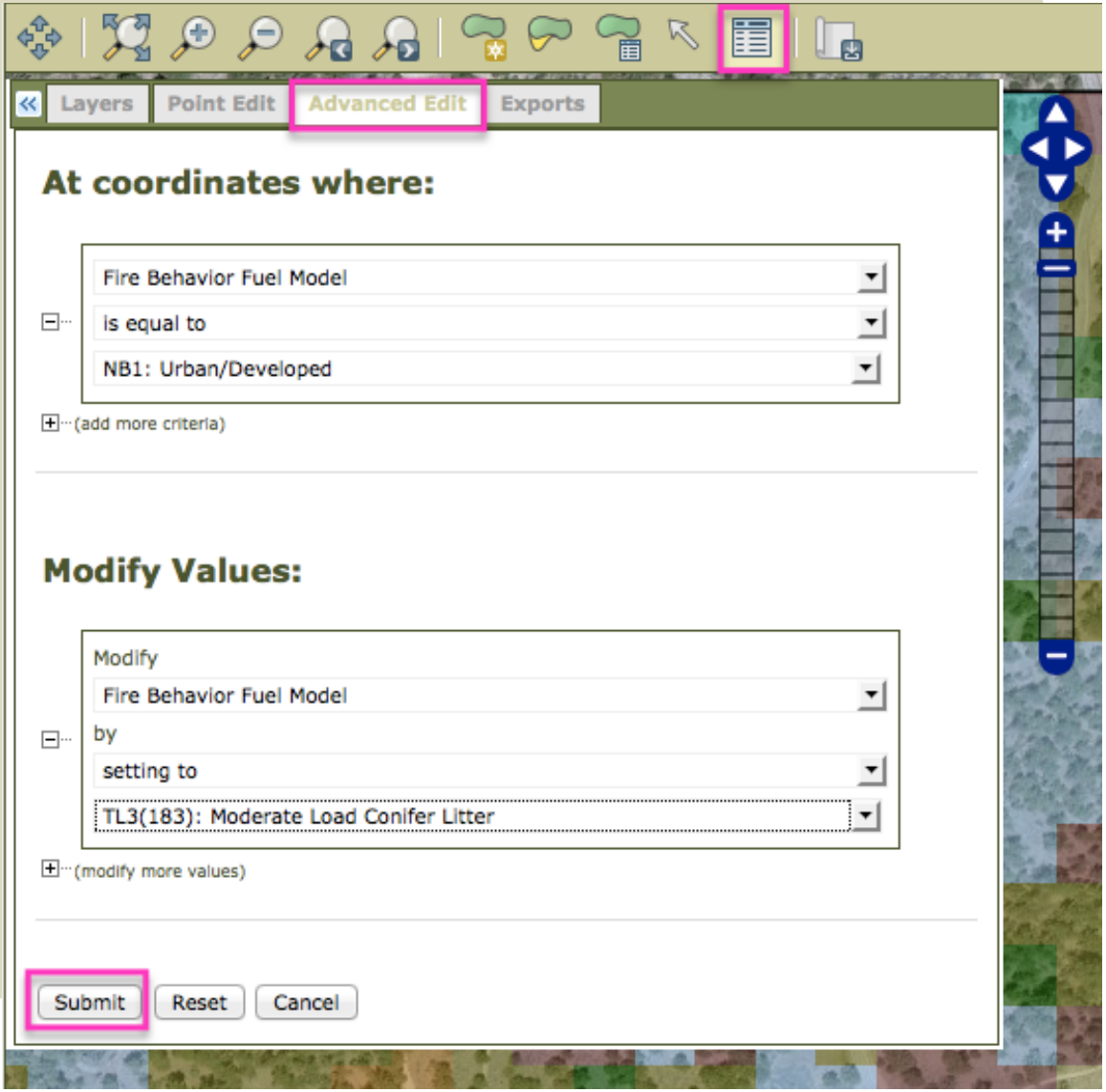
Editing Spatial Landscape Data (Multiple Grids across the Run Area)

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.

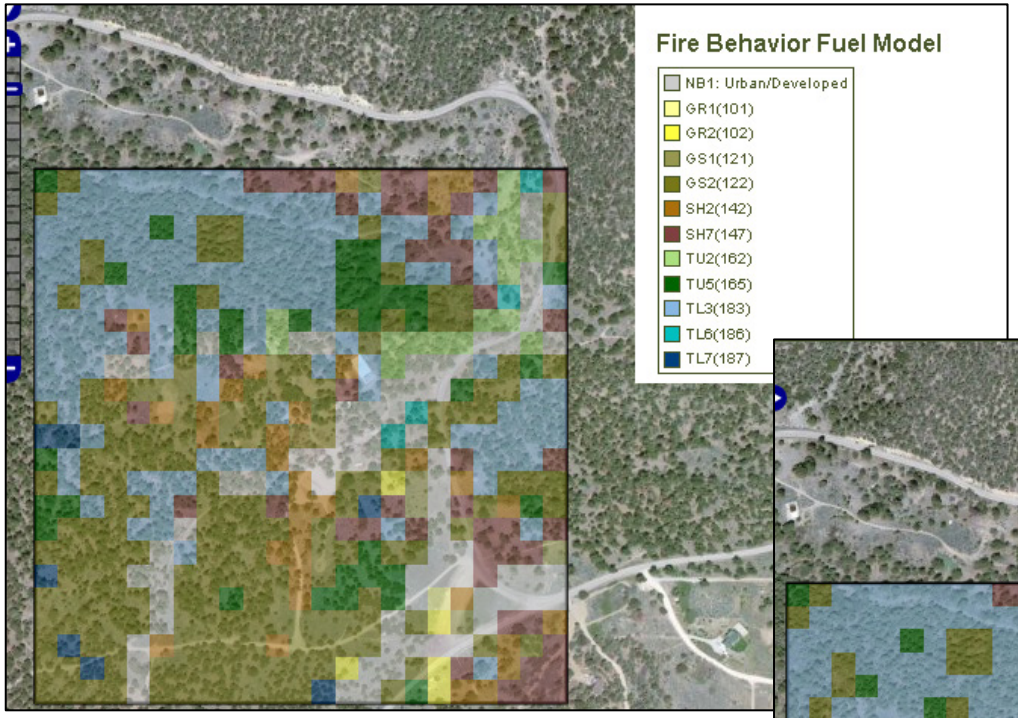
In this panel, you can modify any of the spatial data in query format so that multiple cells can be changed at once.

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**.

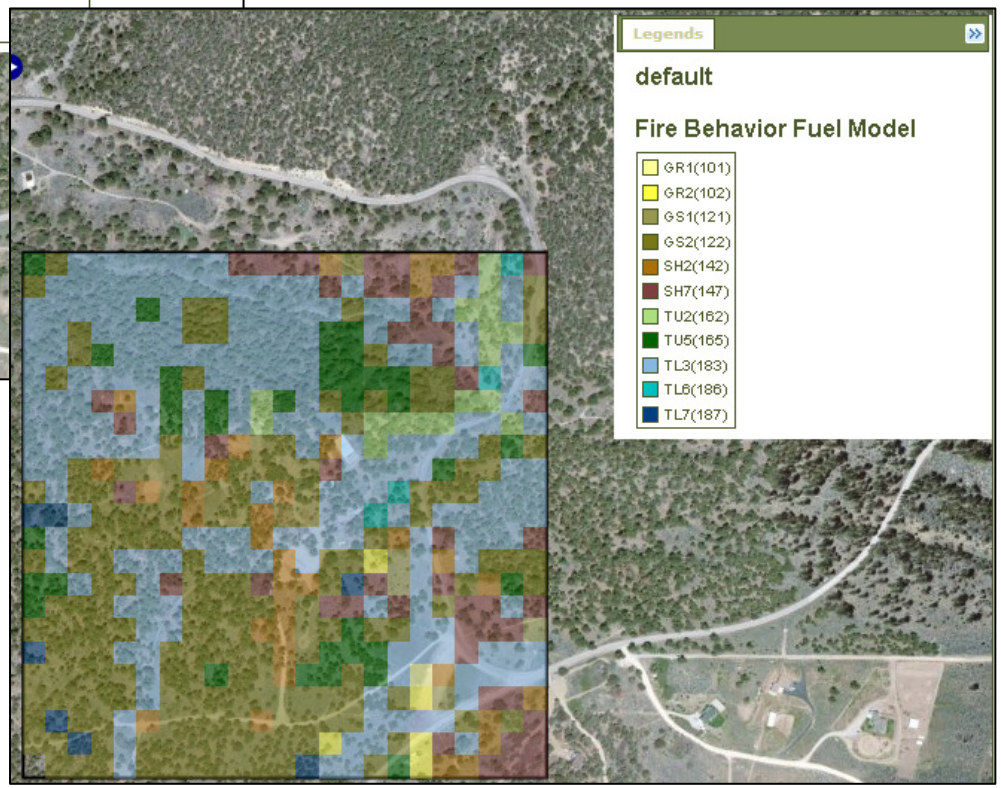


Editing Spatial Landscape Data

Before Editing



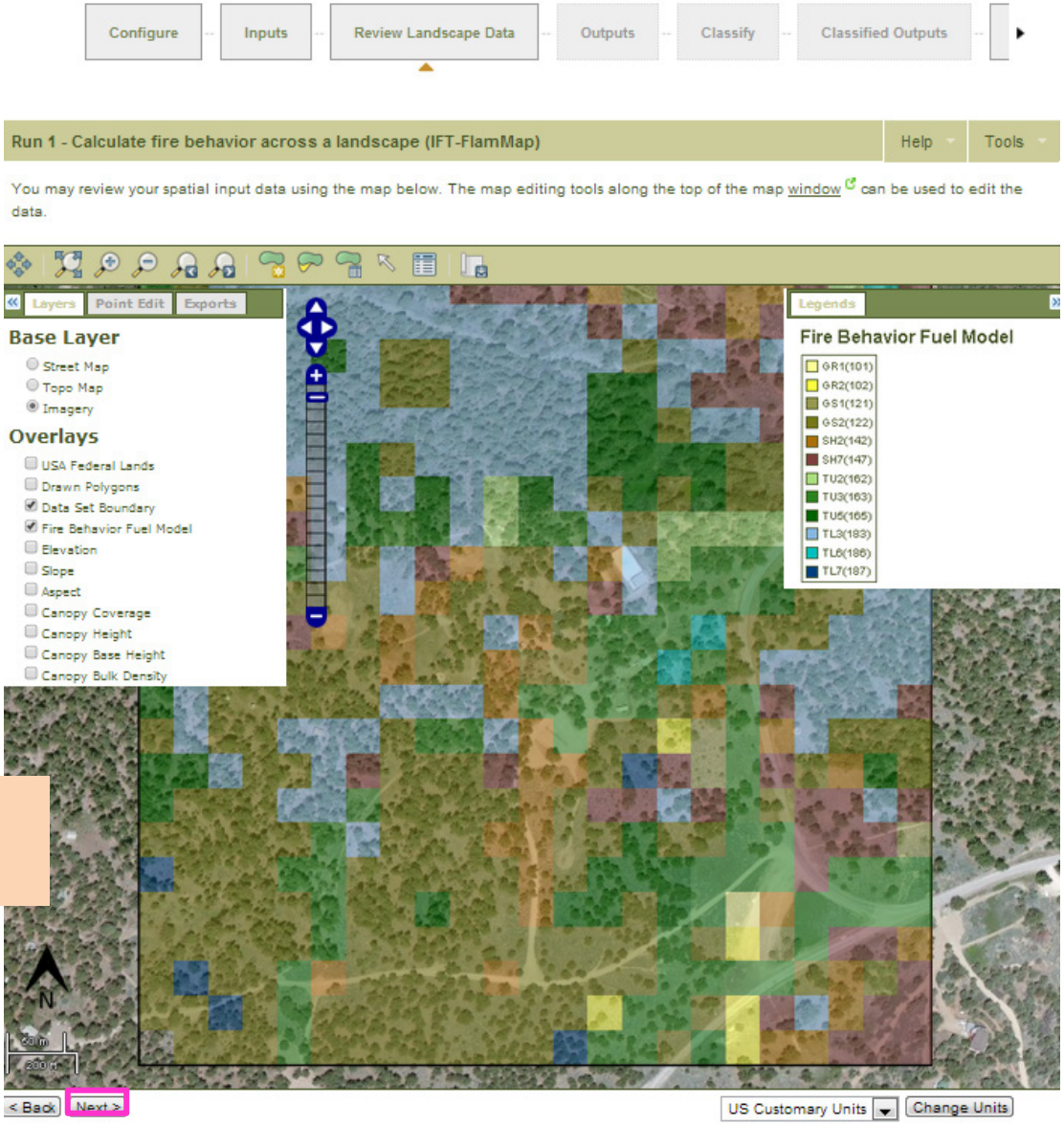
After Editing



Reviewing Spatial Landscape Data

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

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



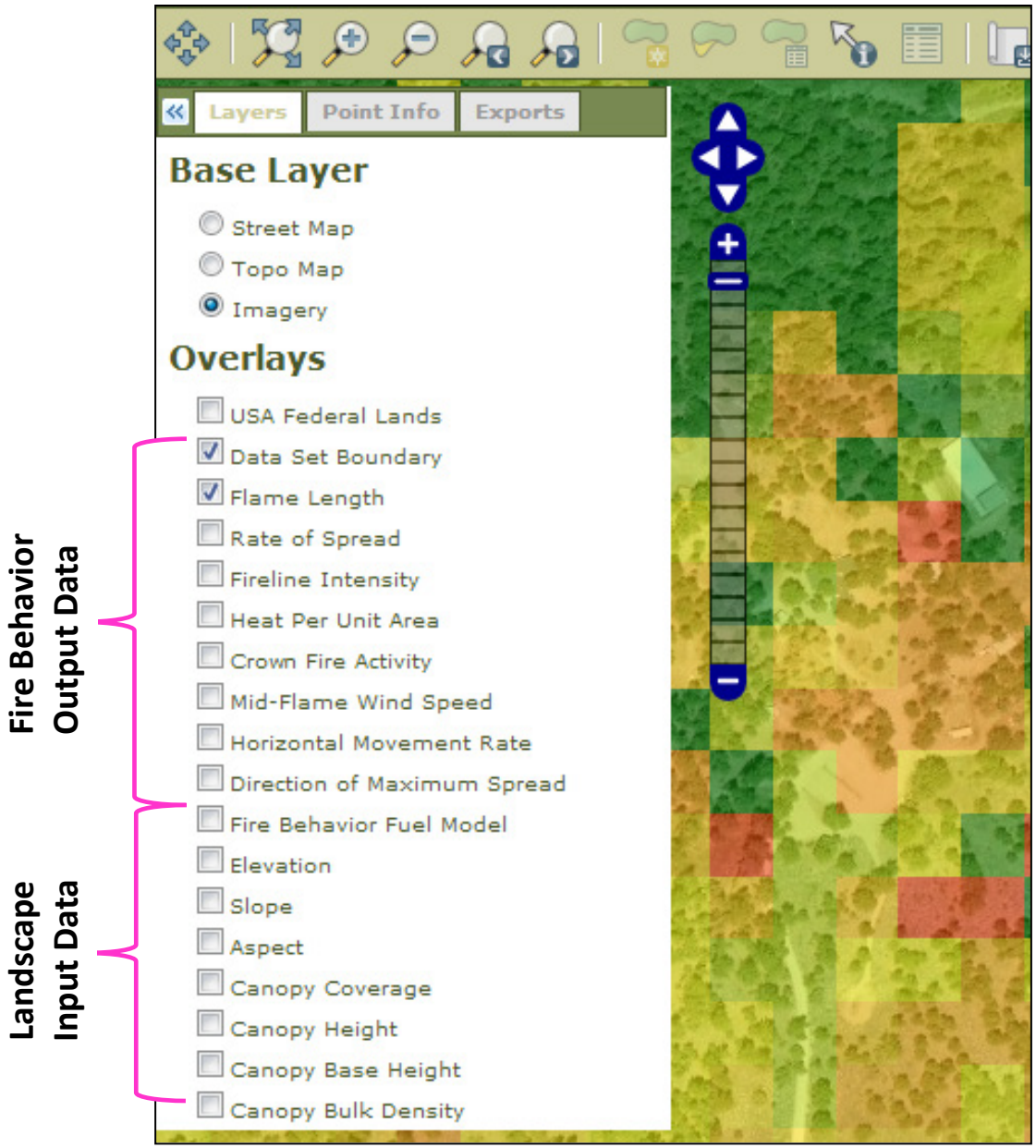
Reviewing Fire Behavior Output Data

After running the module, you can review your spatial 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

To help outline a burn unit, you can use information derived from the modeled fire behavior, as well as fire behavior parameters.

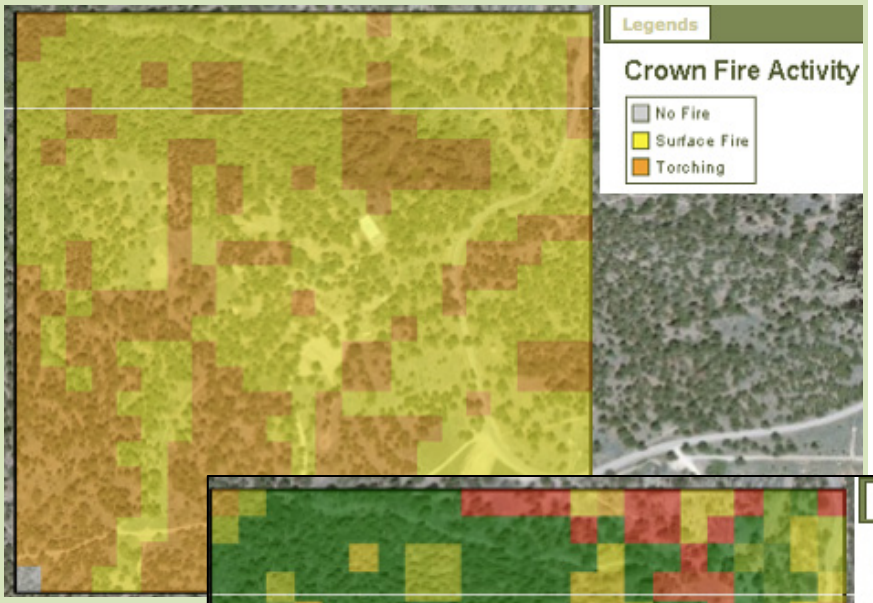
We only want to consider a surface fire (no torching or crowning) and we want a majority of our burn unit to have flame lengths ≤ 4 feet.

Desired parameters:

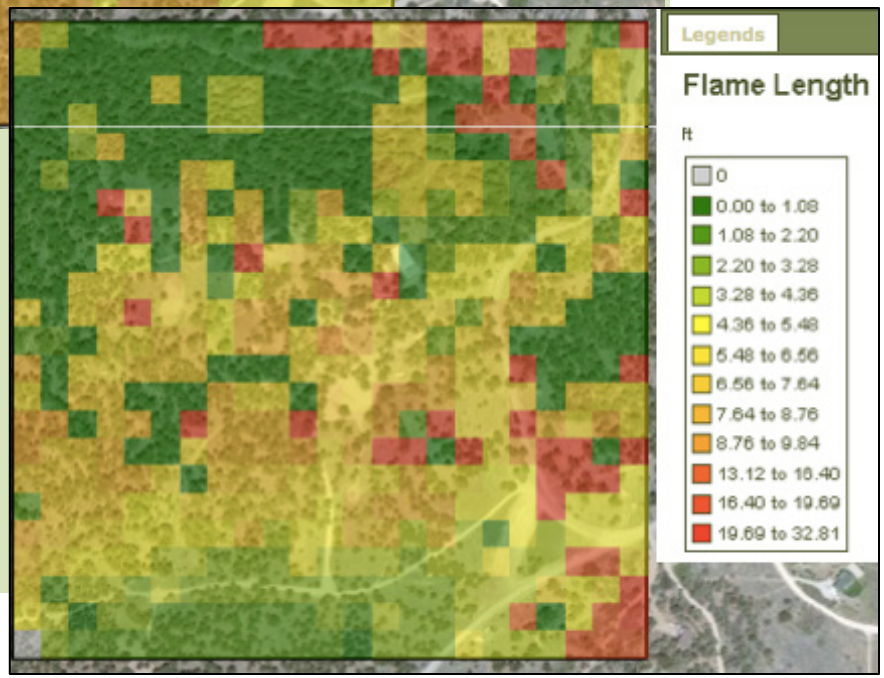
- Surface Fire (minimal torching)
- Flame Lengths ≤ 4 feet

Next, we discuss how the output data for each of the fire behavior parameters is divided into bins and relative bins.

Crown Fire Activity



Flame Length



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.

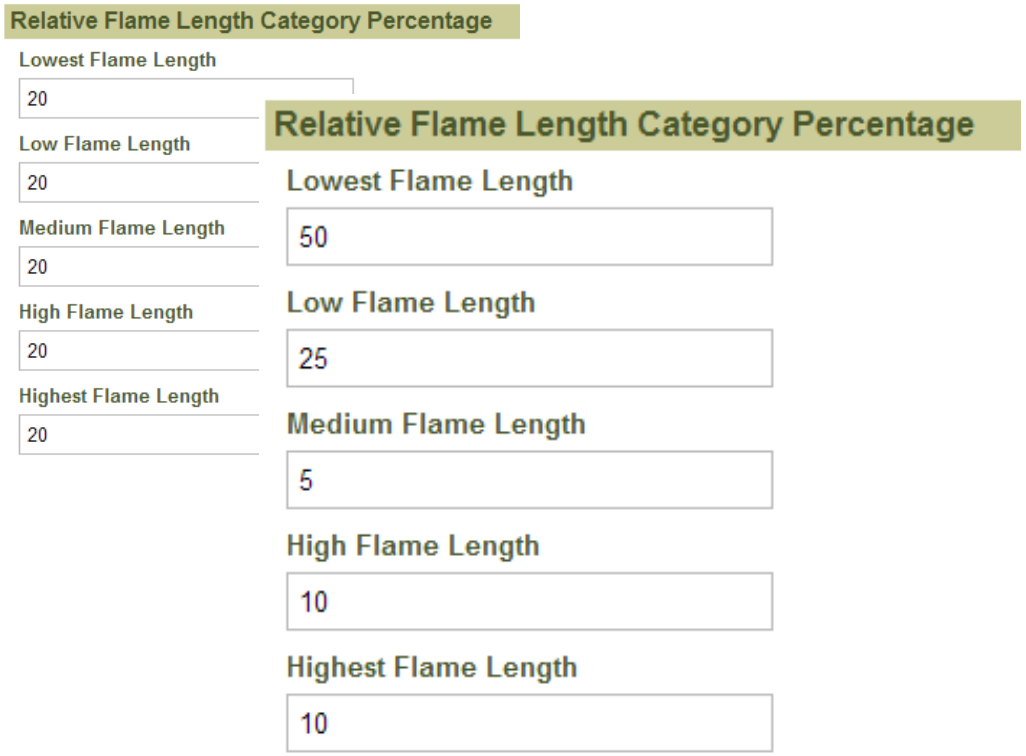
(Table modified from the National Wildfire Coordinating Group, 2004.)

Classifying Outputs

In the **Classify** step, you can also adjust the weights of the five relative data subsets for each parameter.

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, we will reduce the output range for the Highest category of each parameter from 20% to 10%.



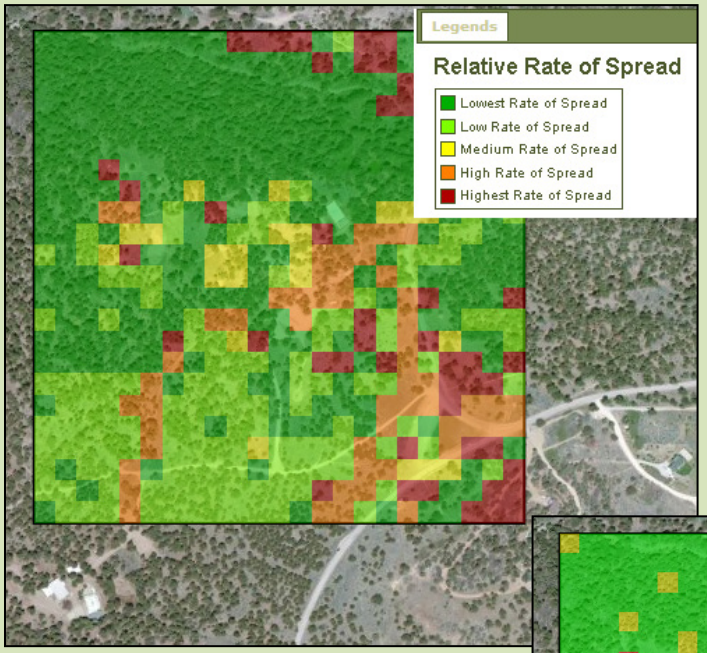
Note: The sum of all five weights *must* be 100%.

To view the user-binned parameters, choose **Next**.

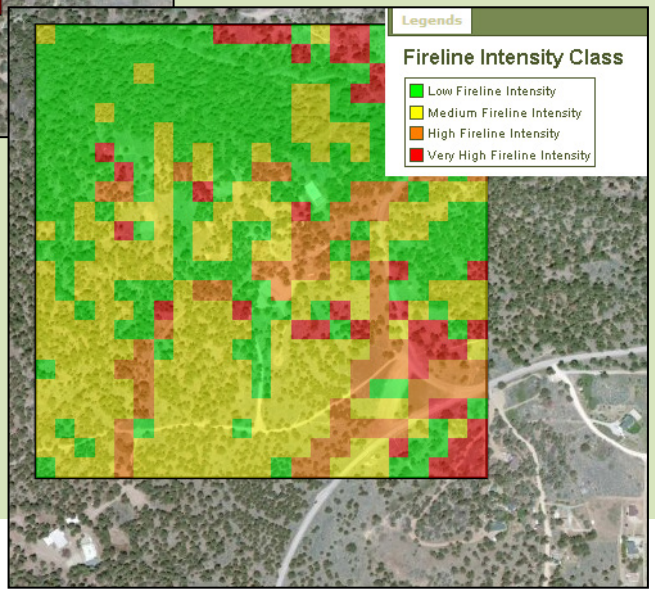
Reviewing Classified Fire Output Data

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



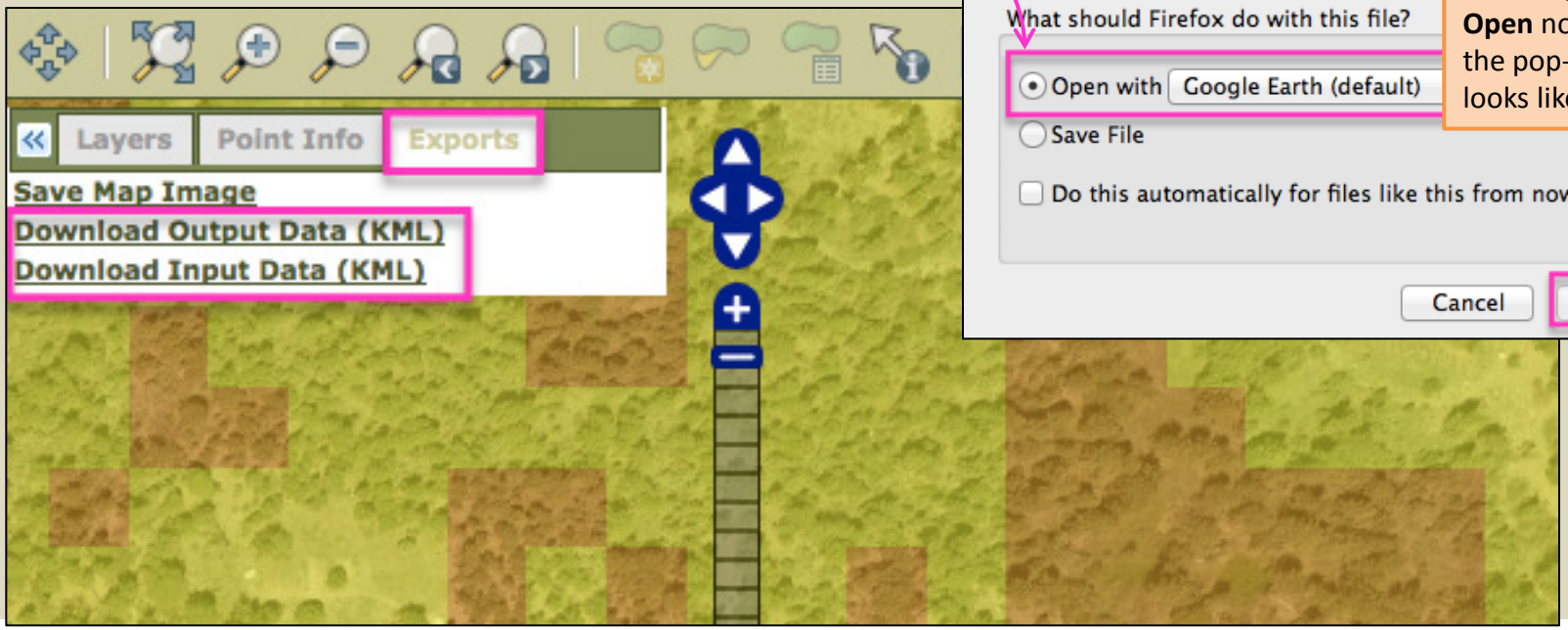
You can export IFTDSS inputs and outputs to Google Earth to examine data relative to other geographic features, and to create burn unit polygons.

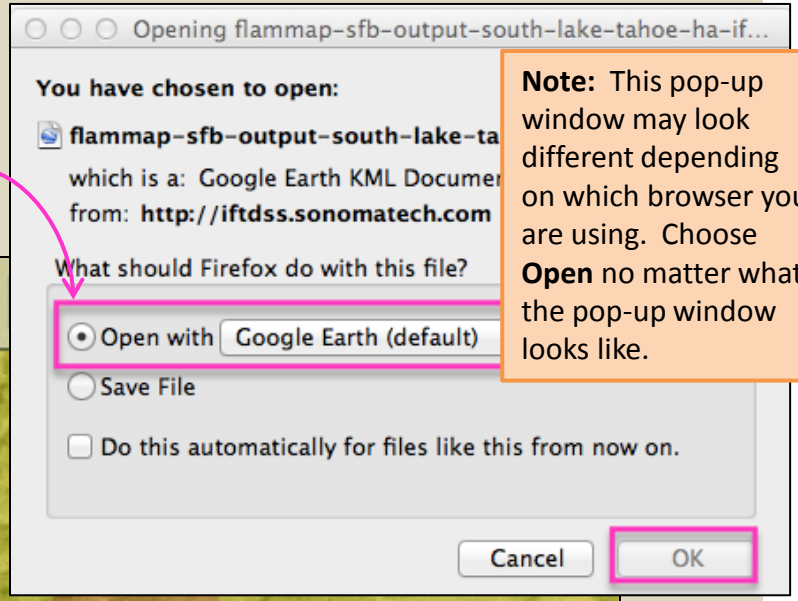
Exporting to Google Earth

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.

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

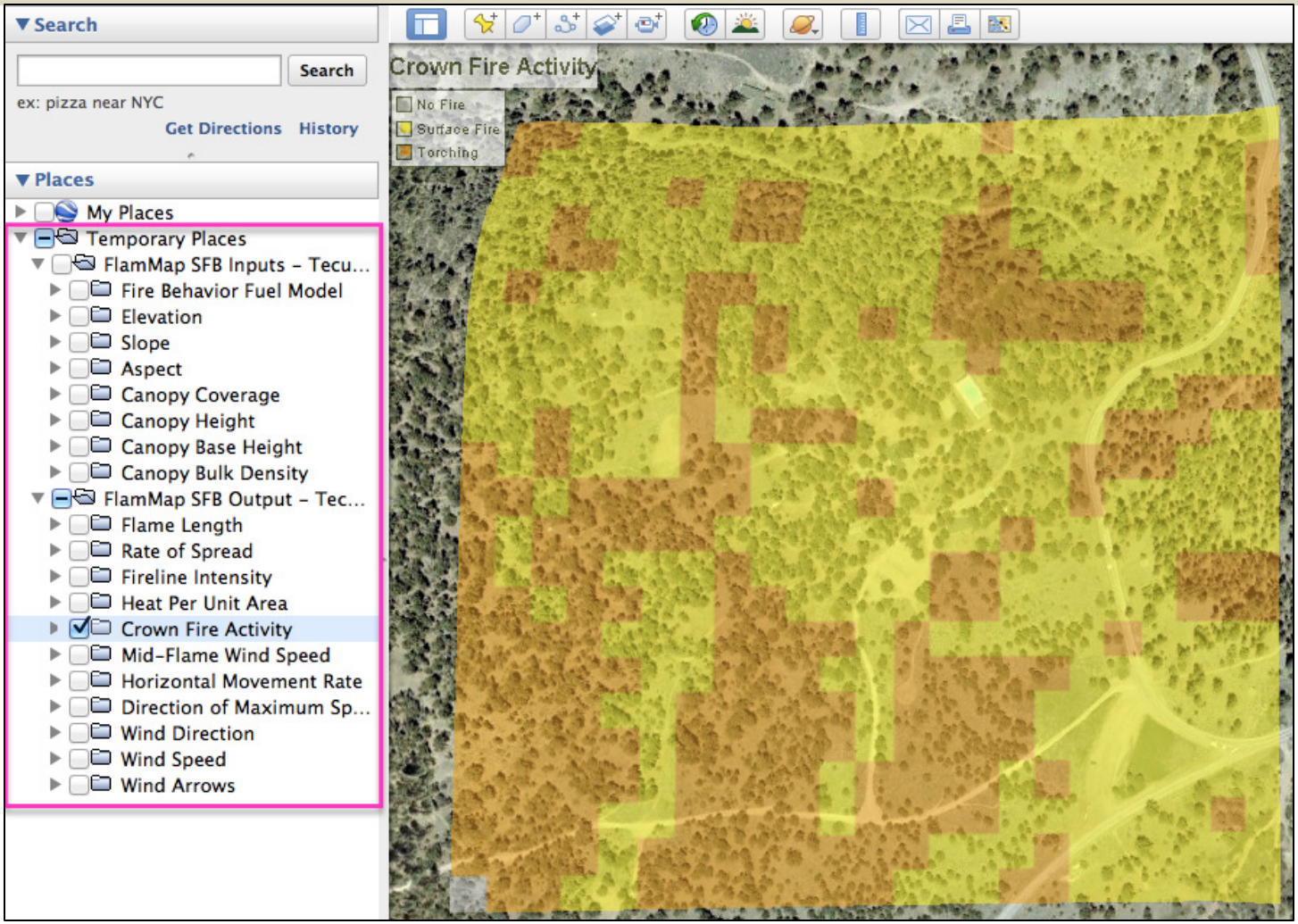




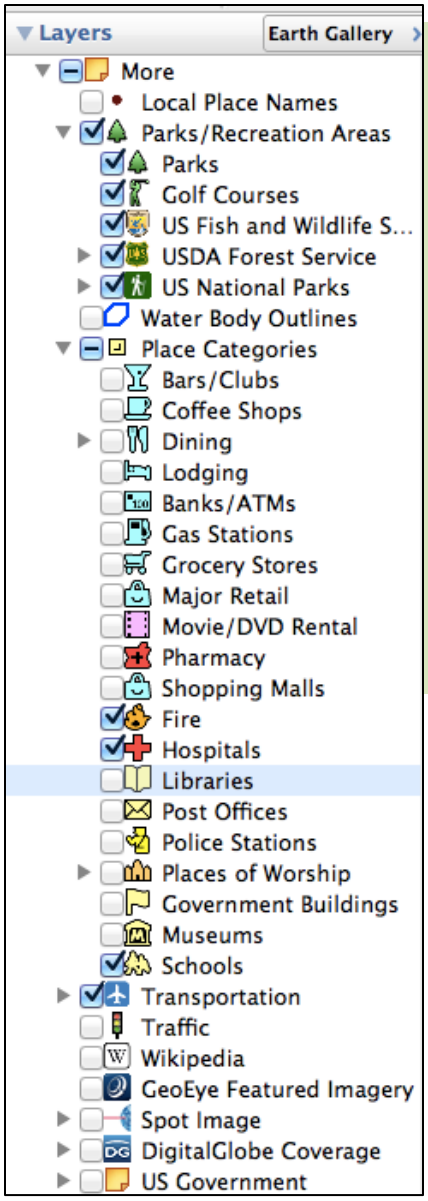
Note: This pop-up window may look different depending on which browser you are using. Choose **Open** no matter what the pop-up window looks like.

Evaluating Results in Google Earth

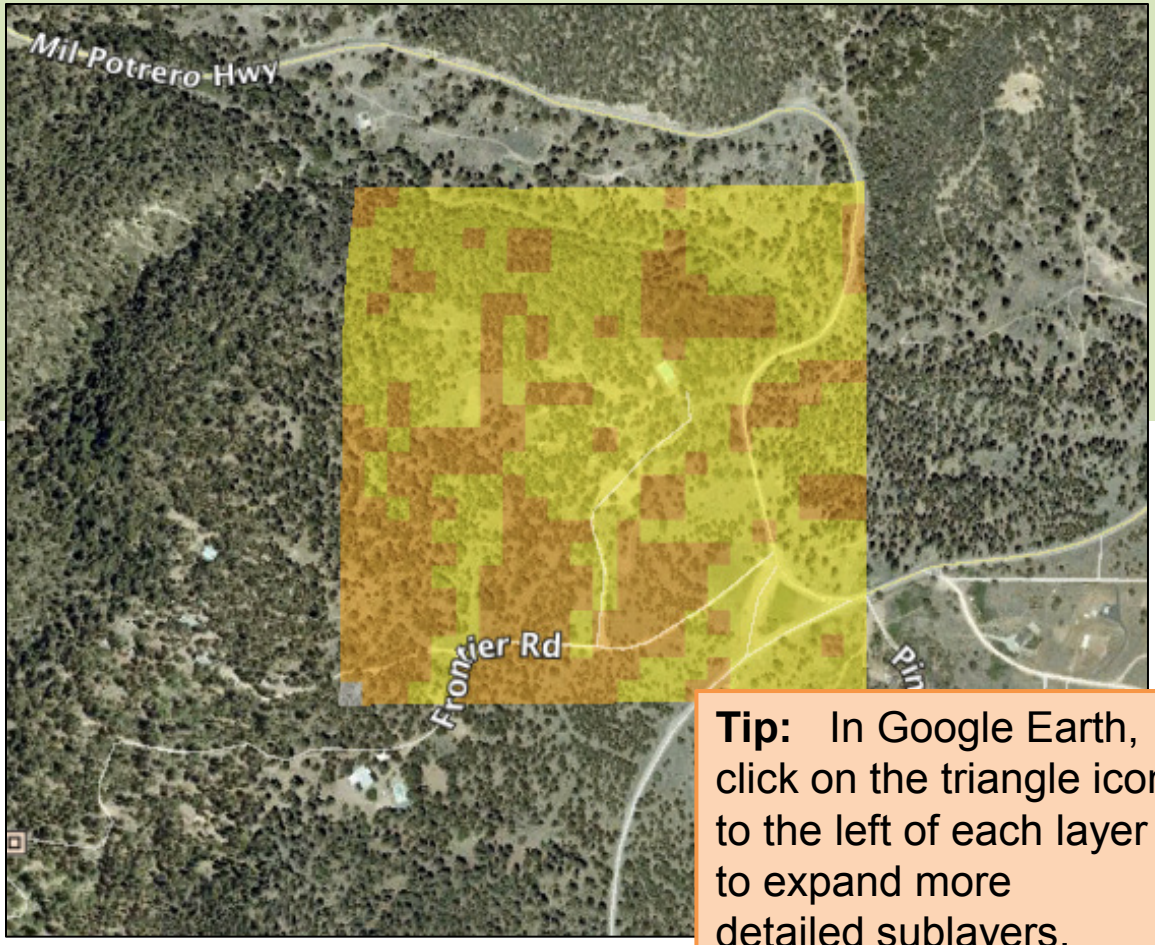
The input and output variables are now stored as layers in the “Temporary Places” folder within Google Earth. Unselect the fuel model and **Flame Length**, and select **Crown Fire Activity**.



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.



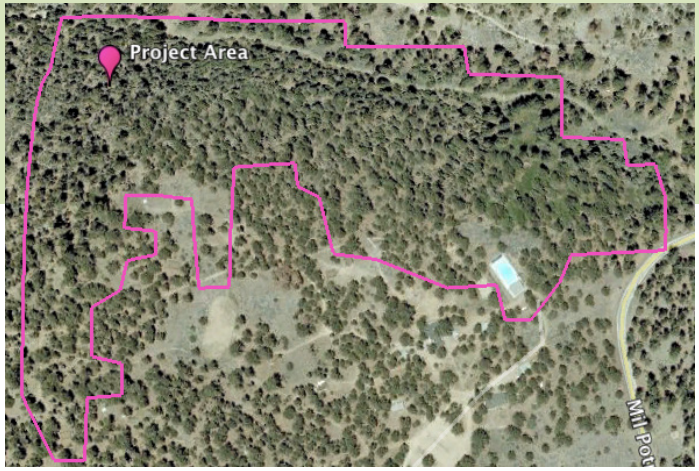
Tip: In Google Earth, click on the triangle icon to the left of each layer to expand more detailed sublayers.

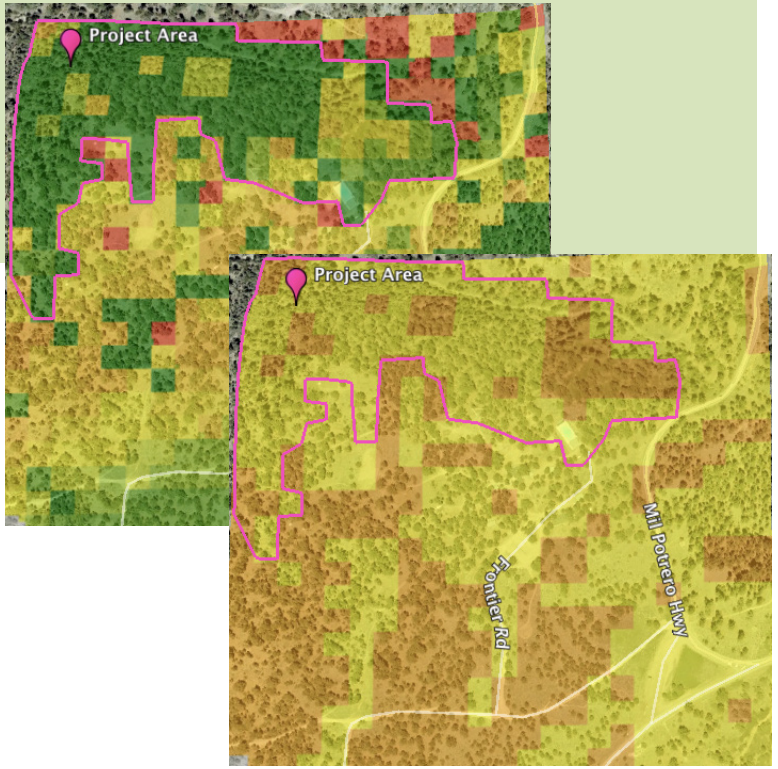
Reviewing Results in Google Earth

In this example, we are going to view our project area with the modeled fire behavior.

Using the **New Polygon** feature in Google Earth, we created a polygon around an area that we are interested in burning. We labeled this polygon "Project Area" using the placemark feature.

Now, we will compare our desired fire behavior parameters (surface fire with minimal torching and ≤ 4 foot flame lengths) to the modeled fire behavior within and outside the project area.





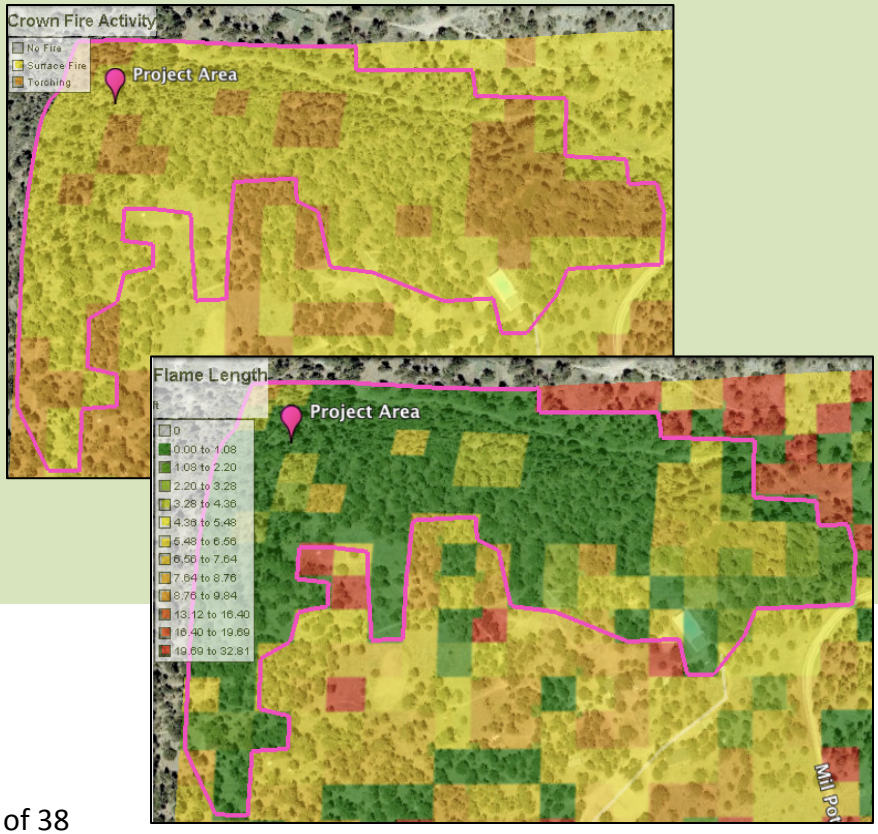
Note: Pages 32-37 show module input and output variables in the Google Earth environment.

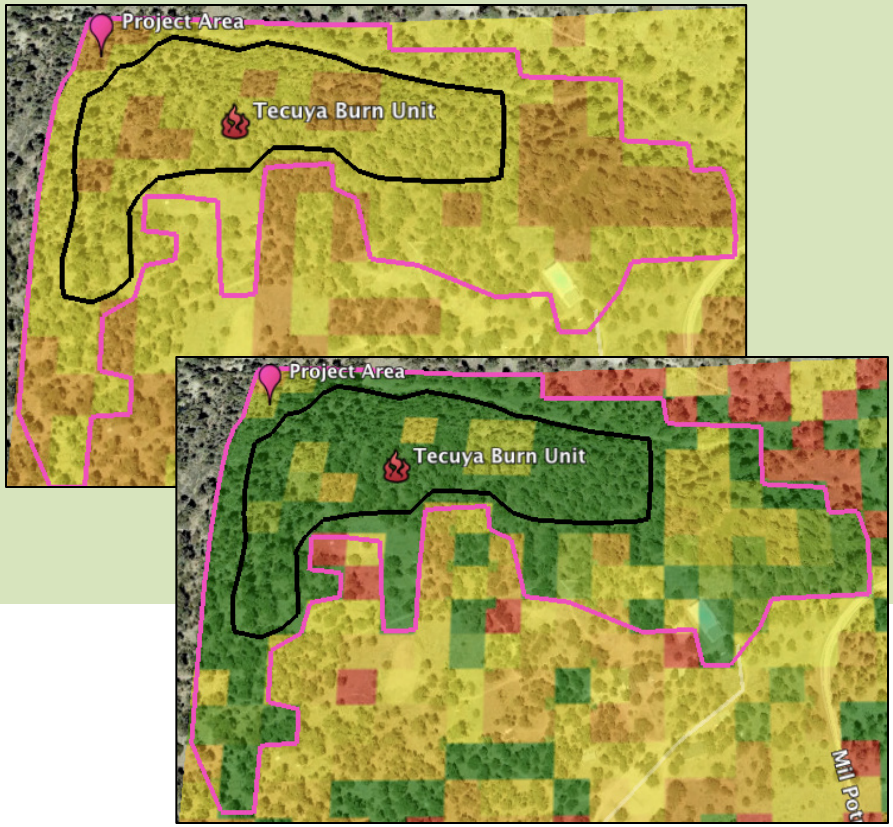
Reviewing Results in Google Earth

There are multiple patches of forest predicted to be “torching” fires (top – light orange) within and adjacent to our project area. There are also several areas where flame lengths are > 4 feet (bottom – yellow, orange, and red).

This information can help determine areas of concern inside and outside the burn unit.

Using this information, as well as natural and man-made fire breaks, we are going to create a new polygon within the project area. This polygon is now the potential Burn Unit.





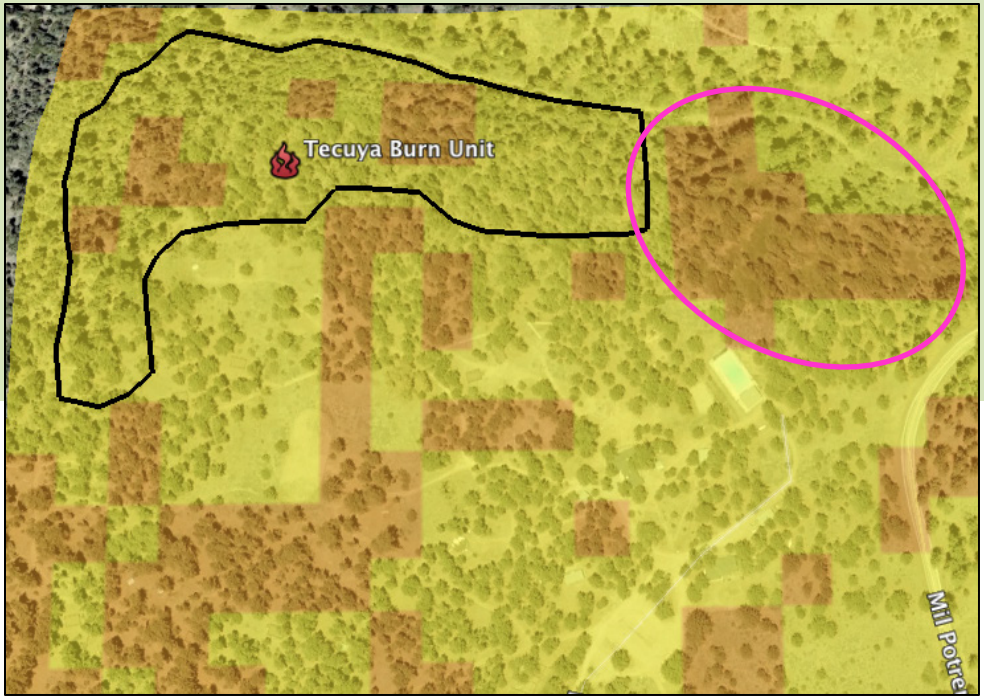
Reviewing Results in Google Earth

You can also view environmental and fire behavior characteristics outside the burn unit which can (1) help you locate critical holding points, vegetation changes, transportation routes, etc. and (2) aid in the development of contingency and holding plans.

In this example, there is a large patch of forest at risk for torching adjacent to the burn unit (circled). This information can help with the development of a holding plan.

Possible actions to reduce the risk of an escaped fire are to establish a wet line along the east boundary and to position a lookout in an area that allows for good viewing of the outside area at risk for torching.

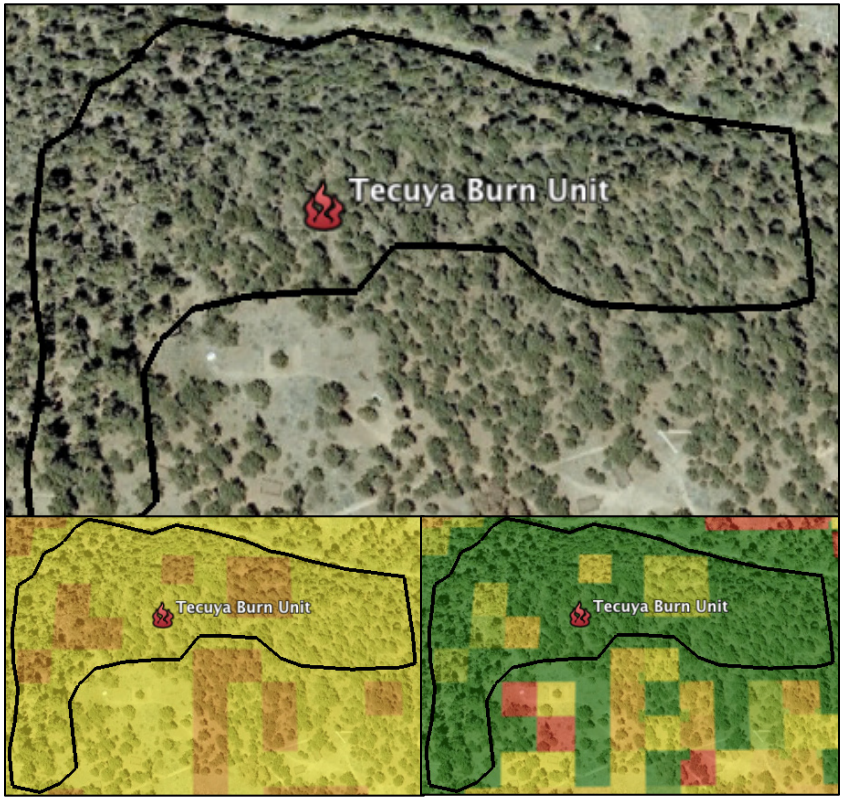
The small patches of forest at risk for torching within the burn unit may require fuels treatment prior to the burn.



Review

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

- Review and edit spatial landscape data.
- Model “high limits” for the environmental parameters required to meet prescribed fire plan objectives.
- Establish potential burn unit boundaries using the modeled fire behavior parameters (IFT-FlamMap).
- Identify potential fire hazards outside the burn unit to help develop holding and contingency plans.



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.