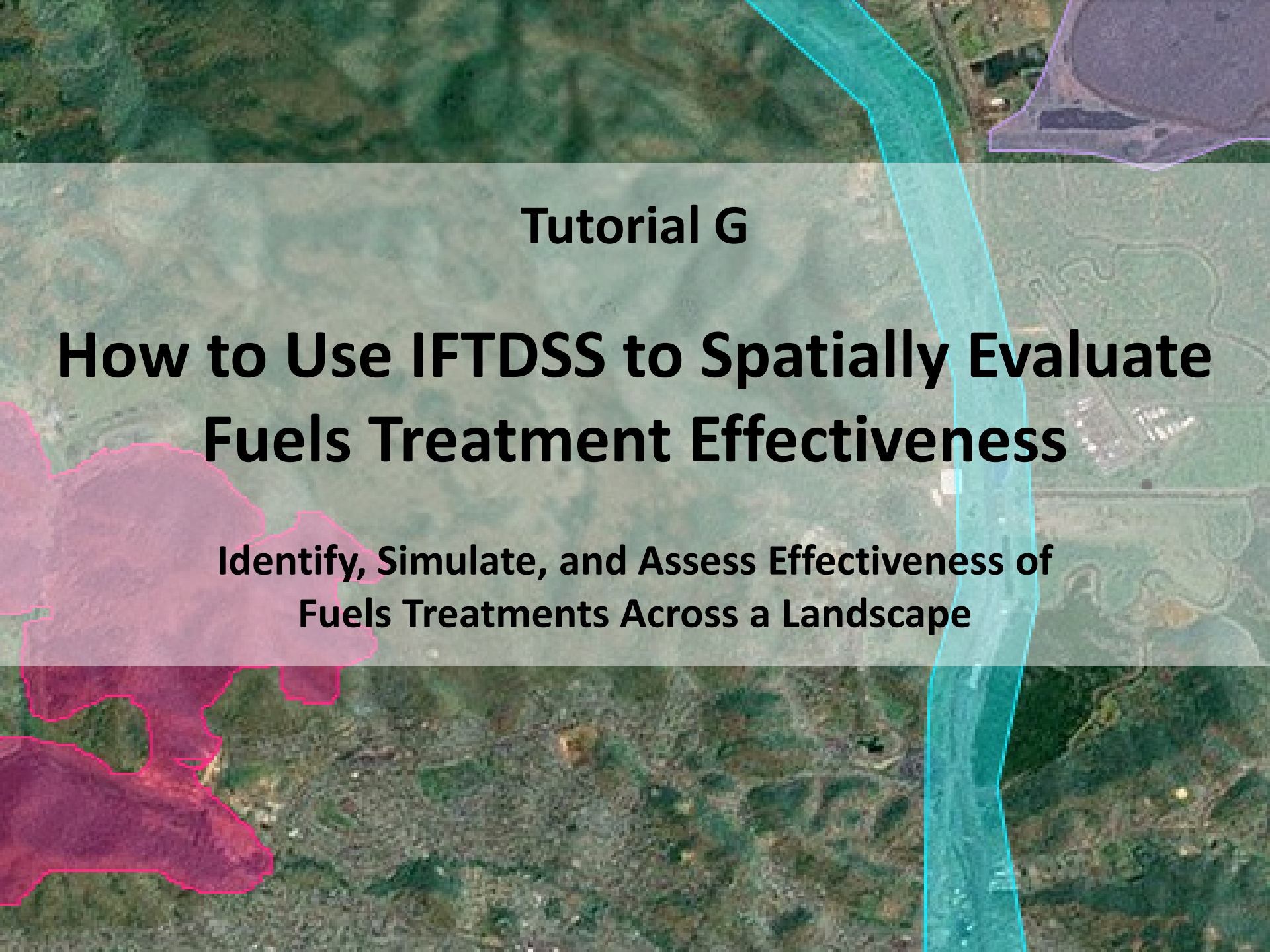


Tutorial G

How to Use IFTDSS to Spatially Evaluate Fuels Treatment Effectiveness

Identify, Simulate, and Assess Effectiveness of Fuels Treatments 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.
- Identifying fuels treatment locations and manipulating the LANDFIRE data to reflect fuels treatments.
- Reviewing pre- and post-treatment fire behavior to evaluate fuels treatment effectiveness.
- Discussing fuels treatment caveats.

Introduction

You can use the spatial “fuels treatment across a landscape” pathways to assess where to locate fuels treatments and to evaluate how effective fuels treatments are at mitigating fire behavior potentials in a spatial context.

You can simulate fuels treatments in a landscape by manually drawing polygons. To simulate treatments, you use a set of tools to manually edit a LANDFIRE .lcp file. With these tools, you can alter values within the fuels treatment polygon (fuel model, canopy height, canopy base height, canopy bulk density, and canopy coverage) to reflect a fuels treatment.

After creating and configuring these polygons, you then run spatial fire behavior modules such as IFT-FlamMap, IFT-MTT, and IFT-RANDIG across the untreated and treated landscape to compare possible effects of treating the fuels on subsequent fire behavior, fire growth, and burn probability.

IFTDSS produces digital maps of percent difference for fire behavior parameters to identify where positive and negative changes have occurred across the landscape because of modeled fuels treatments.

Introduction

The output from the fuels treatment workflow can be useful for

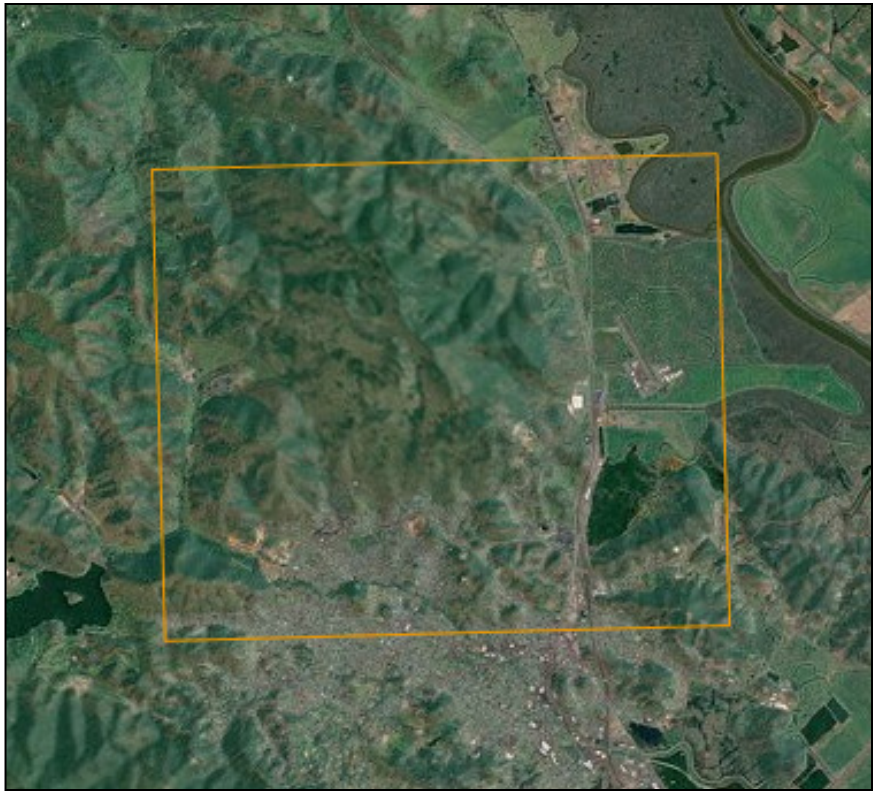
1. Identifying where fuels treatments may have the greatest influence for mitigating wildland fire at the stand or landscape scale.
2. Investigating the potential effectiveness of fuels treatments across spatial and temporal scales.
3. Providing tools and processes for fuels treatment planners to evaluate potential fuels treatment options, including no treatment, pile and burning, thin from below, thin by DBH, pile burn surface fuel, and prescribed burn at the stand level.

The following tutorial focuses on using the IFTDSS system to (1) identify where fuels treatments may have the greatest influence for mitigating wildland fire at the landscape scale, and (2) investigate the potential effectiveness of fuels treatments across spatial scales.

Tutorial Objectives

- Walk step by step through a fuels treatment pathway in IFTDSS.

  There are multiple ways that fuels treatment effectiveness can be addressed. This tutorial uses one possible set of criteria for identifying fuels treatment locations and evaluating the effectiveness of fuels treatments, while introducing some of the functionality within IFTDSS.
- Identify where to perform fuels treatments based on high fire hazard potentials surrounding the Olompali State Historic Park (located near Novato, California).
- Investigate the potential effectiveness of fuels treatments on mitigating modeled fire behavior at the landscape level.
- Discuss caveats to this approach.



Getting Started

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

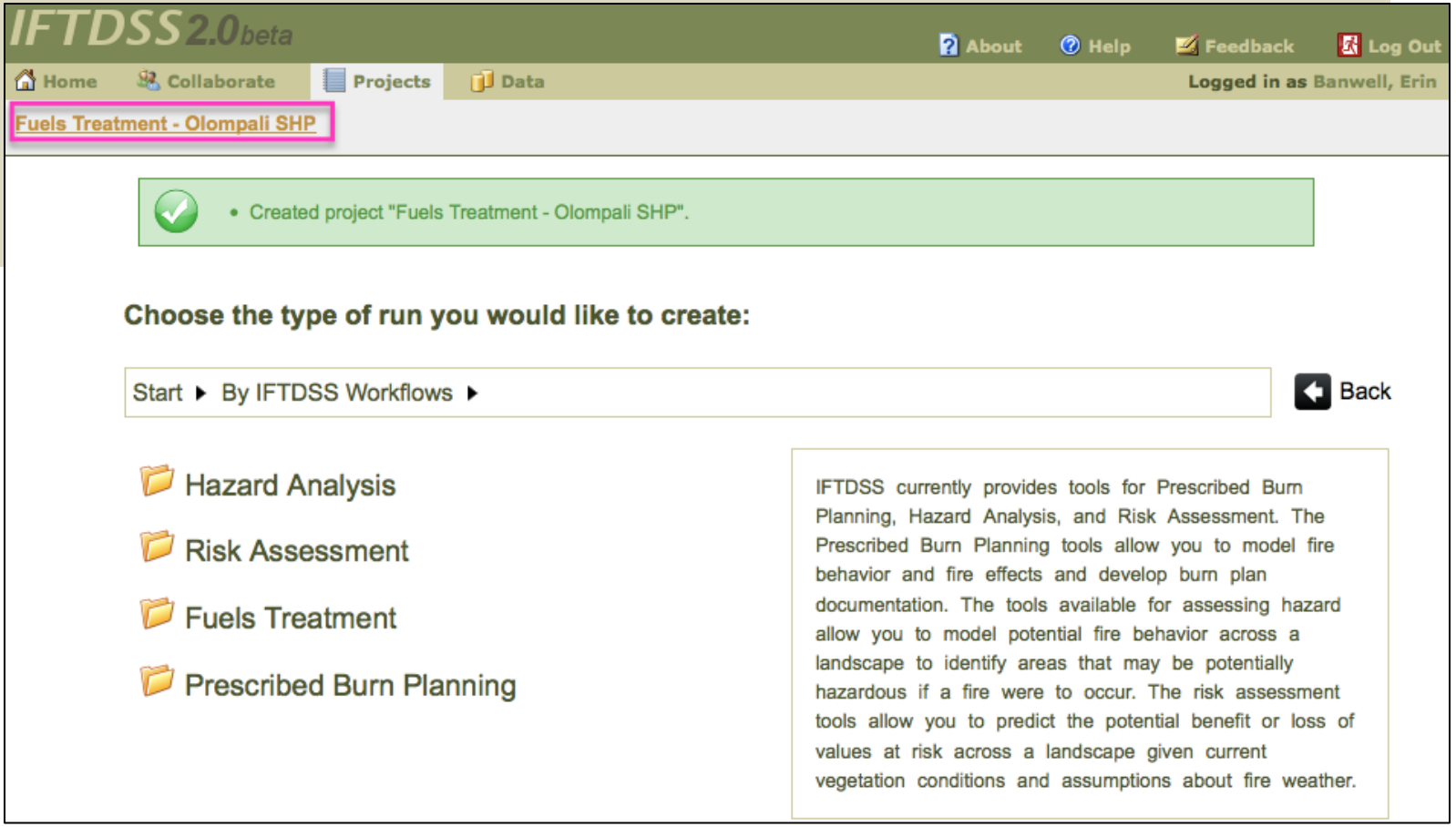
- Choose a descriptive project name.
- If desired, fill in the optional information.

Choose **Next**.

Getting Started

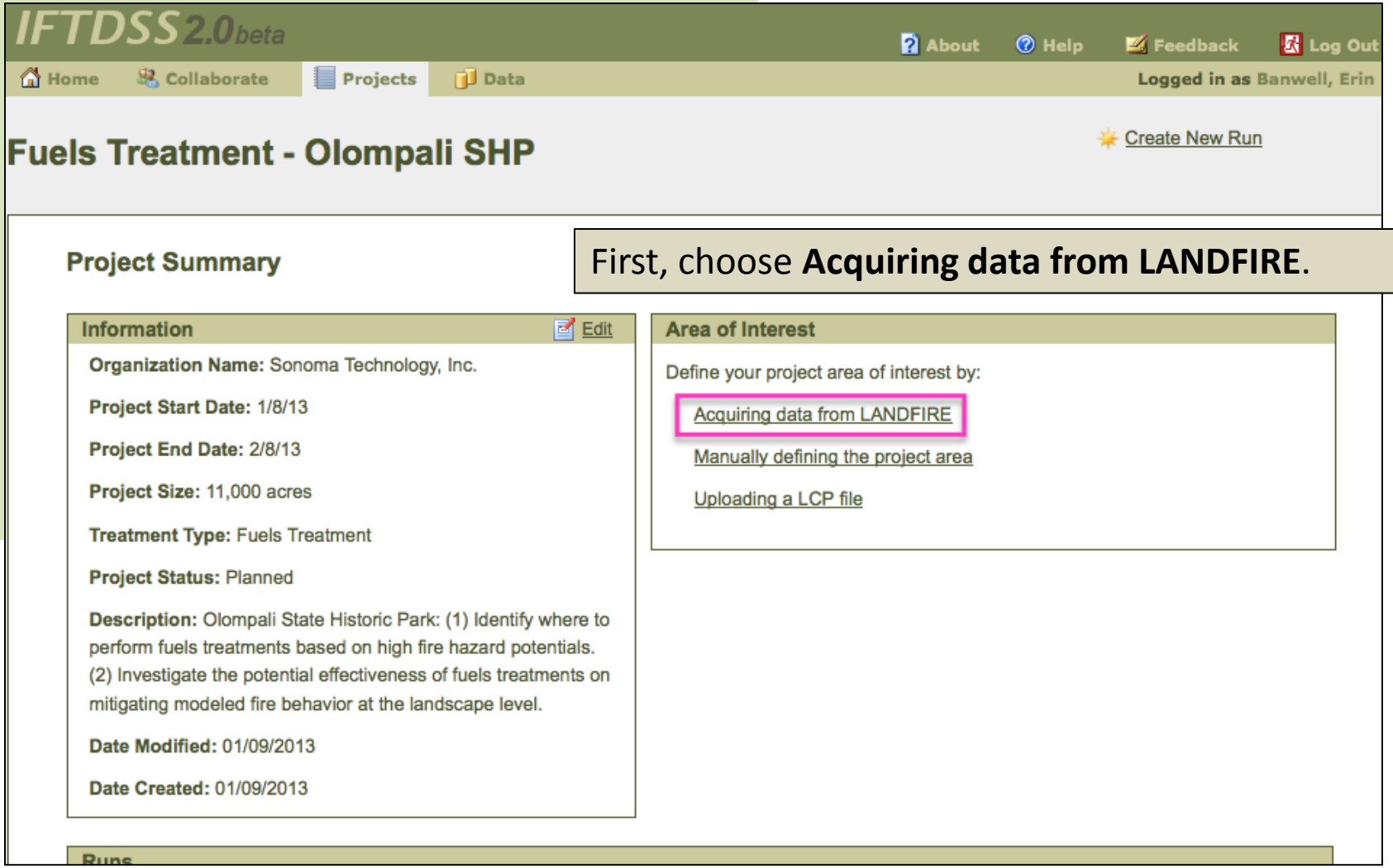
After creating a new project, you will see the page for creating a new run. The next step is to acquire LANDFIRE data, so we are going to navigate away from this page.

Access the project you created. In this example, we chose the **Fuels Treatment – Olompali SHP** link.



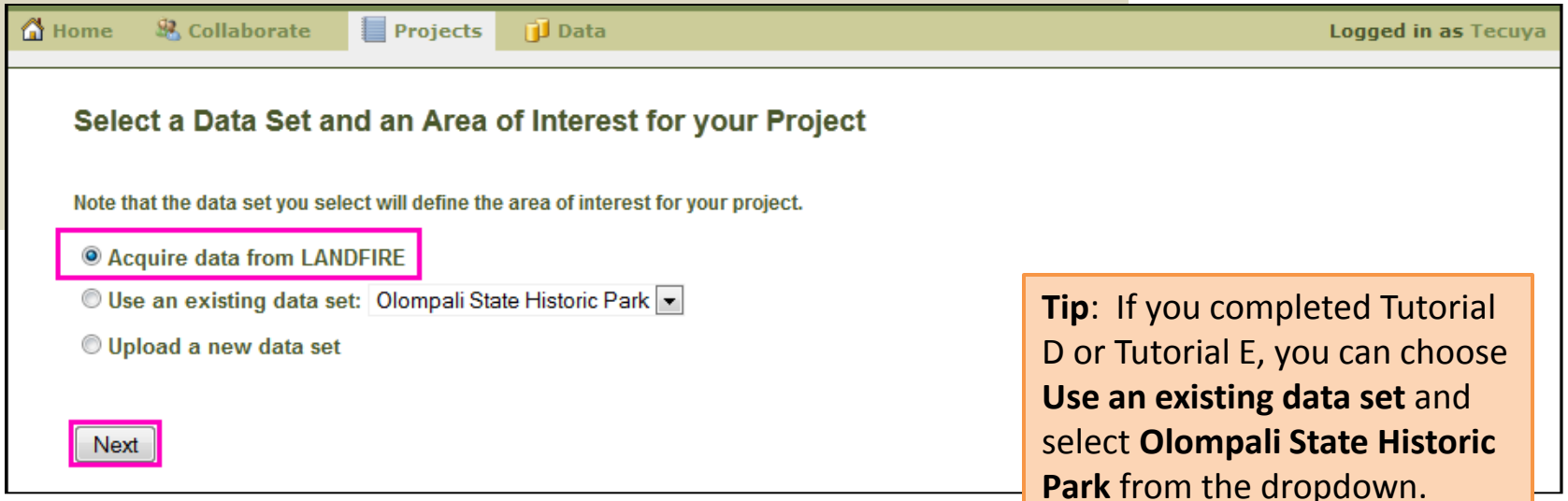
Getting Started

Now, we will acquire data from LANDFIRE.



Getting Started

Select **Acquire data from LANDFIRE**, and then choose **Next**.

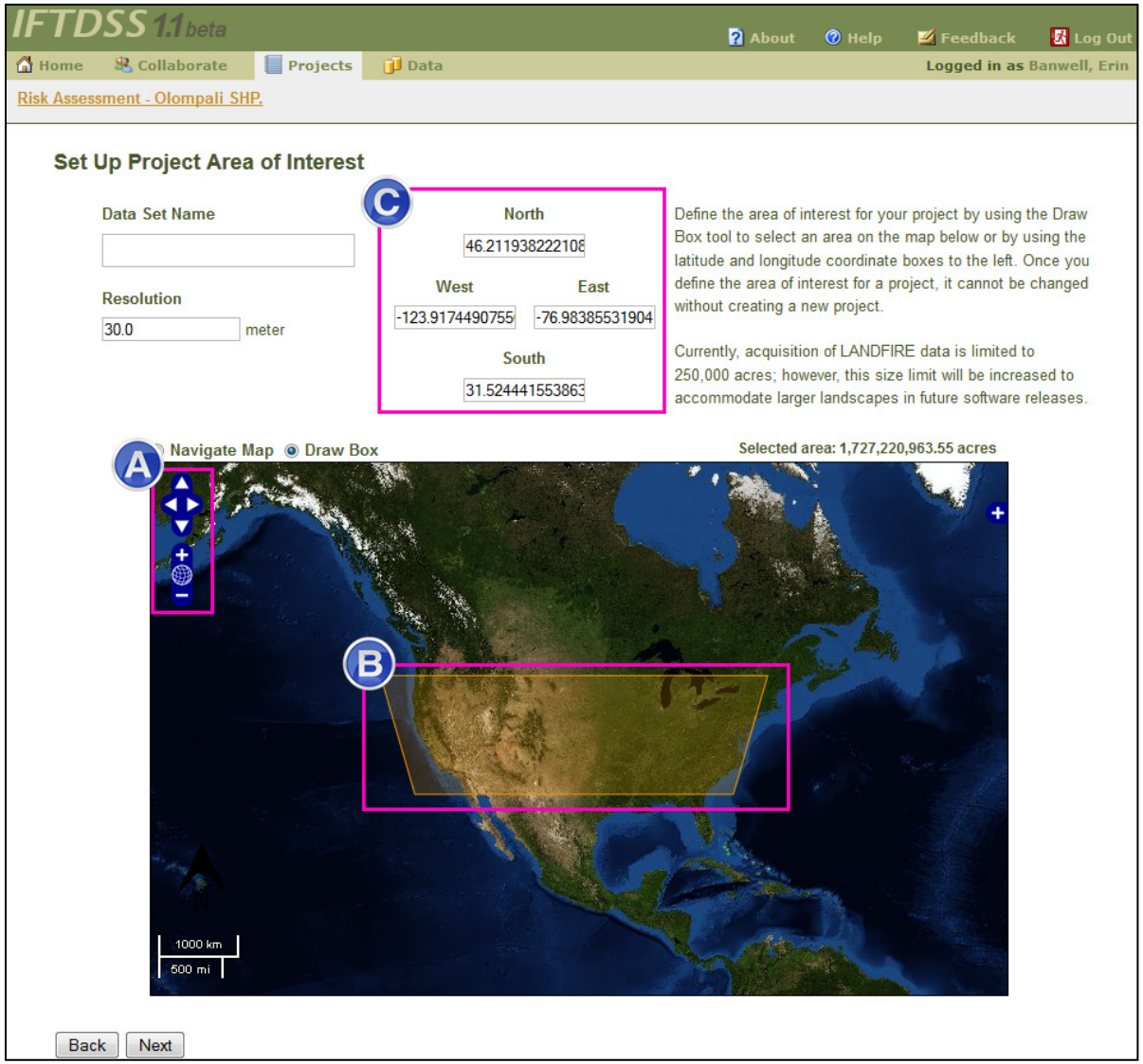


Tip: If you completed Tutorial D or Tutorial E, you can choose **Use an existing data set** and select **Olompali State Historic Park** from the dropdown. Then choose **Next** and skip to page 13.

Selecting a Project Area of Interest

Navigate to your desired location using one of these methods:

- **A** Use the navigation tools located in the top left portion of the map.
- **B** Use the mouse. Click and drag to move; double-click to zoom in.
- **C** **Enter coordinates.**



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

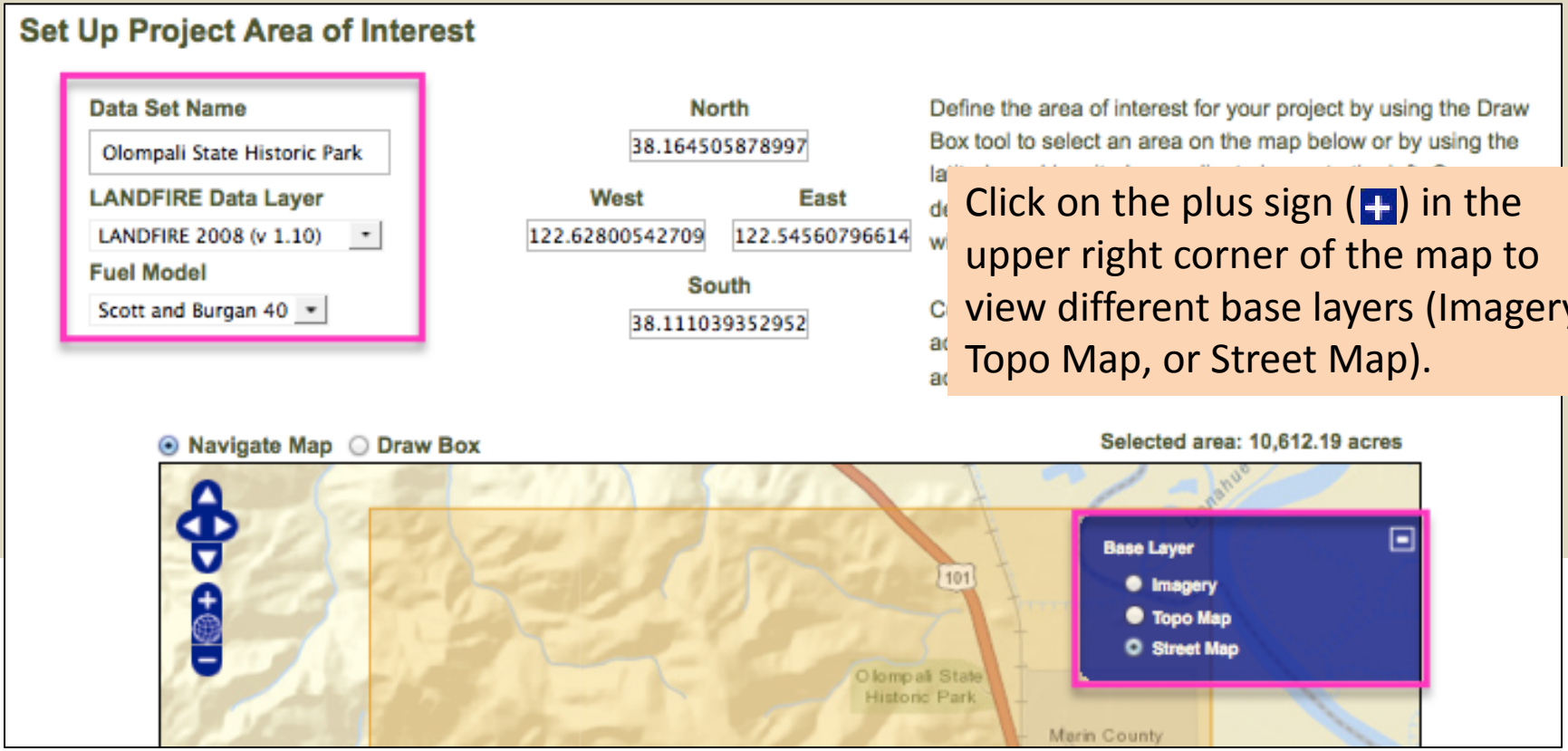
- **North:** 38.164505878997
- **East:** -122.54560796614
- **South:** 38.111039352952
- **West:** -122.62800542709

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 from 2001).

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

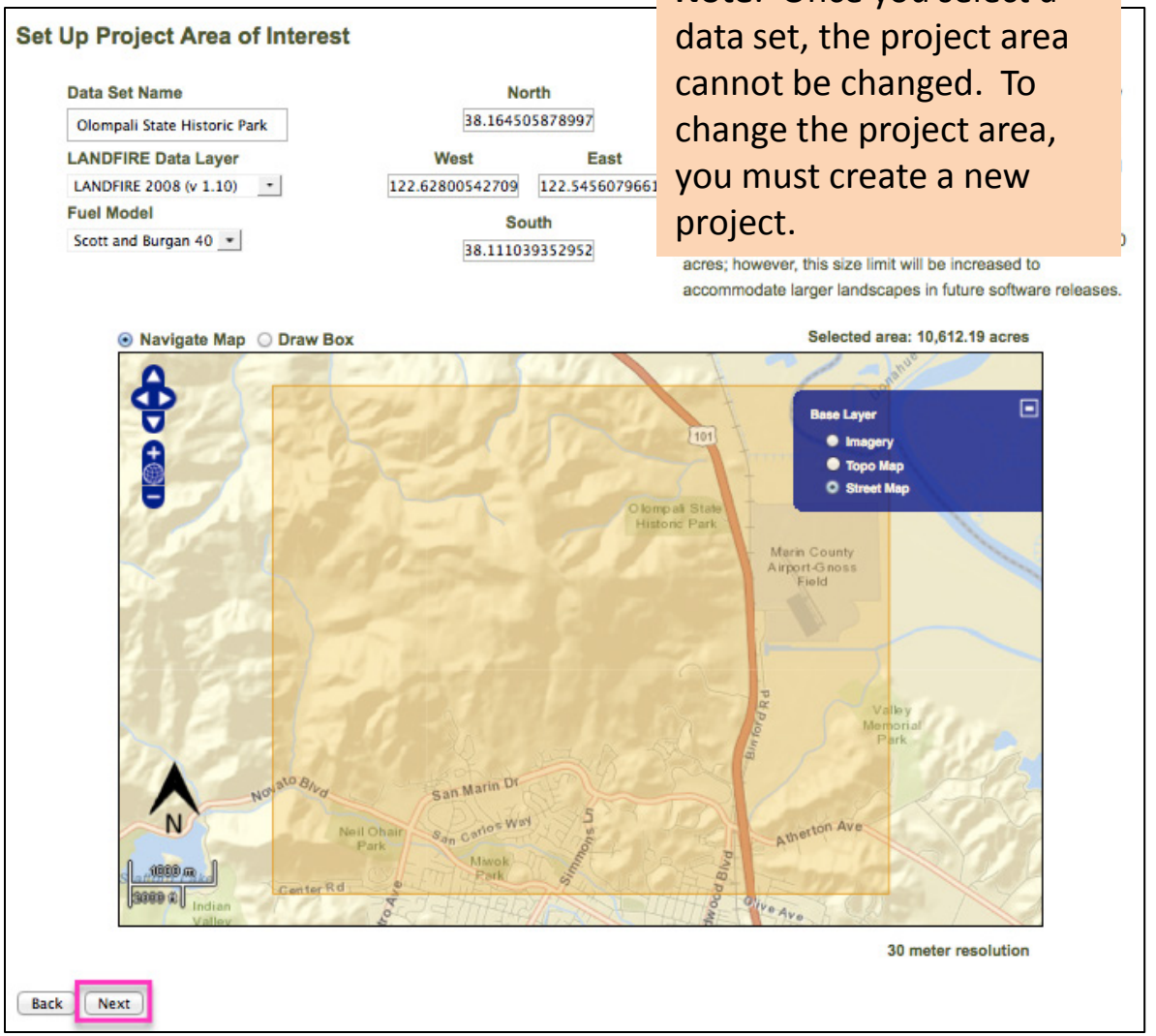
Choose **Next** to import LANDFIRE data.

There will be a short wait while IFTDSS imports the LANDFIRE data.

Tip: In this type of fuels treatment assessment, 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 where fuels treatments may be warranted.

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.

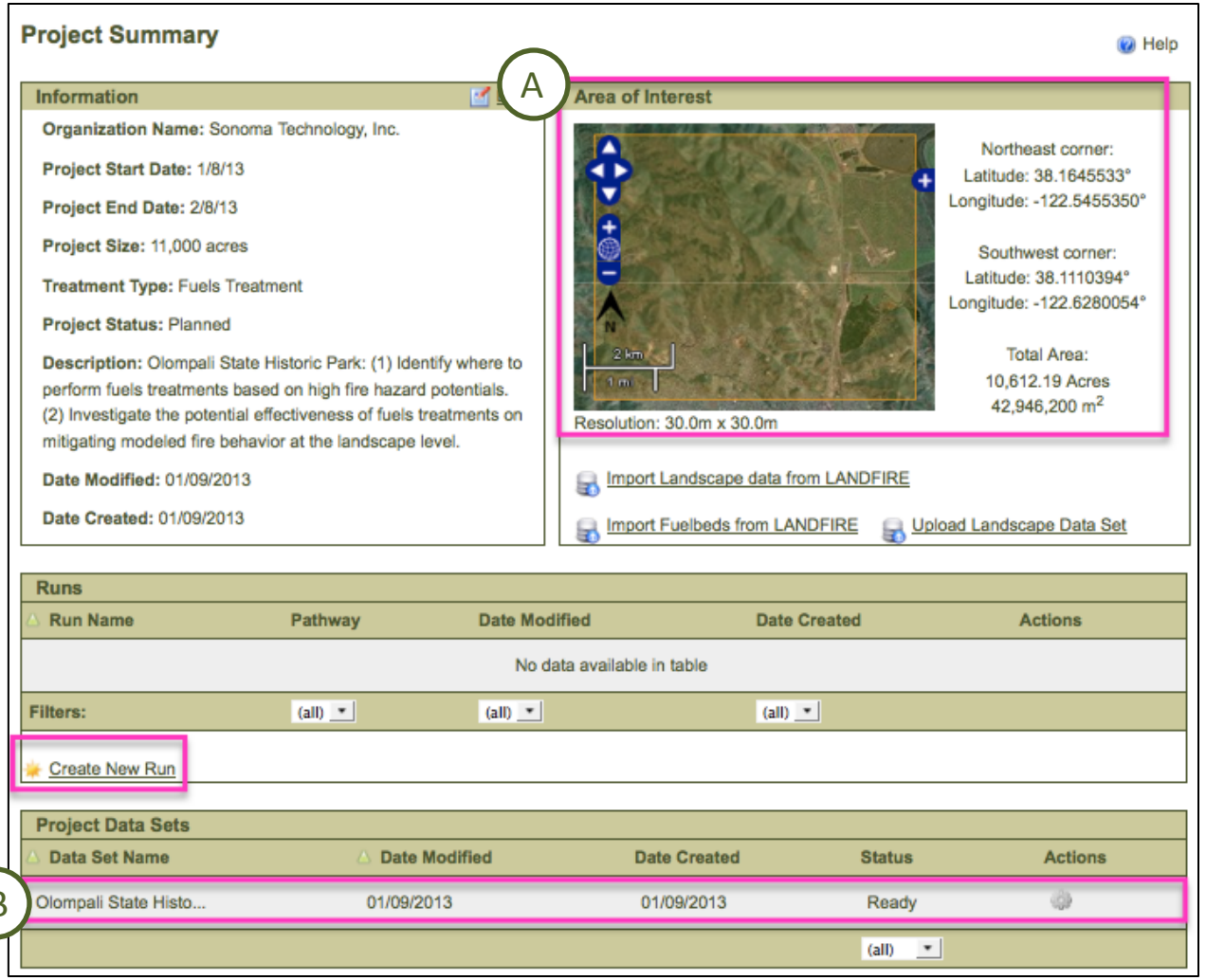
For use in spatial modules, you now have

A a Project Area of Interest

and

B a Project Data Set.

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



Creating a New Run

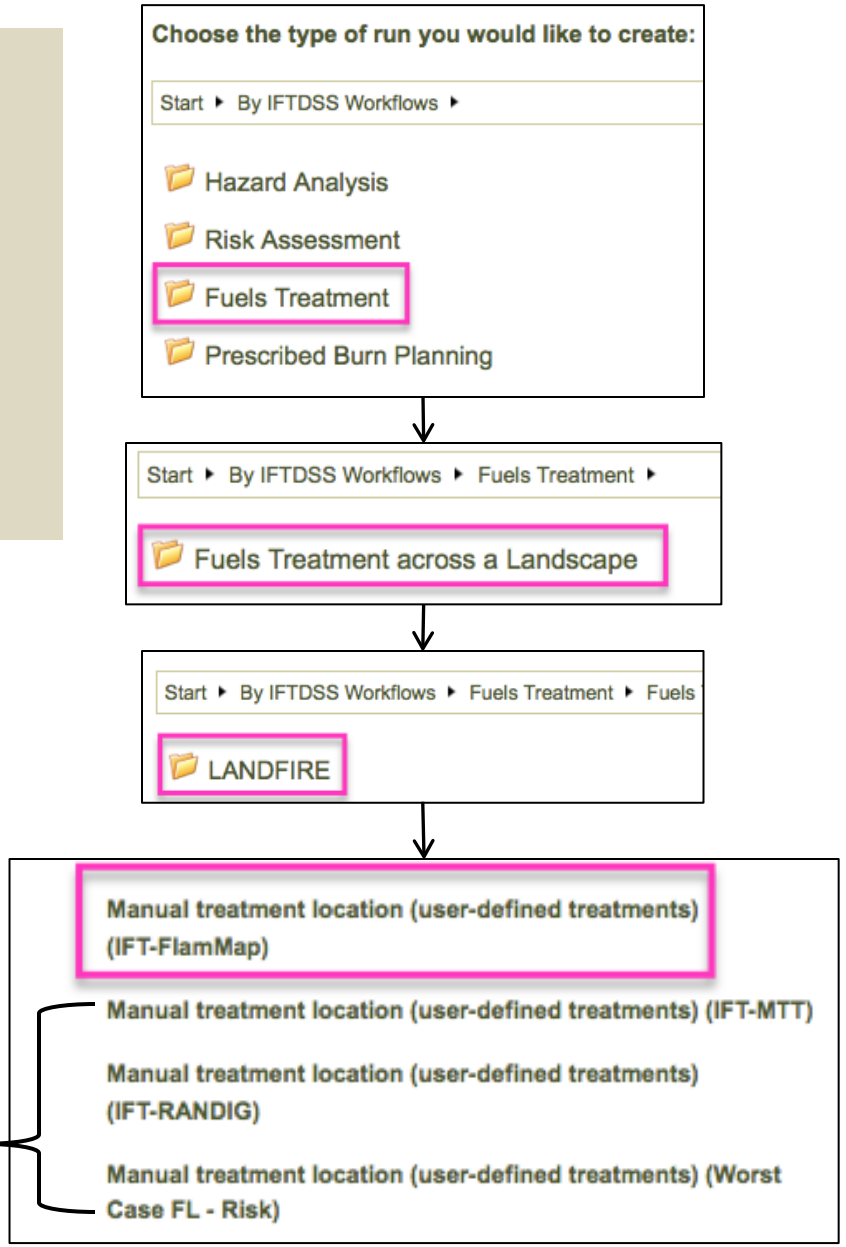
Choose the type of run you would like to create by **choosing the following links:**

Fuels Treatment
→ Fuels Treatment across a Landscape
→ LANDFIRE
→ Manual treatment location (user-defined treatments) (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 and identify fuels treatment locations.
e. Manipulate the LANDFIRE data to reflect fuels treatments.
f. Review pre- and post-treatment fire behavior to evaluate fuels treatment effectiveness.

Note: Later you may want to model the same area using IFT-MTT, IFT-RANDIG, and/or the Worst Case Flame Length Risk pathways.

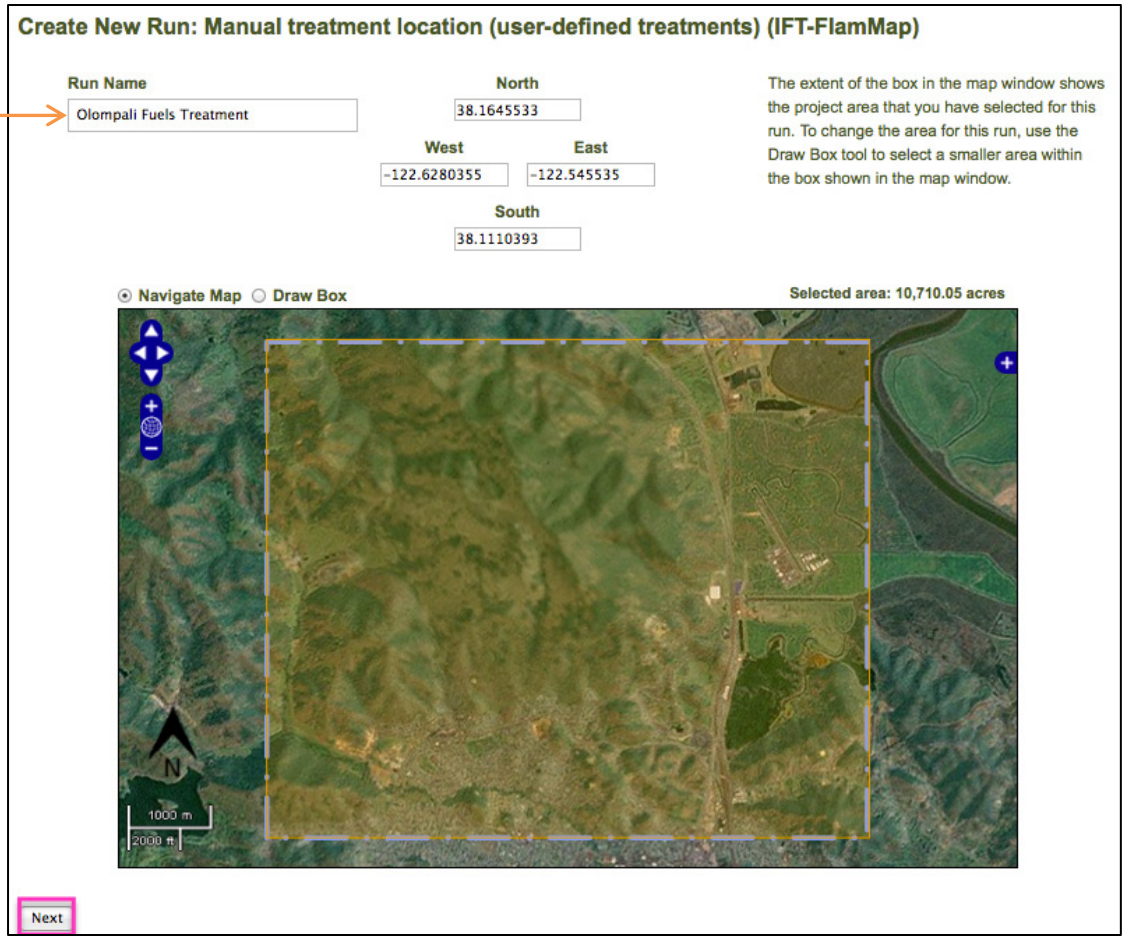


Selecting an Area of Interest

Tip: Give your runs descriptive names for future reference.

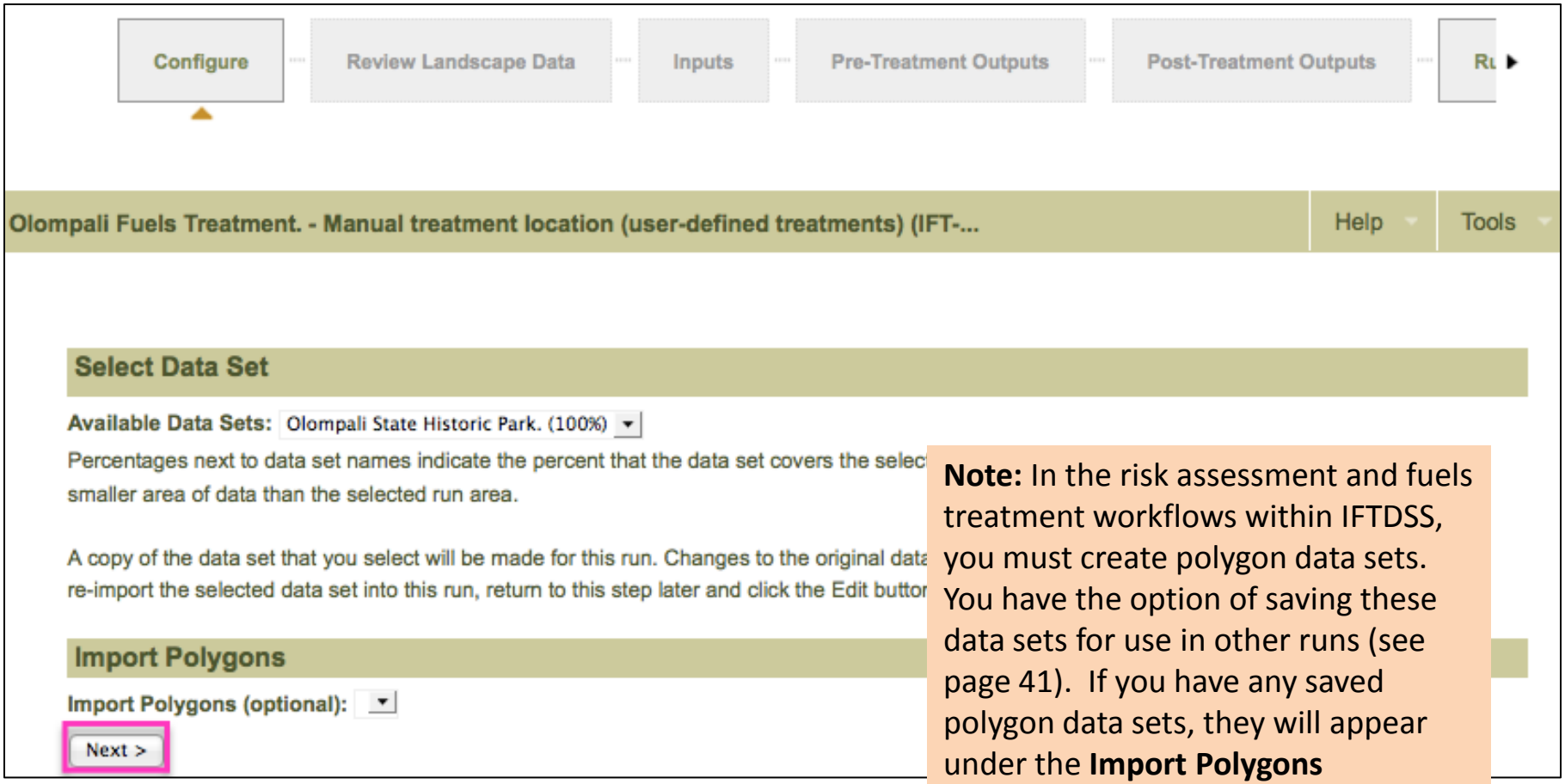
In this step, select an area of interest within the project boundary. For this example, we selected the entire project boundary. This approach is useful if you want to model fire behavior across a landscape.

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



Selecting a Data Set

Select the “Olompali State Historic Park (100%)” data set and choose **Next**, which takes you to the Review Landscape Data step.



Note: In the risk assessment and fuels treatment workflows within IFTDSS, you must create polygon data sets. You have the option of saving these data sets for use in other runs (see page 41). If you have any saved polygon data sets, they will appear under the **Import Polygons** dropdown.

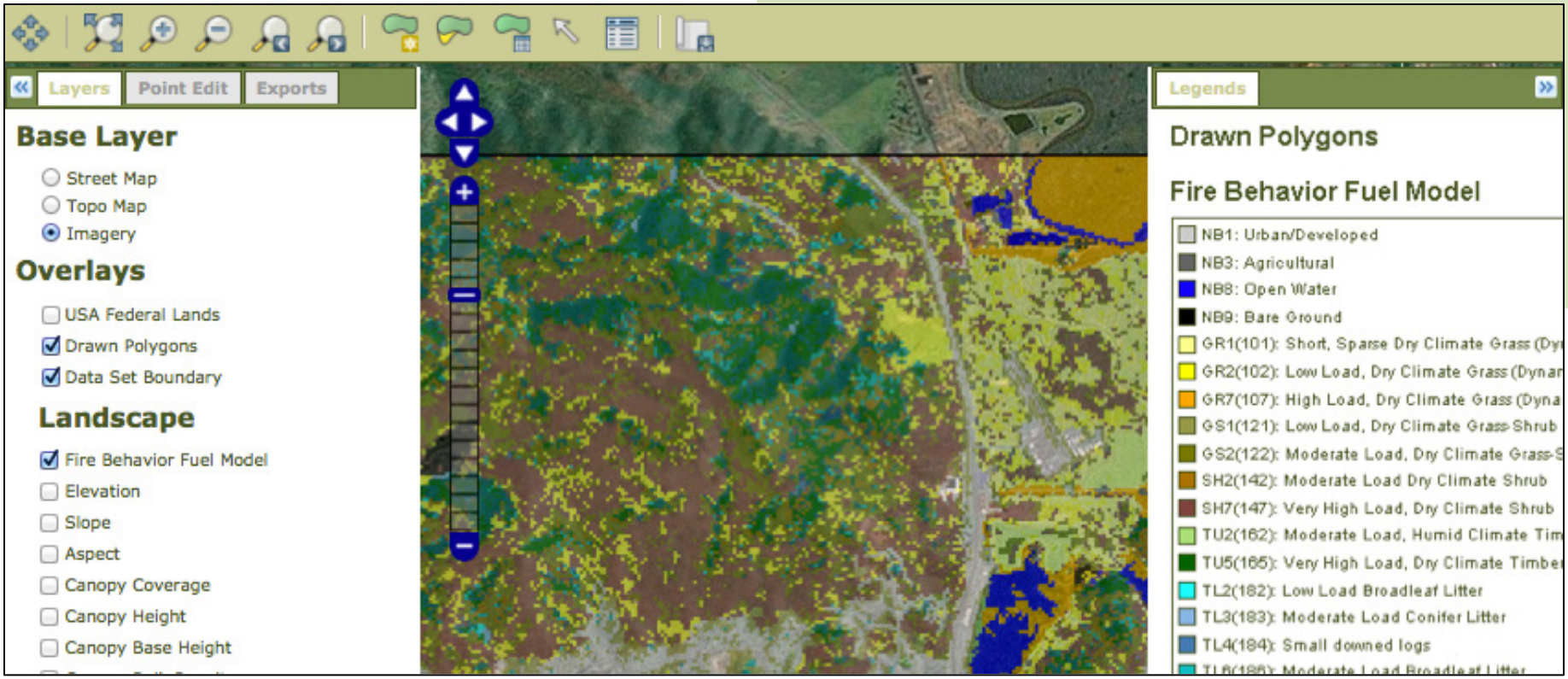
Introducing the Map Toolbar

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

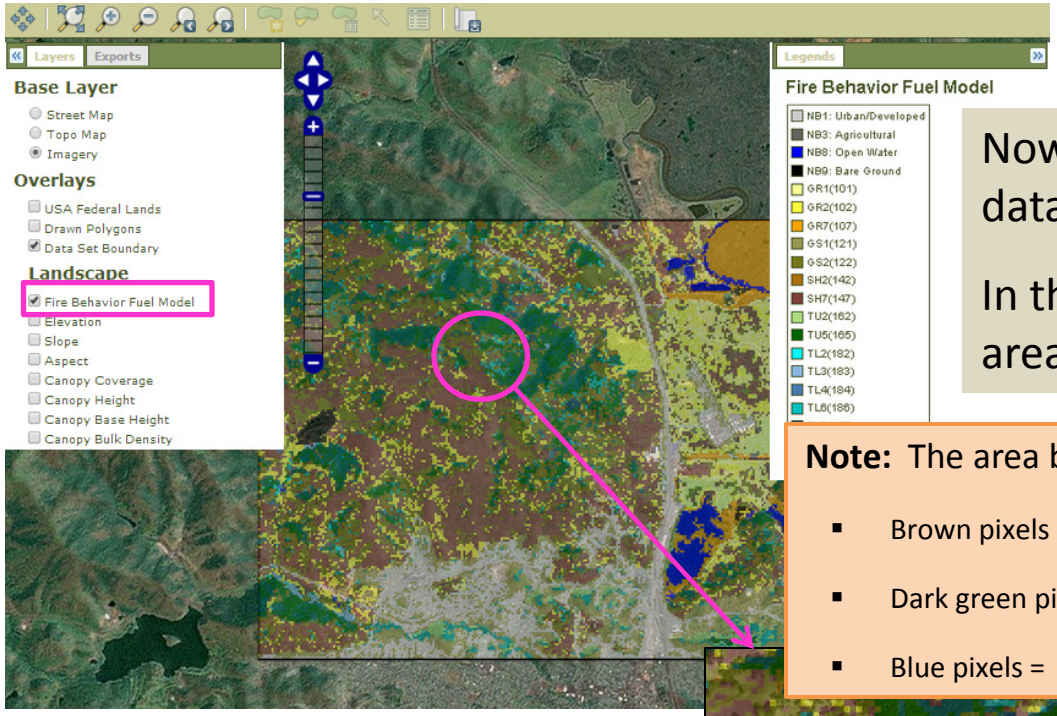
Now you are on the **Review Landscape Data** step.

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.



Reviewing Spatial Landscape Data

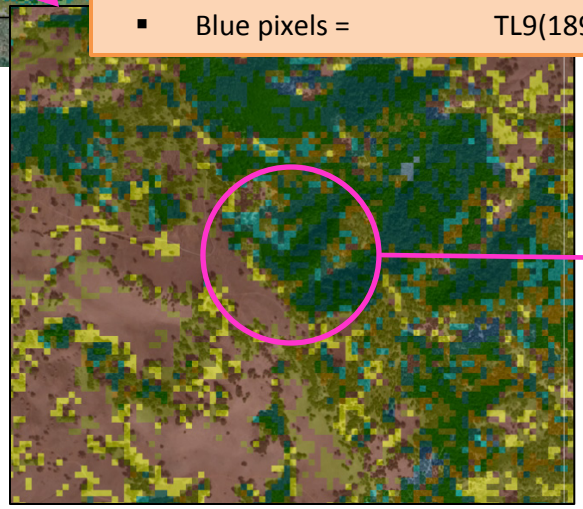


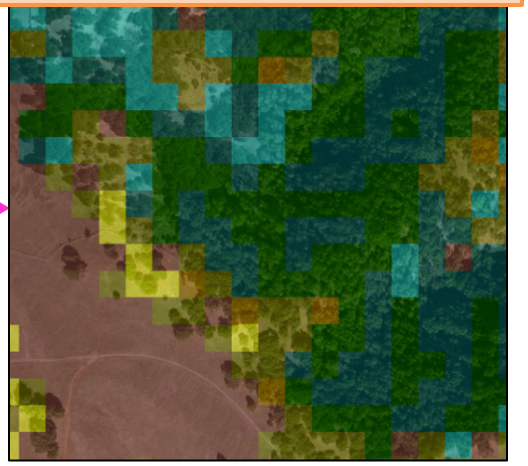
Now you can review your spatial landscape data using the map.

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:

- Brown pixels = SH7(148): Very high load, dry climate shrub
- Dark green pixels = TU5(165): Very high load, dry climate timber-shrub
- Blue pixels = TL9(189): Very high load broadleaf litter





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

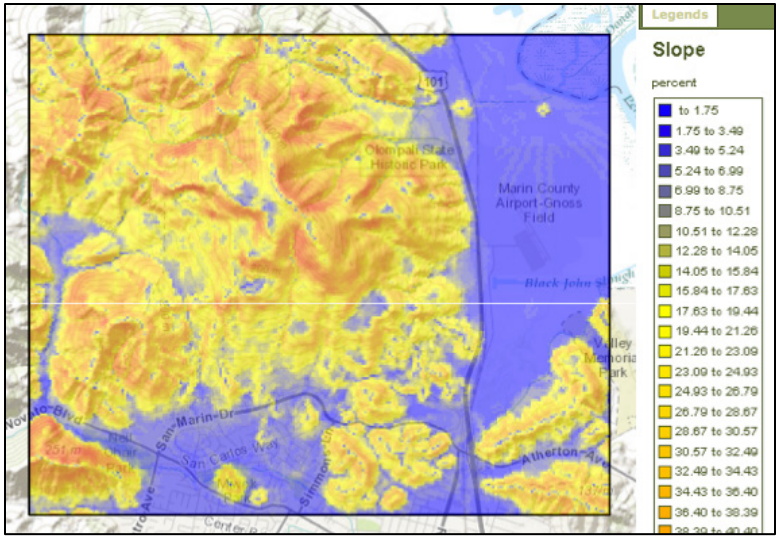
Reviewing Spatial Landscape Data

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



Canopy Height (street view)

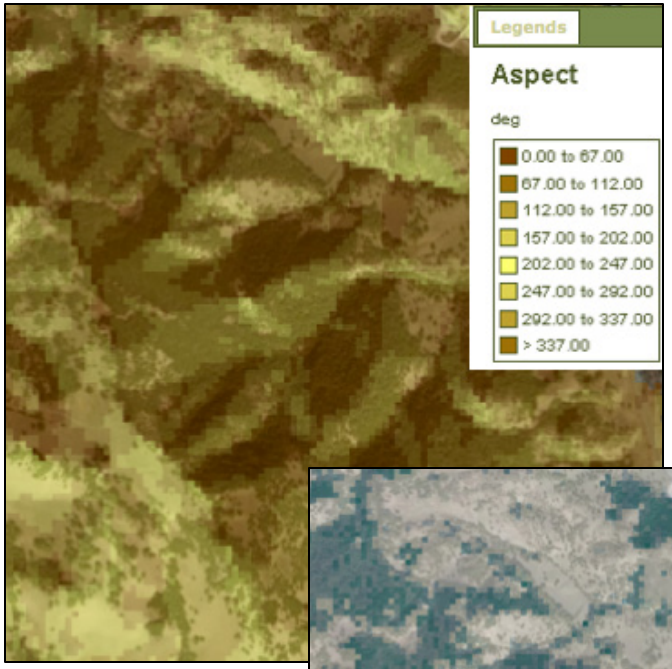
Reviewing Spatial Landscape Data

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

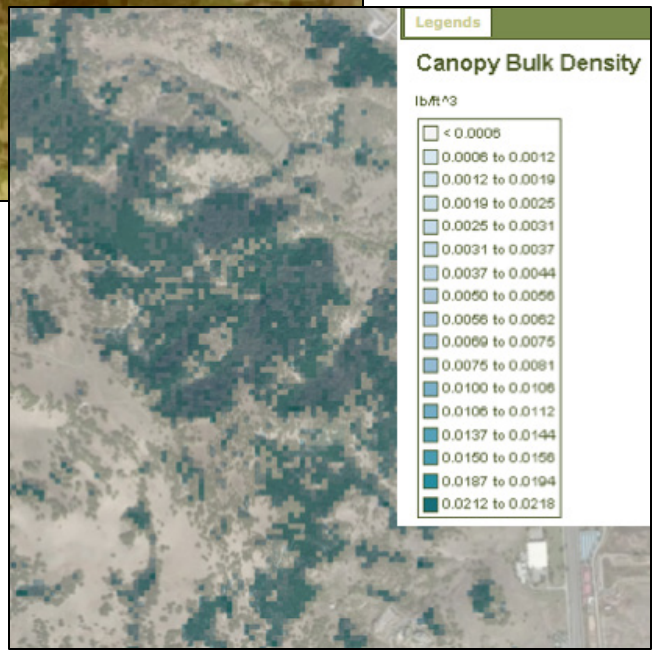
Recognizing the spatial influence of these variables is important to fuels treatment placement because spatial patterns of landscape composition and structure influence fire spread and intensity.

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

Aspect



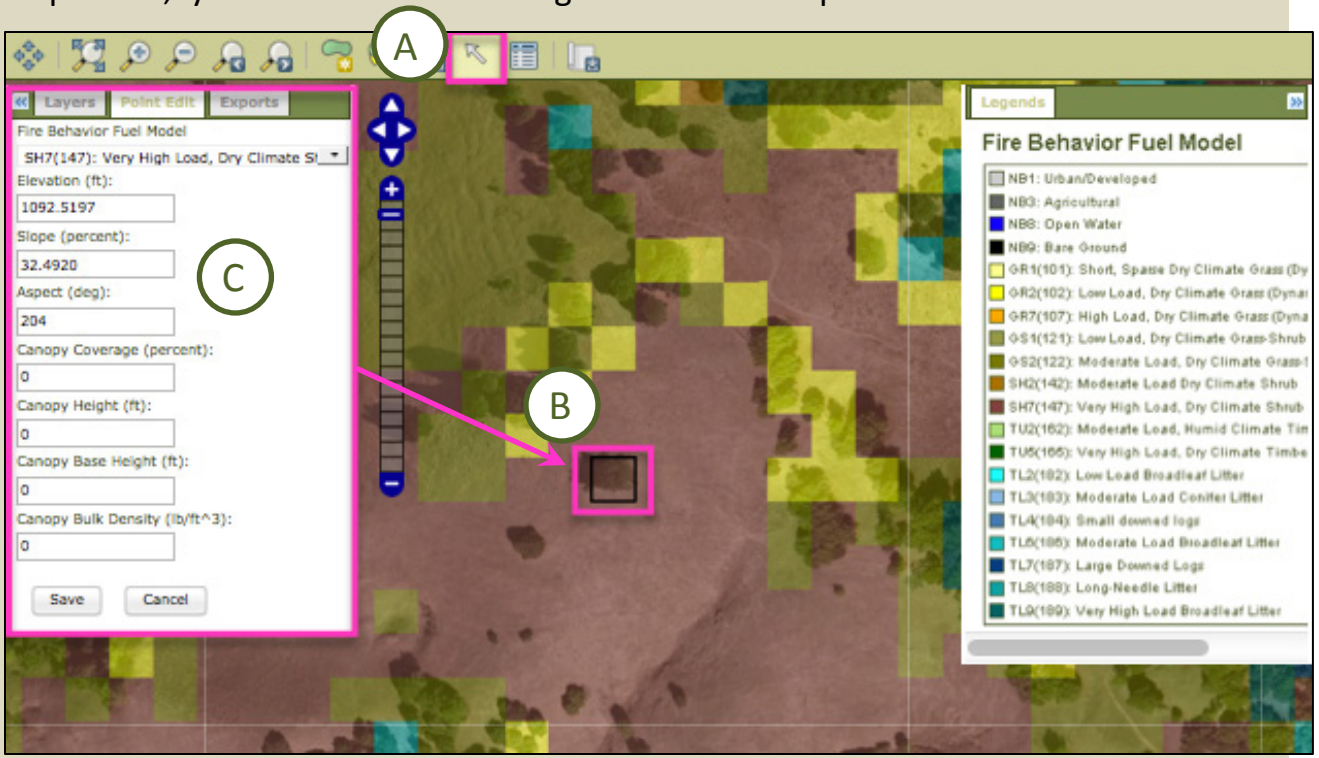
Canopy Bulk Density



Editing Spatial Landscape Data (One Grid at a Time)

If you need to edit the spatial landscape data, you can use 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.

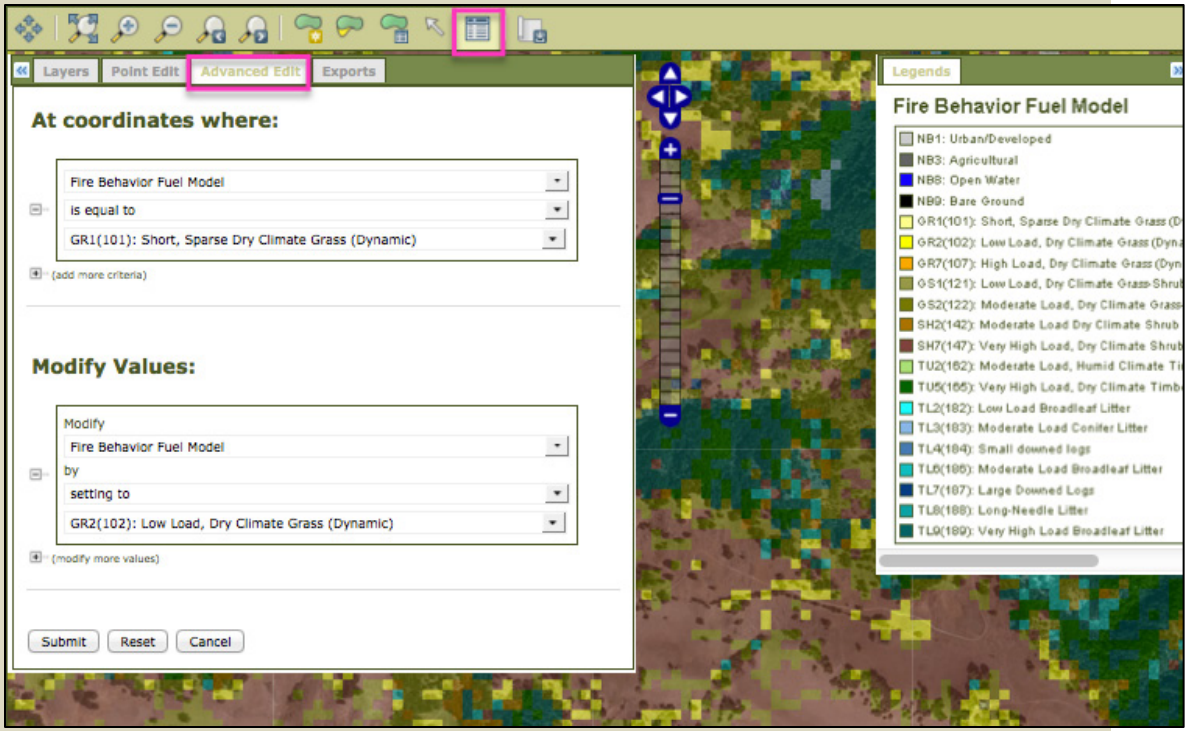
Editing Spatial Landscape Data (Multiple Grids Across the Run Area)

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.

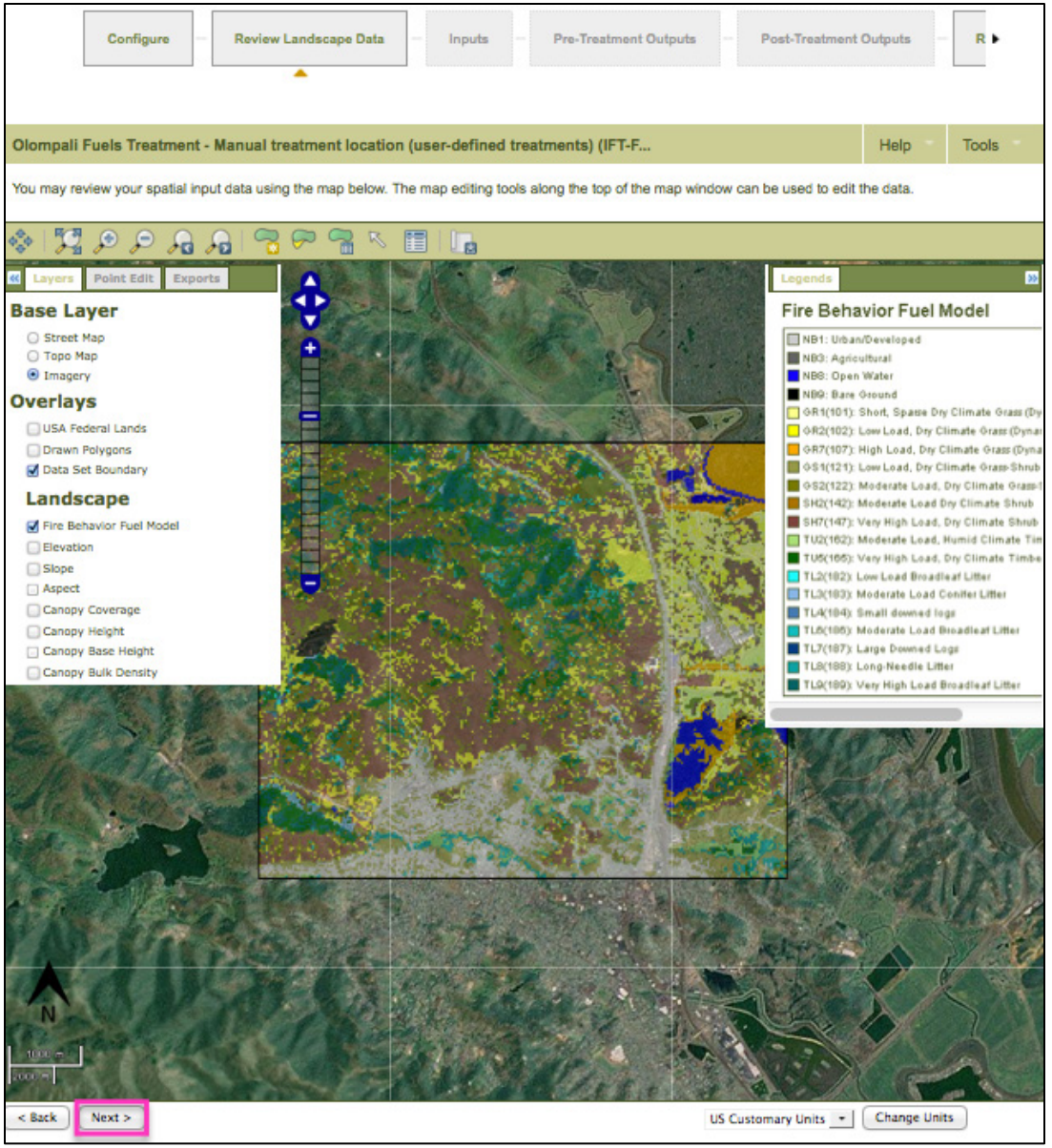
In this panel, you can modify any of the spatial data in query format so that multiple cells can be changed at once.

To learn how to edit pixels using the **Polygon Advanced Edit** tool, see pages 37 through 40.

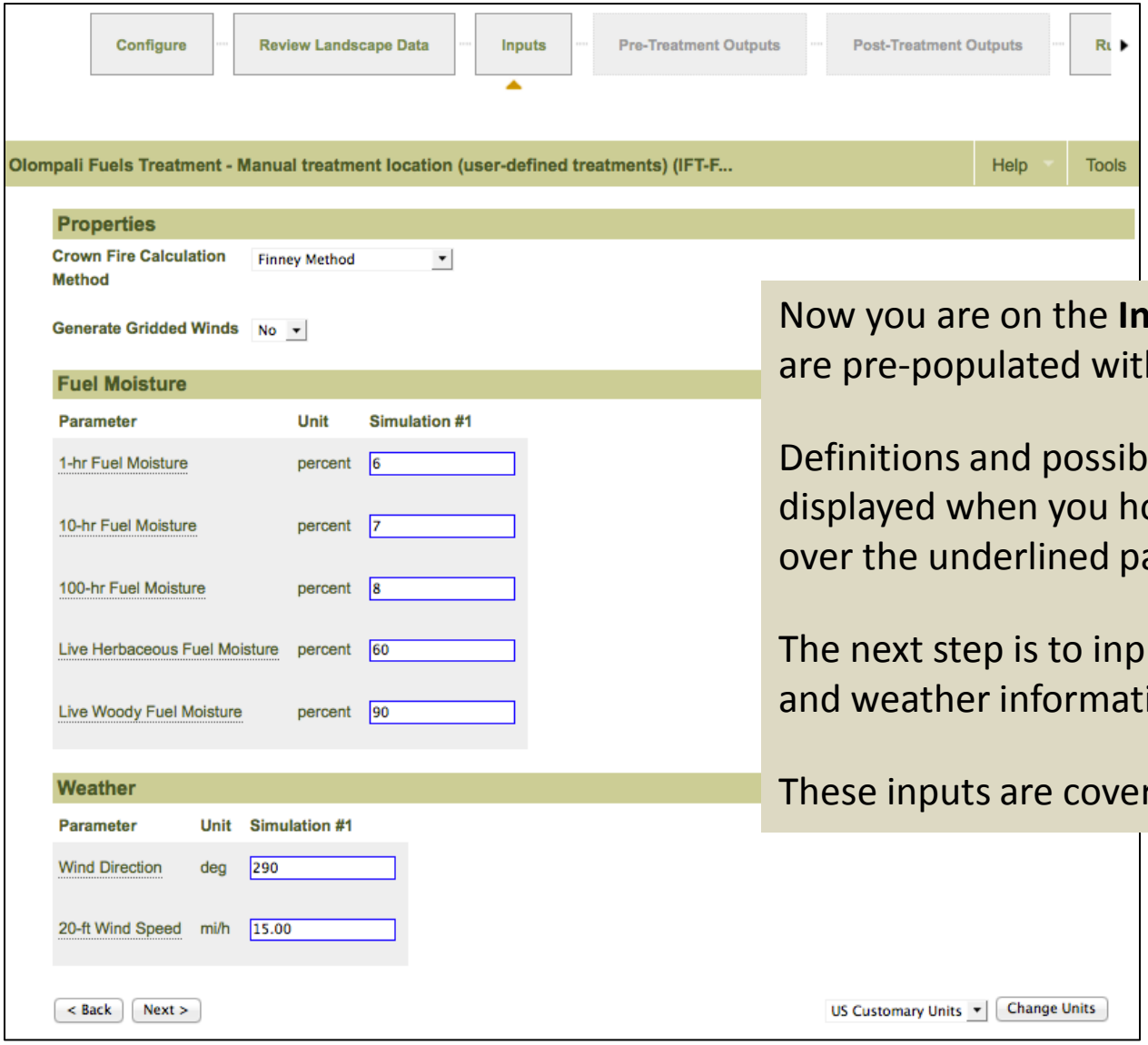


Reviewing Spatial Landscape Data

After reviewing and editing the spatial landscape data, choose **Next**. This 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 are displayed when you hover your mouse cursor 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, wind speed, and wind direction.

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

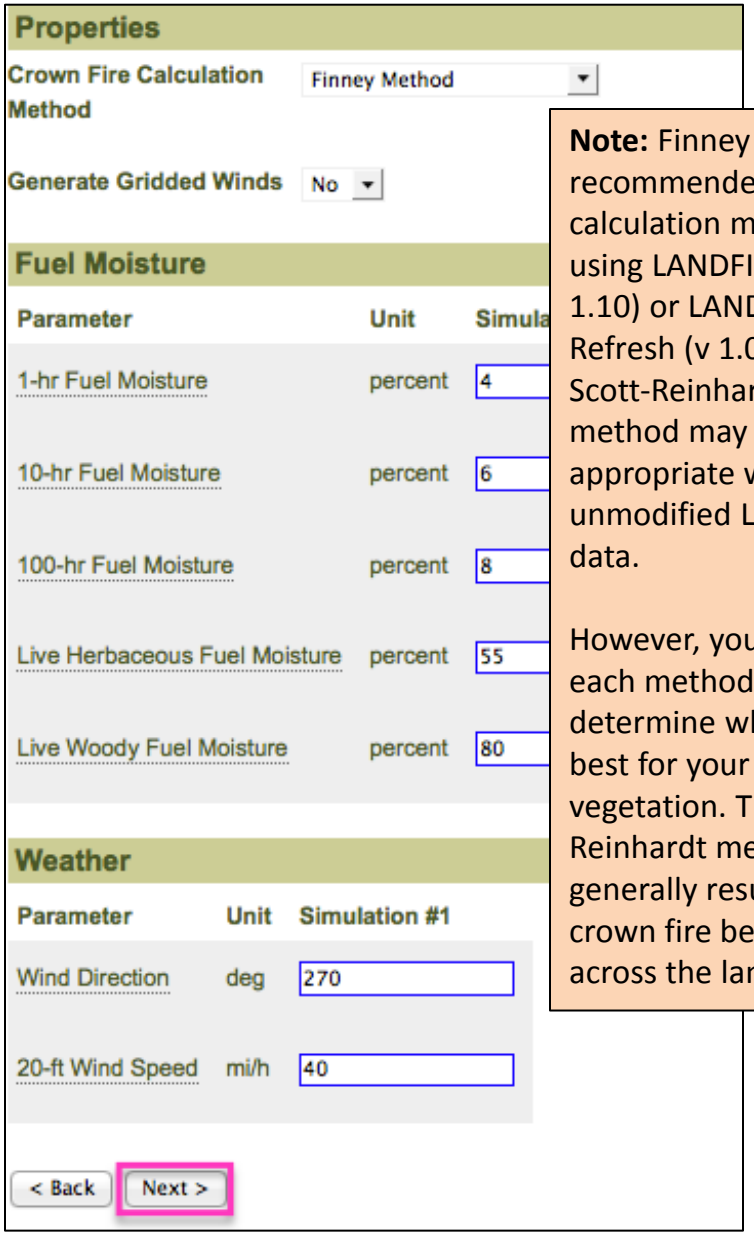
Create multiple runs to test different weather scenarios that can produce

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

For this example, we input environmental characteristics that would produce high fire behavior.

Choose **Next**, which takes you to the pre-treatment outputs step.

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



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 works best for your local vegetation. The Scott-Reinhardt method will generally result in more crown fire being modeled across the landscape.

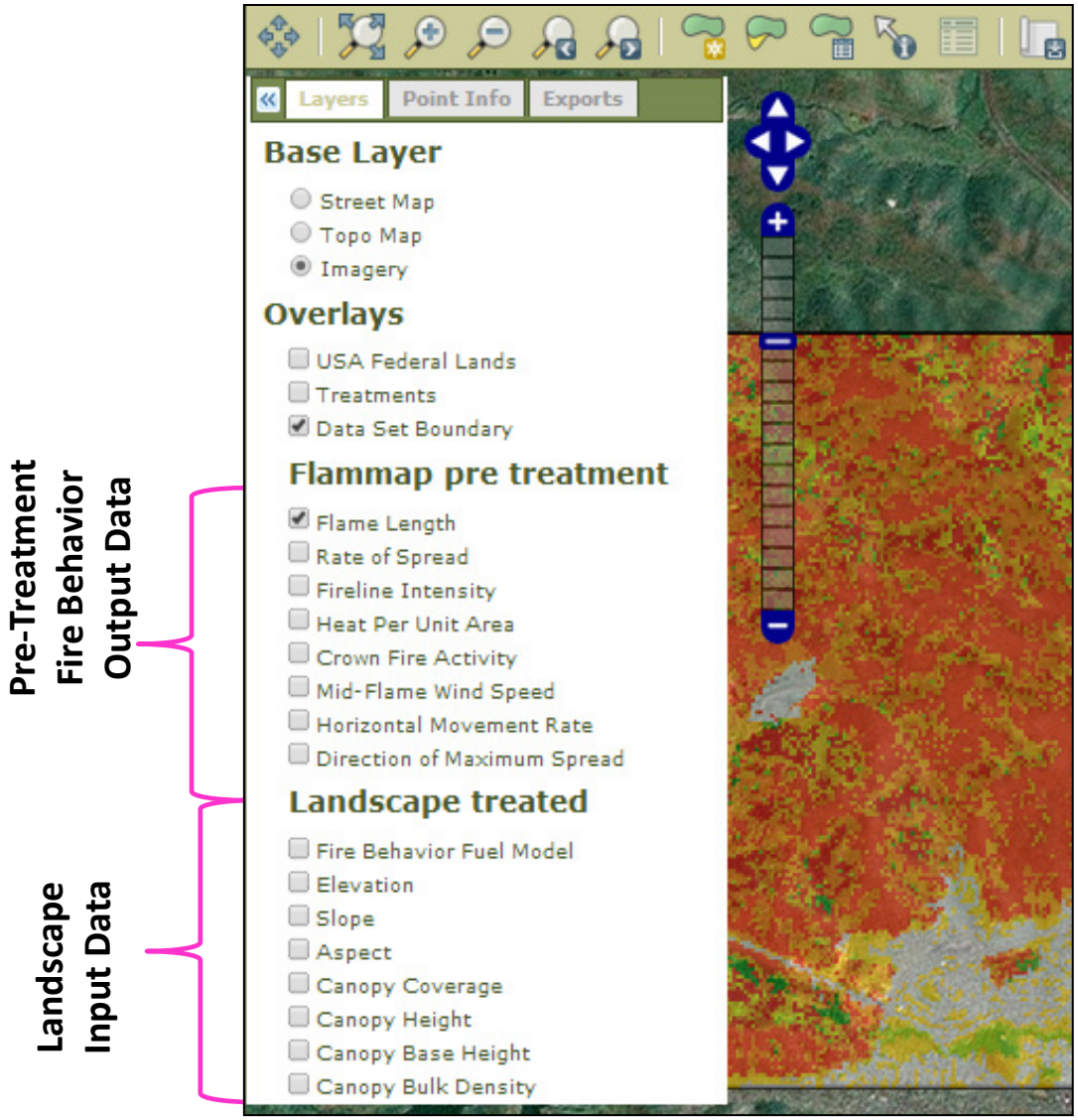
Reviewing Pre-Treatment Fire Behavior Output Data

After running the module, you can review your pre-treatment 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

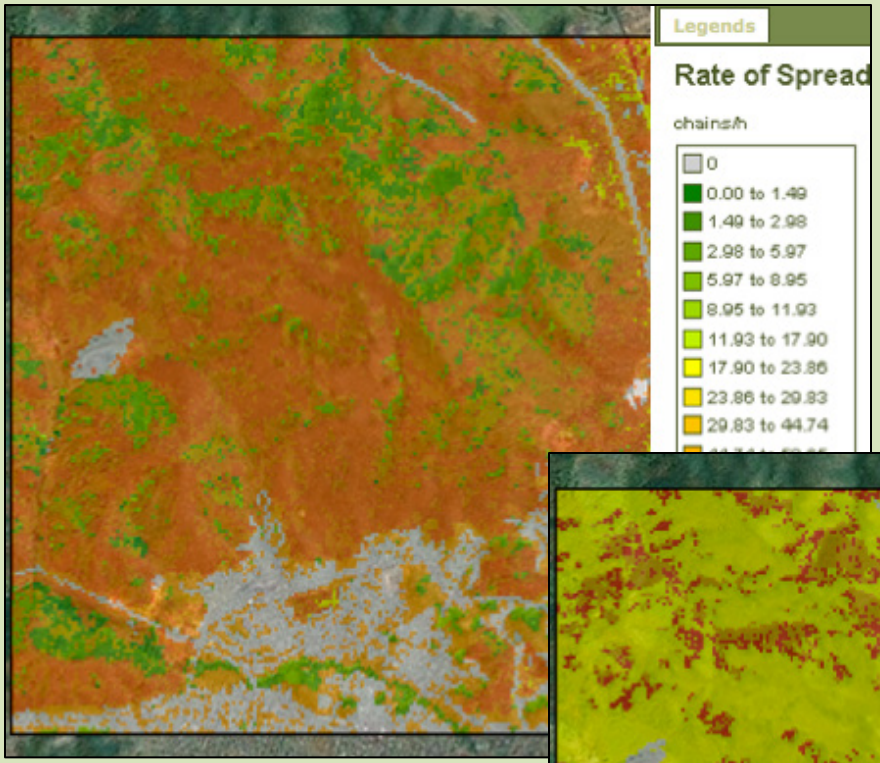


Reviewing Pre-Treatment Fire Behavior Output Data

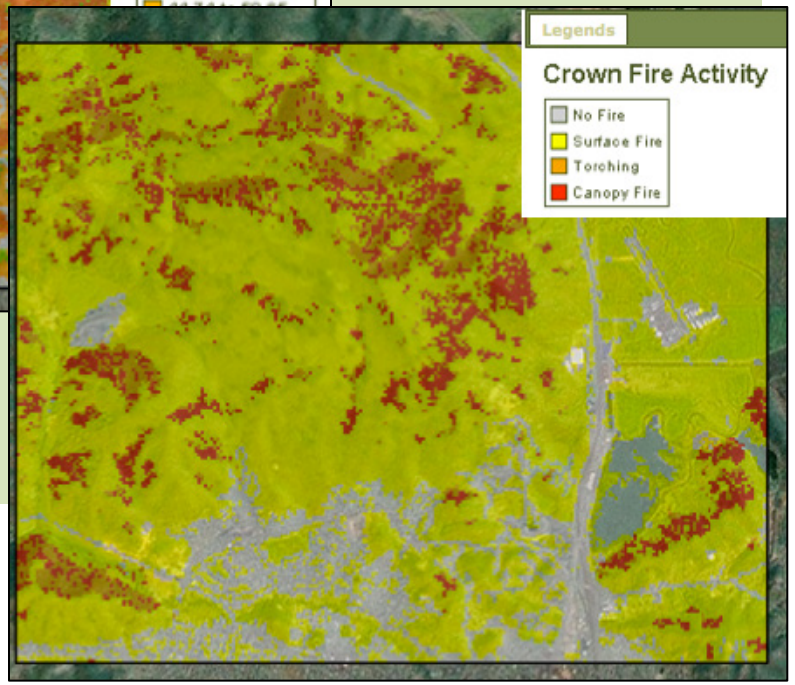
Potential high fire hazard areas can be identified across a landscape using the modeled fire behavior with landscape data.

Next, we will identify where to perform fuels treatments based on high fire hazard areas.

Rate of Spread



Crown Fire Activity



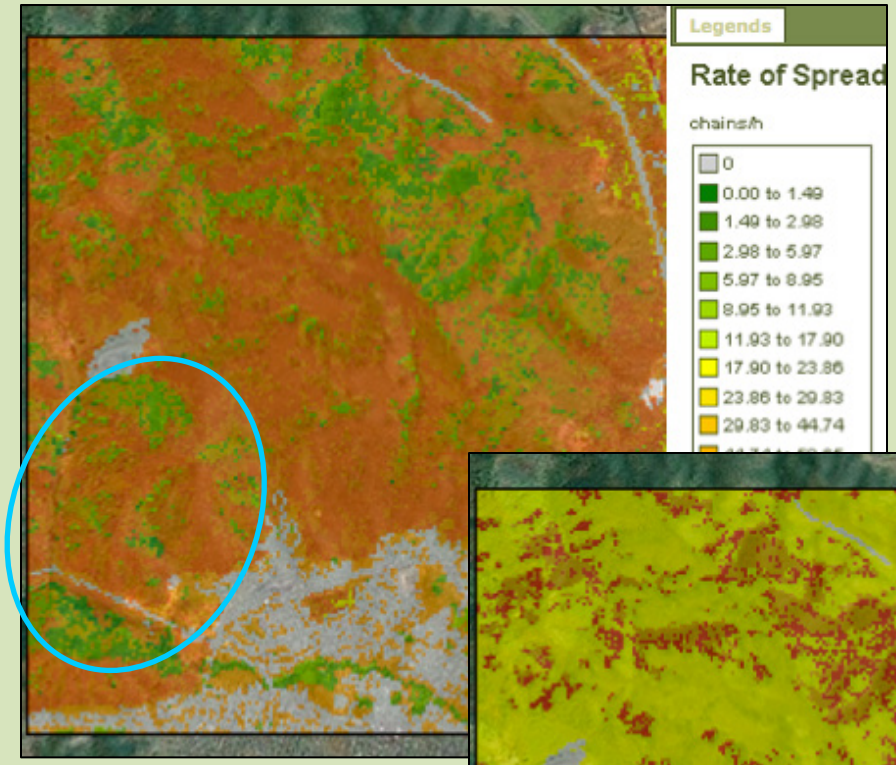
Identifying Fuels Treatment Locations

In this example, the areas with a low rate of spread (green pixels in upper left screenshot) are at risk for canopy fires (red pixels in lower right screenshot).

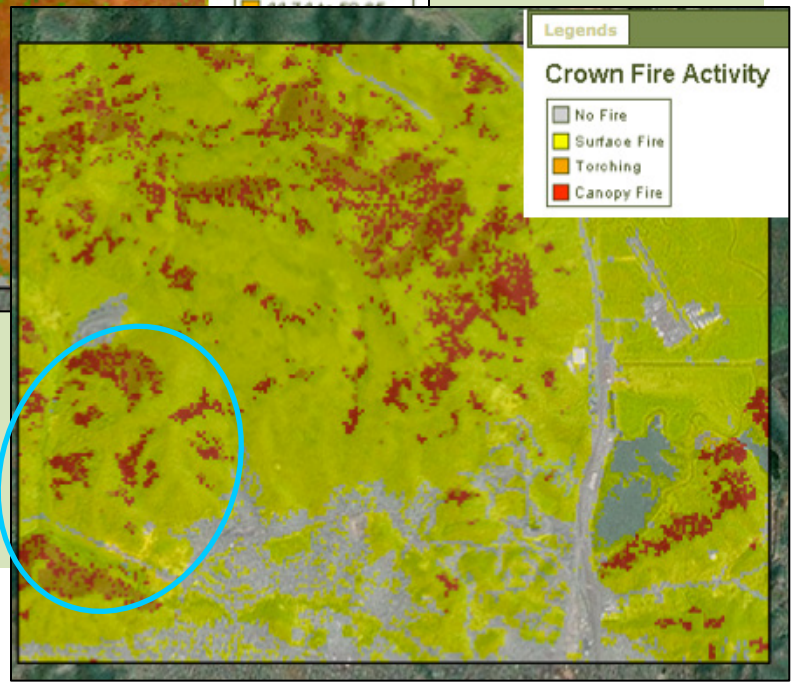
We would like to reduce the risk of canopy fires near the Wildland Urban Interface (grey pixels at bottom of screenshot).

We have identified our first fuels treatment location (circled in blue). Our objective will be to **reduce canopy fire potential in the area surrounding the Wildland Urban Interface**.

Rate of Spread



Crown Fire Activity

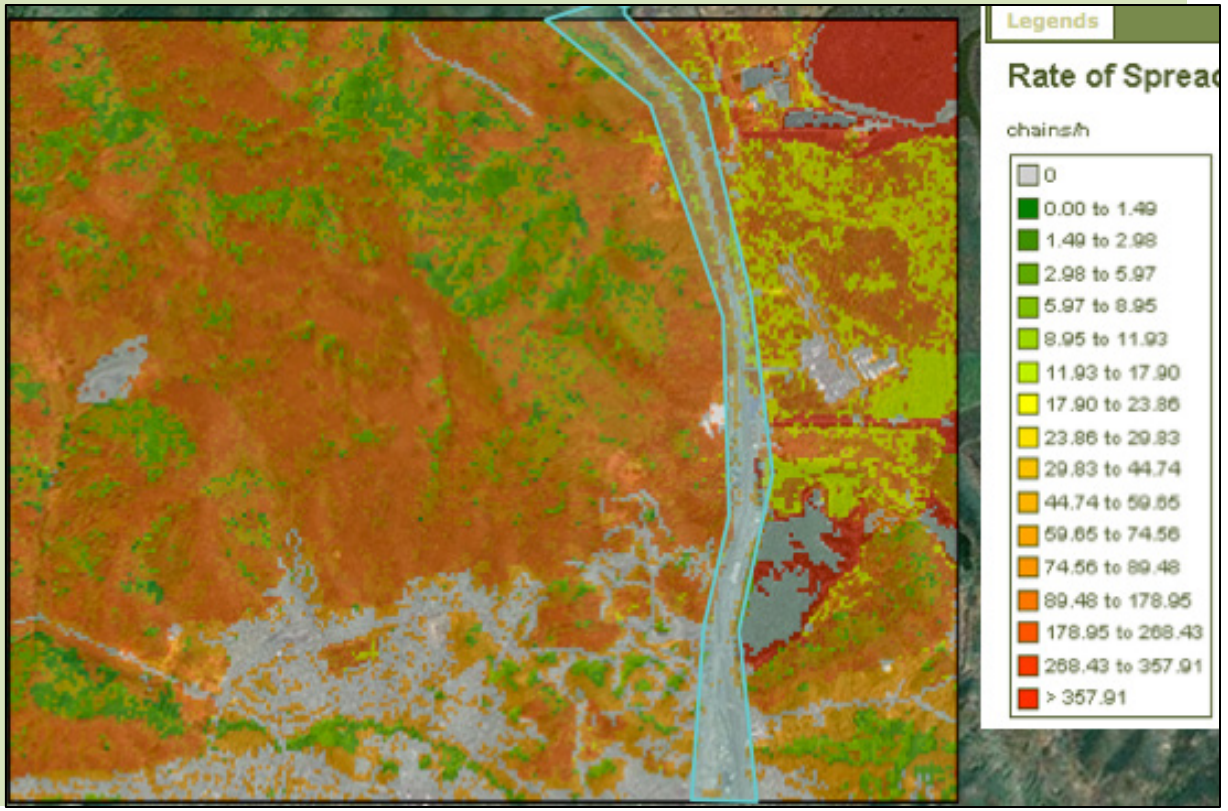


Identifying Fuels Treatment Locations

Our next fuels treatment location will be the grassland/oak woodland buffer along U.S. Highway 101 (outlined in light blue).

Our fuels treatment objective will be to **reduce the potential rate of spread adjacent to Highway 101** in order to decrease the likelihood of human-caused fire along the roadside, and to lower the risk of a wildfire jumping the highway.

Rate of Spread

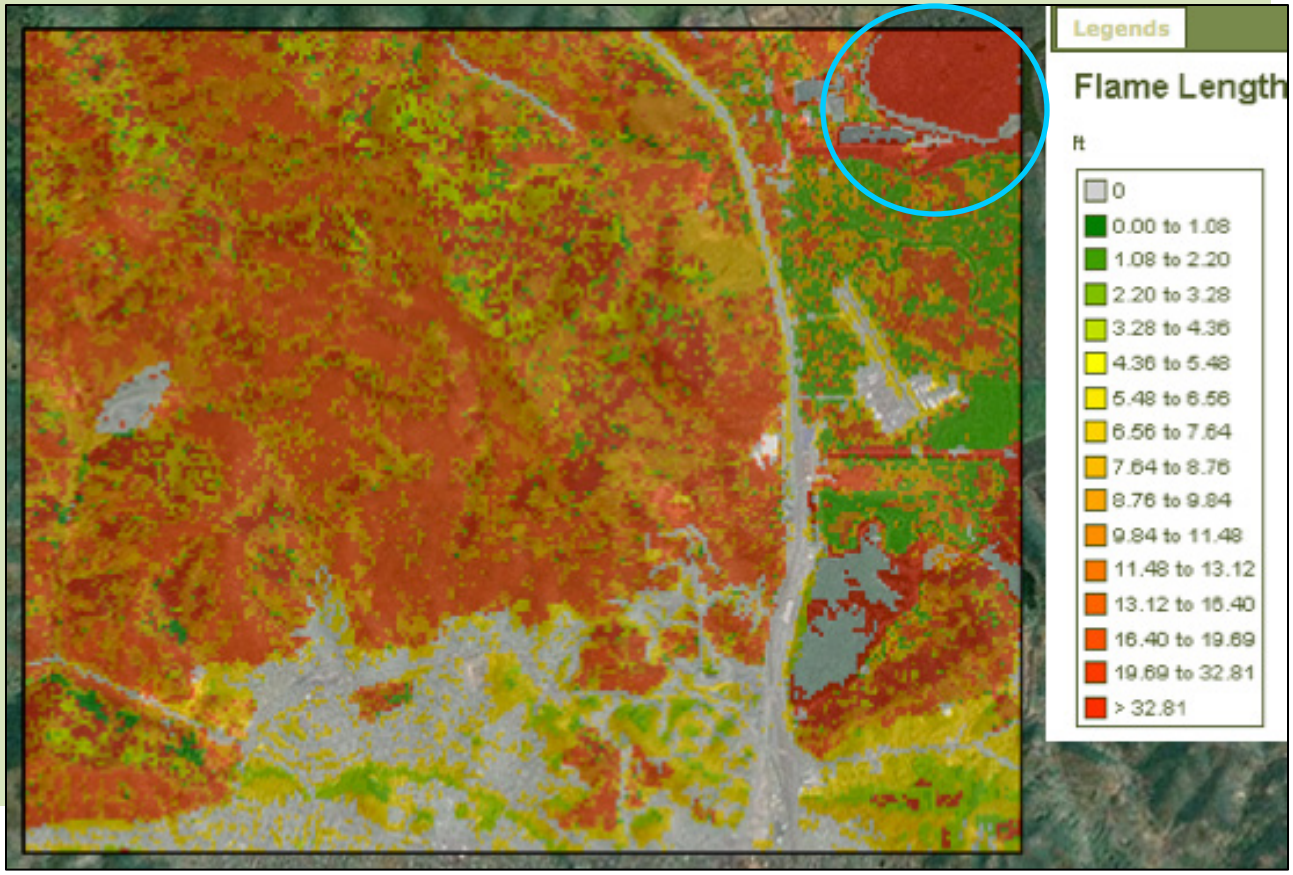


Identifying Fuels Treatment Locations

Lastly, our third fuels treatment location will be Gnoss Field (the Marin County Airport). This area is classified as **high load – dry climate grass** (fuel model GR7(107)), and has the potential to reach flame lengths greater than 32 feet.

The objective of this fuels treatment (circled in blue) is to **reduce the potential flame lengths near the Marin County Airport**.

Flame Length



Identifying Fuels Treatment Locations

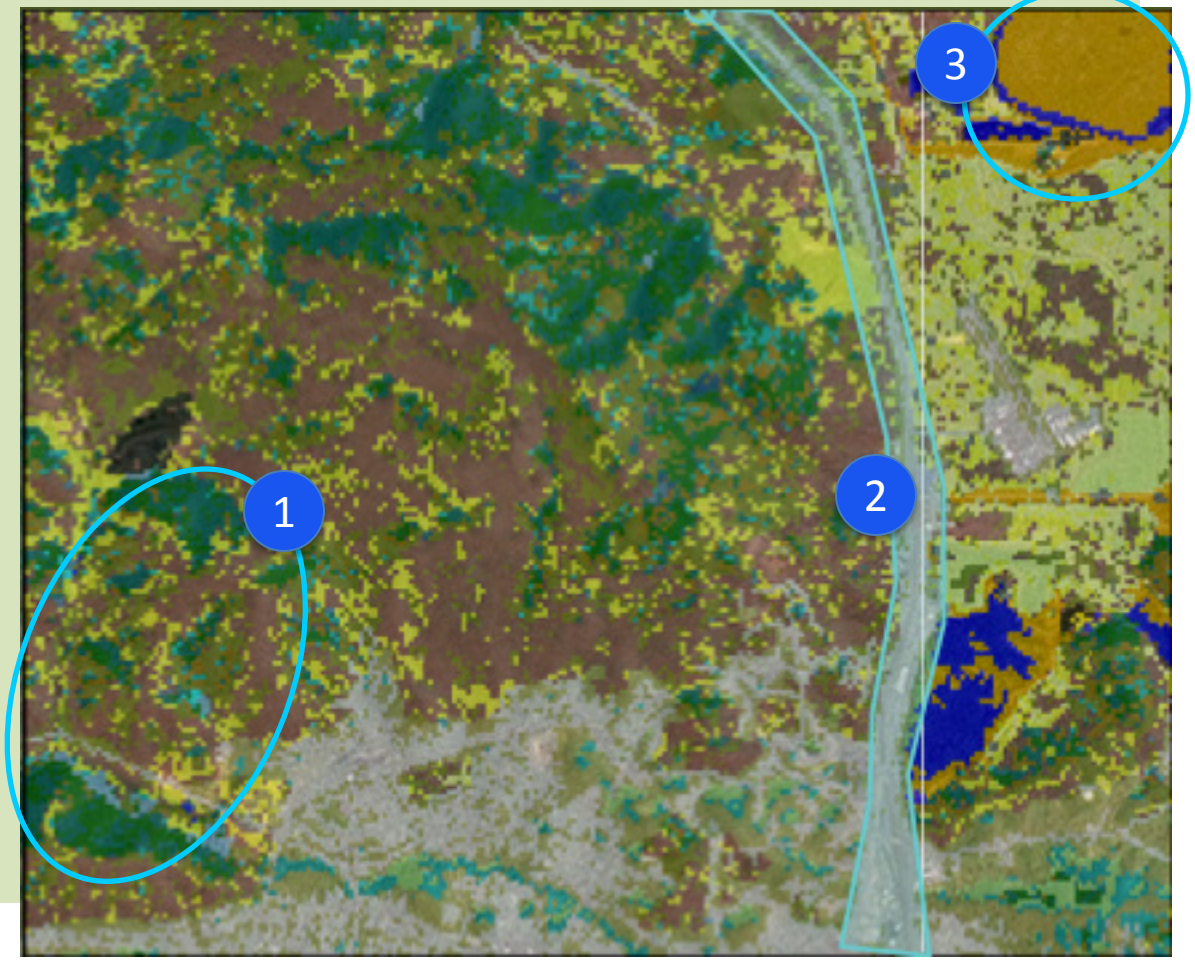
We identified three fuels treatment locations based on high fire hazards across the landscape.

Fuels Treatment Objectives:

1. Reduce canopy fire potential in the area surrounding the Wildland Urban Interface.
2. Reduce the potential rate of spread adjacent to Highway 101.
3. Reduce the potential flame lengths near the Marin County Airport.

In the next steps, you will learn how to outline these fuels treatments using the **Draw Polygon** tool.

Fire Behavior Fuel Model

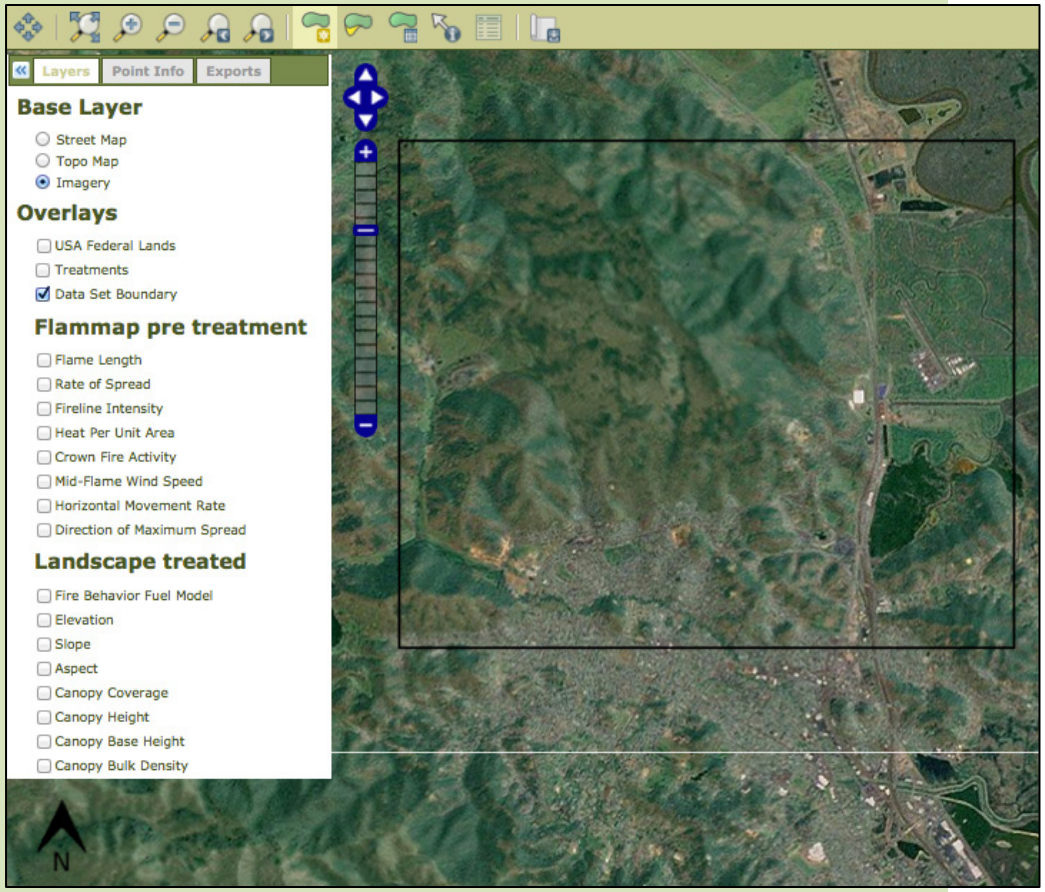


Placing Fuels Treatments Across the Landscape

In the next few steps, you will create fuels treatments by drawing polygons and editing LANDFIRE data.

There are two methods for using the map tools to draw polygons.

1. The **freeform drawing method** is useful when
   - You want to quickly and easily draw polygons.
   - You have a small area of interest.
   - You can see the entire area that your polygon will encompass without moving the map.
2. The **point and click method** is useful when
   - You want to zoom in to make a detailed polygon.
   - You need to move the map (using the pan tool) while you are drawing a polygon.



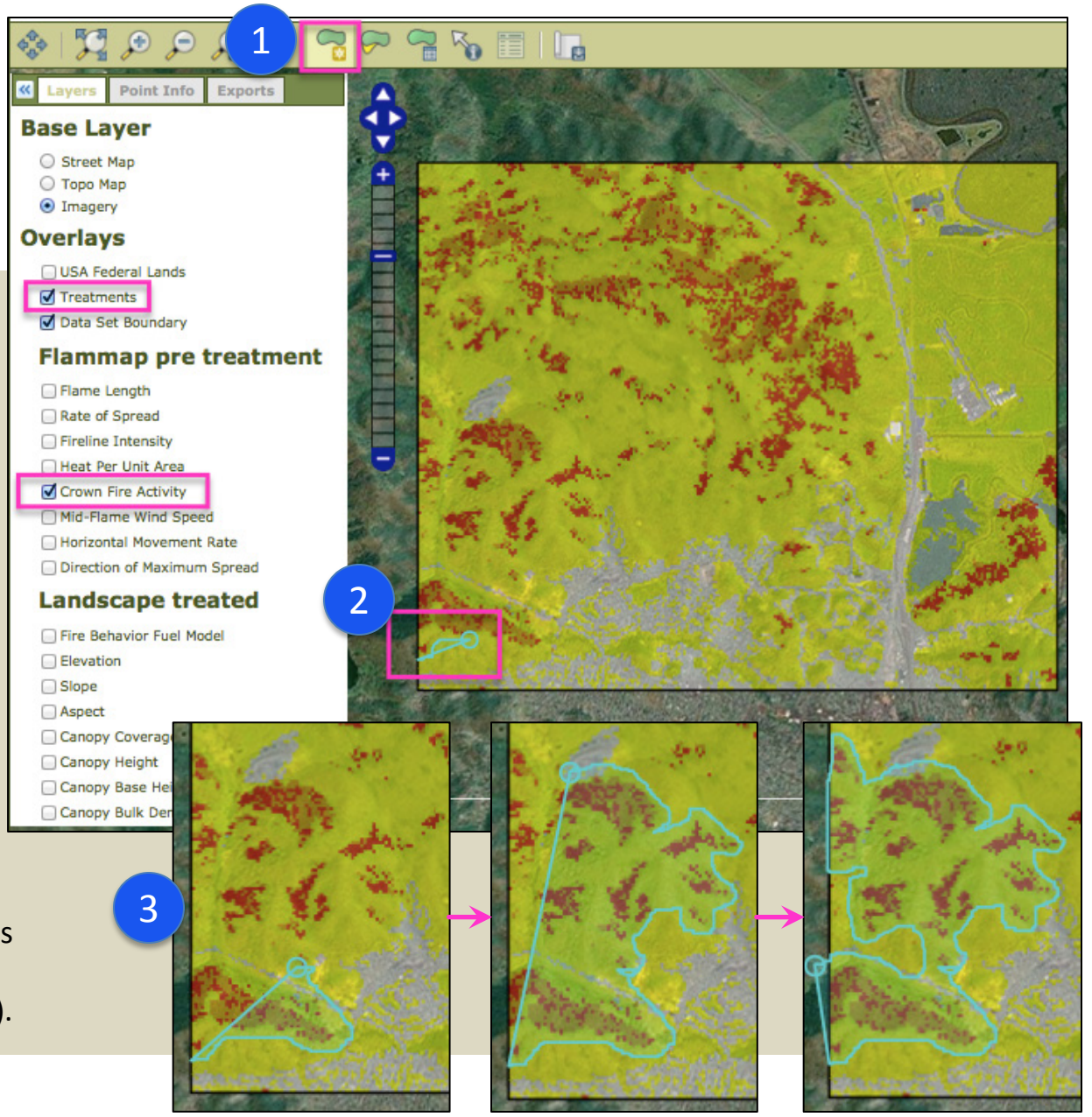
These polygon drawing methods are discussed on pages 33 through 36.

Placing Fuels Treatments – Freeform Drawing Method

In this step, you use the freeform drawing method to outline the fuels treatment near the Wildland Urban Interface.

1. Verify that the **Treatments** layer is selected, then select the **Draw Polygon** tool.
2. While holding down the **Shift** key, click on the map, hold down the left mouse button and start drawing your first polygon.
3. Continue to hold down the shift key and left mouse button. Moving the mouse as if it were a pencil, draw your polygon (outlining the red canopy fire pixels near the wildland urban interface).

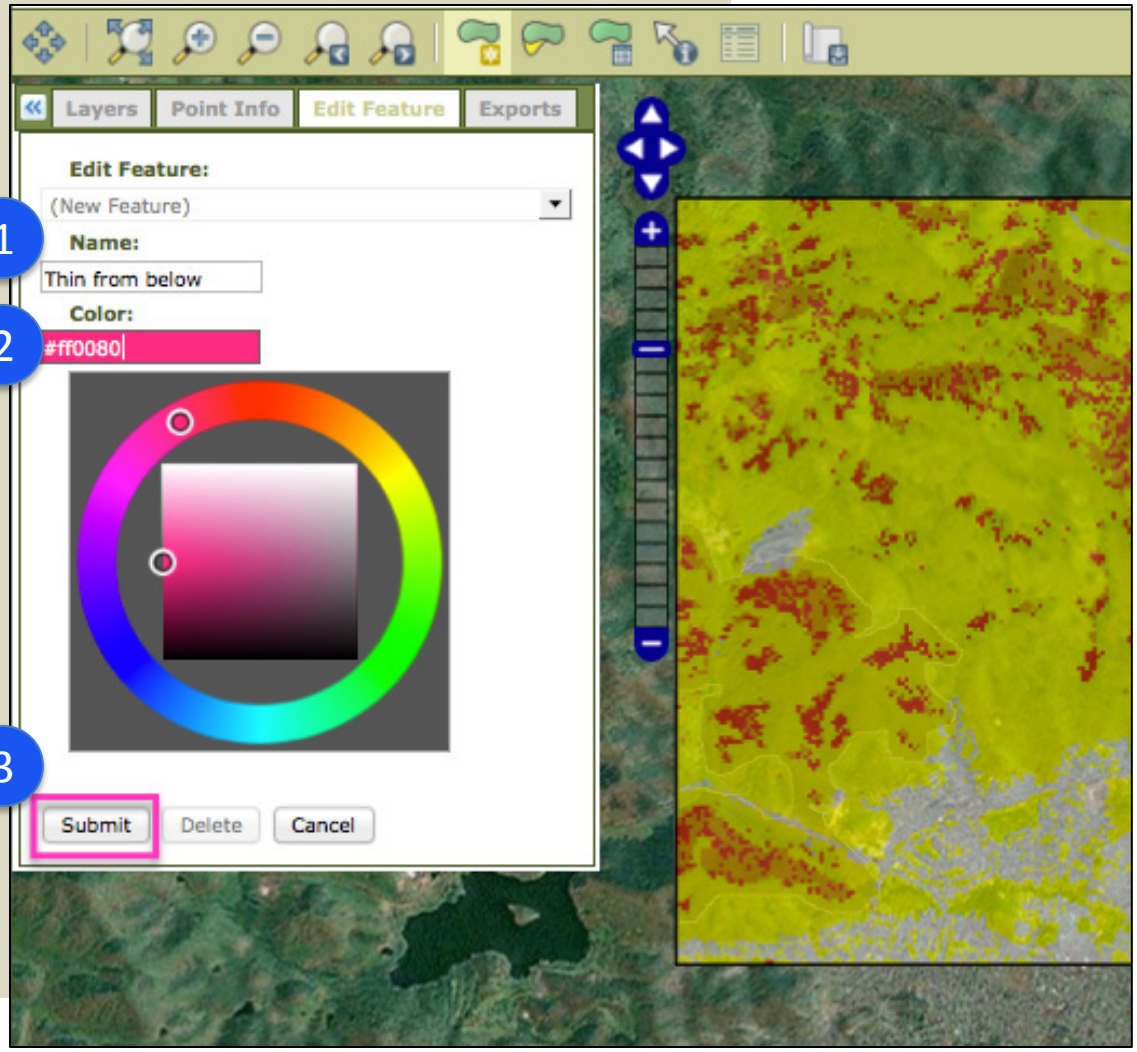
Release the left mouse button when you are done drawing the polygon. This creates the polygon and opens the **Edit Feature** panel (shown on the next page).



Using the Edit Feature Panel to Define a Fuels Treatment Polygon

After you create the polygon, the **Edit Feature** panel appears. To edit the polygon,

1. Name the polygon.
2. Give the polygon a color.
   - Click on the **Color** text box. A color wheel appears.
   - Use the color wheel to choose a color.
   - Use the inner box to choose the shade of the color selected.
3. Choose **Submit** to save the polygon data.



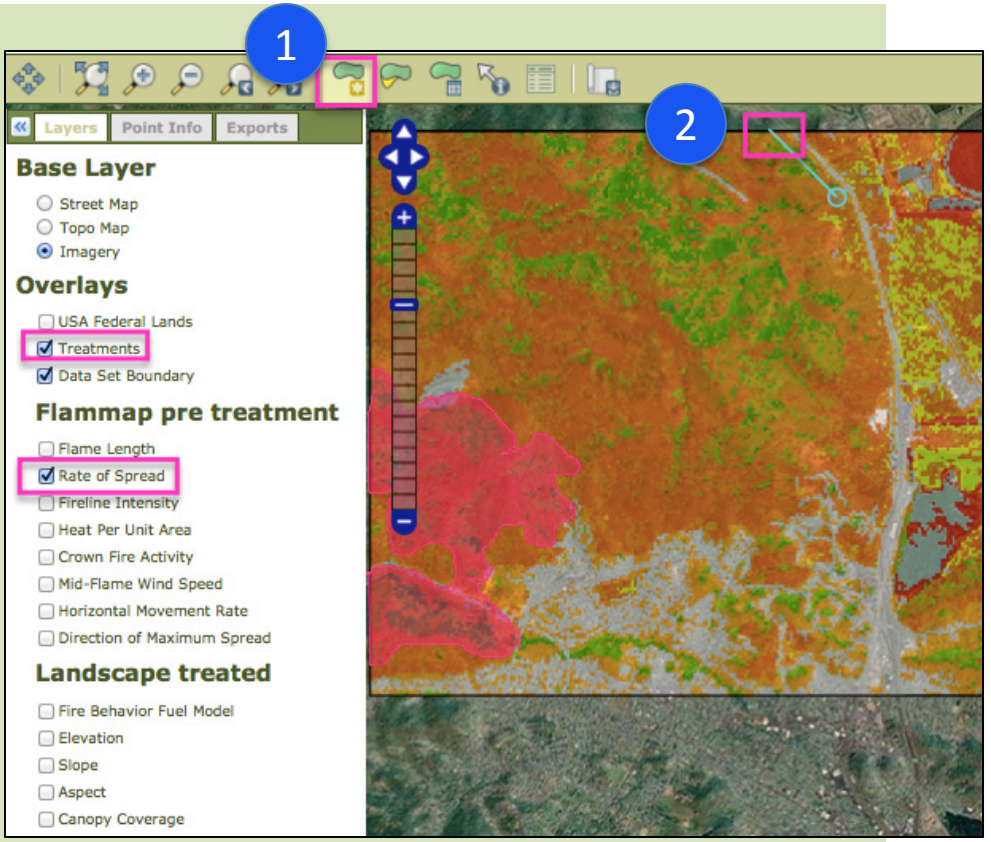
Placing Fuels Treatments – Point and Click Method

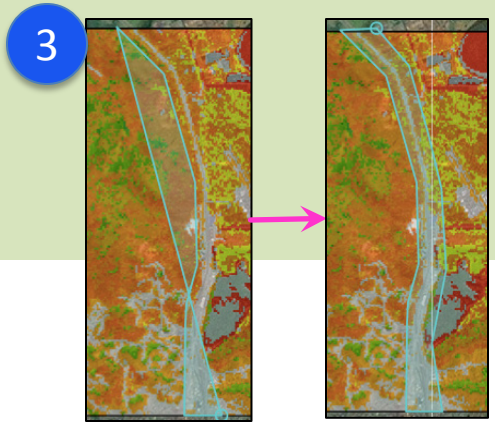
Next, define another fuels treatment.

In this example, use the **point and click method** to draw a fuels treatment polygon around the Highway 101 buffer.

1. Select the **Draw Polygon** tool.
2. Click on the map and release to start drawing your first polygon.
3. Move the mouse to a new point and click to add another point. Before moving on, make sure the point is established (by moving the mouse away from the point). Continue this process until you are done drawing your polygon.

Double-click when you are done drawing the polygon to create the polygon and to open the **Edit Feature** panel (shown on the next page).

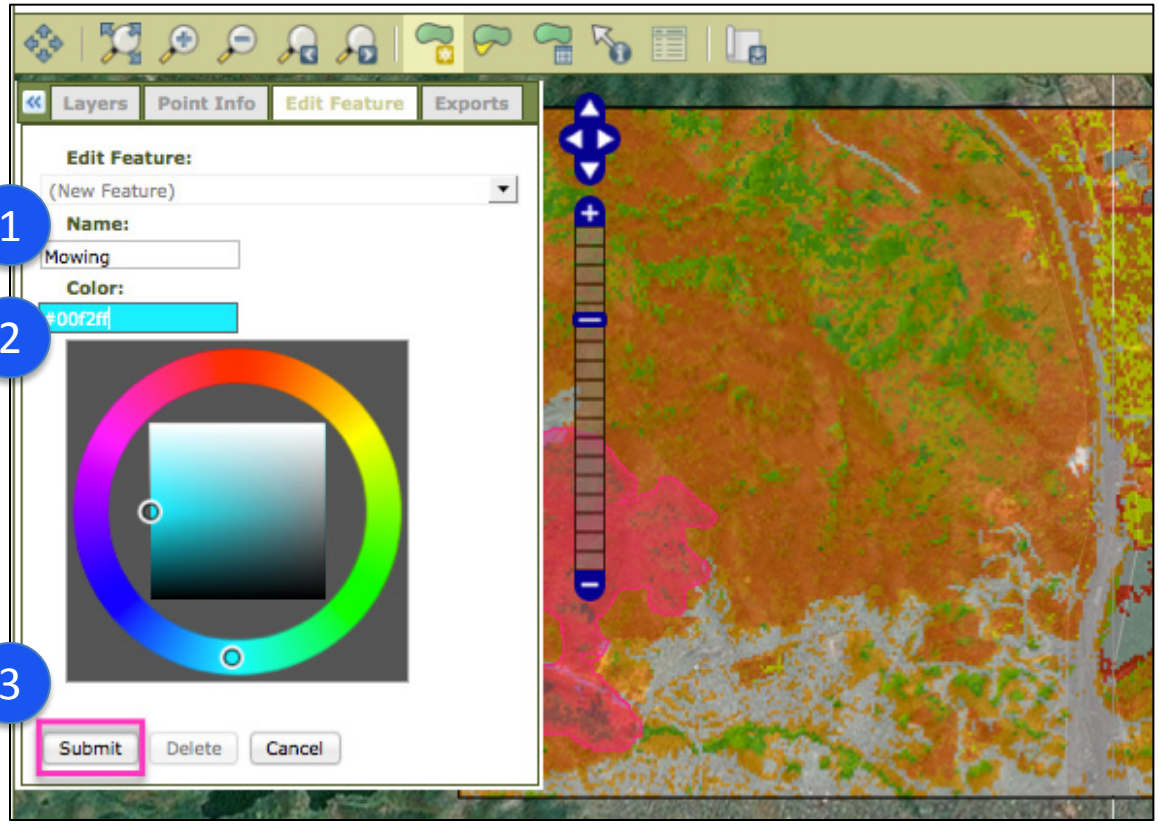




Using the Edit Feature Panel to Define a Fuels Treatment Polygon

After double-clicking to create the polygon, the **Edit Feature** panel appears. To edit the polygon,

1. Name the polygon.
2. Give the polygon a color.
   - Click on the **Color** text box. A color wheel appears.
   - Use the color wheel to choose a color.
   - Use the inner box to choose the shade of the color selected.
3. Choose **Submit** to save the polygon data.



Repeat the steps defined on pages 33 to 35 to draw the third fuels treatment on the landscape. Choose your favorite draw polygon method.

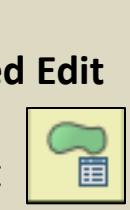
Editing LANDFIRE Data to Create Fuels Treatments

Now that we have created the fuels treatment polygons, the next step is to manually edit the landscape (LANDFIRE) data within these polygons to reflect fuels treatments.

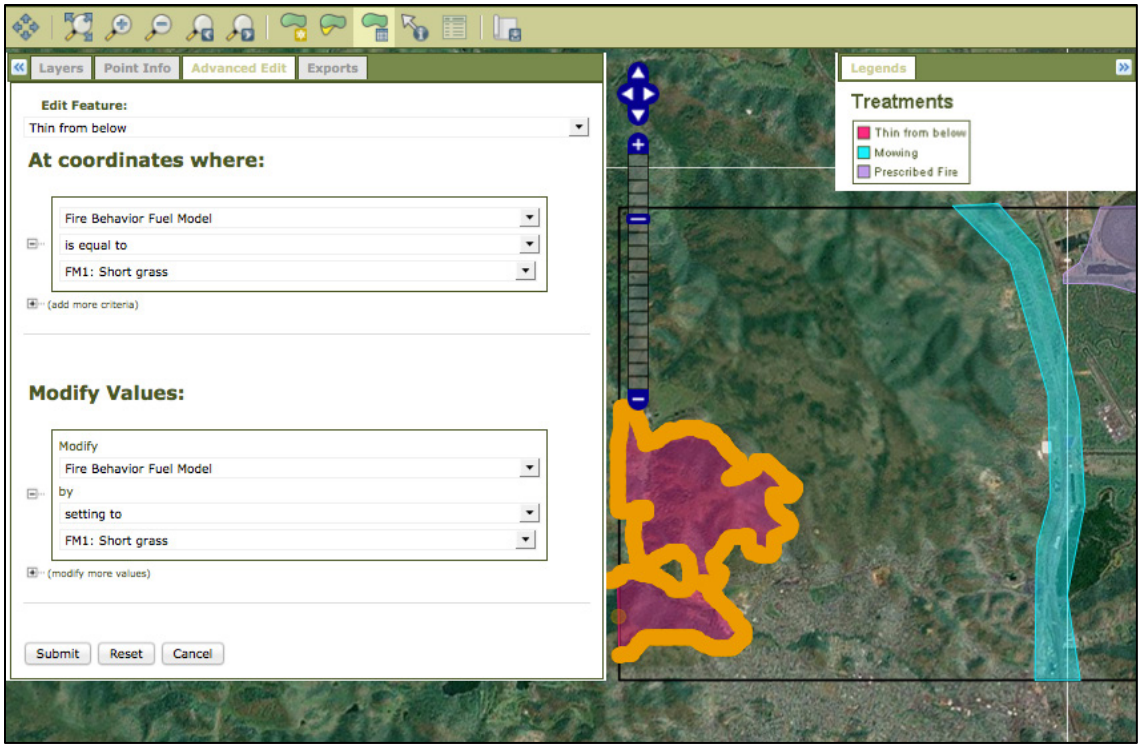
Within the fuels treatment polygons, you can edit

- The fire behavior fuel model
- Canopy coverage
- Canopy height
- Canopy base height
- Canopy bulk density

Select the **Polygon Advanced Edit** tool, and click on the **Thin from below** fuels treatment polygon.



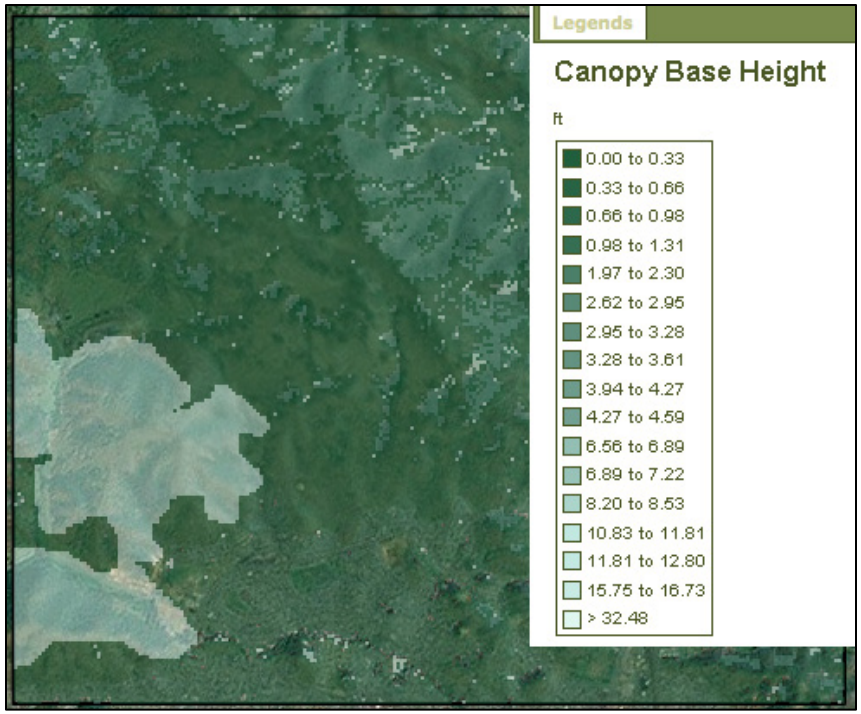
The **Advanced Edit** panel appears (discussed on next page).

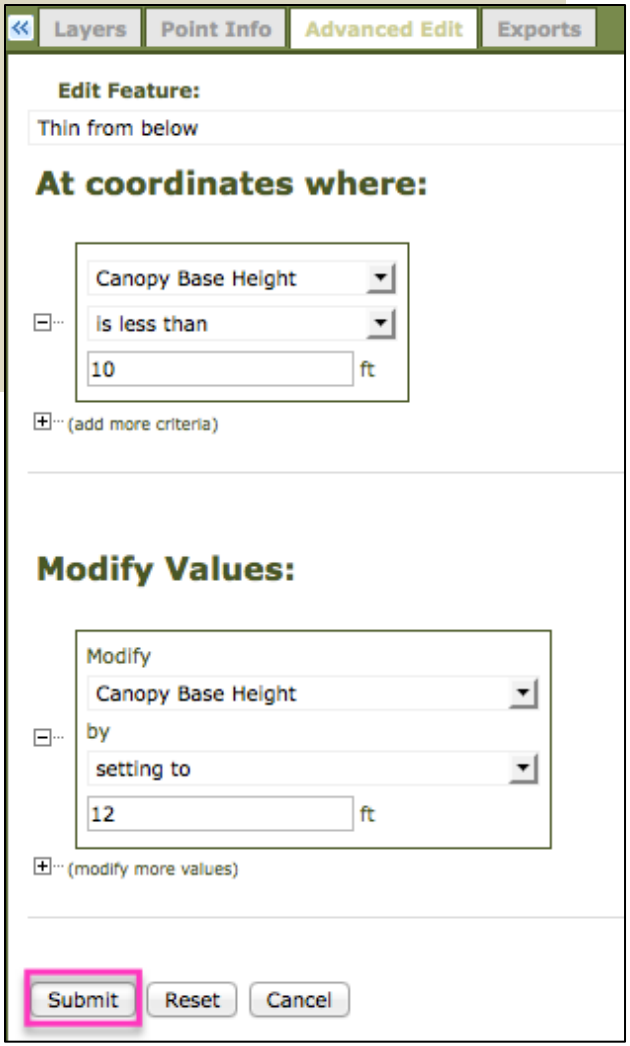


Editing LANDFIRE Data to Create Fuels Treatments

You can modify the landscape data within a fuels treatment polygon using the **Advanced Edit** panel.

With the **Advanced Edit** panel, you can edit the pixels within the selected polygon using a query format. In this example, we will modify all pixels within the polygon that have a canopy base height less than 10 feet, and raise the canopy base height to 12 feet. Make these changes, and then choose **Submit** to make edits to the polygon.





Editing LANDFIRE Data to Create Fuels Treatments

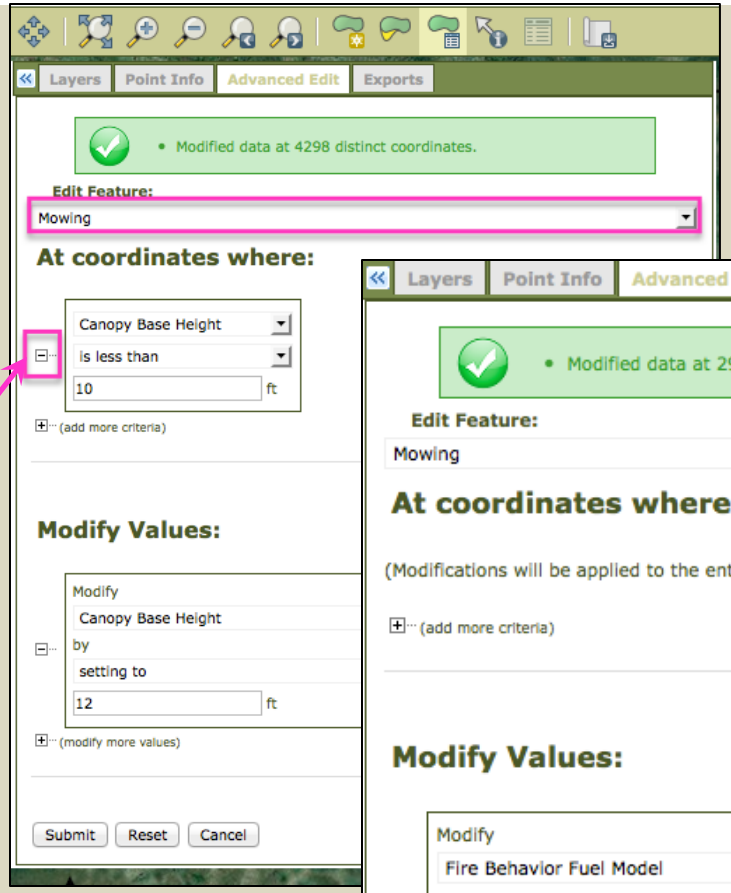
Next, we will modify the Mowing fuels treatment polygon.

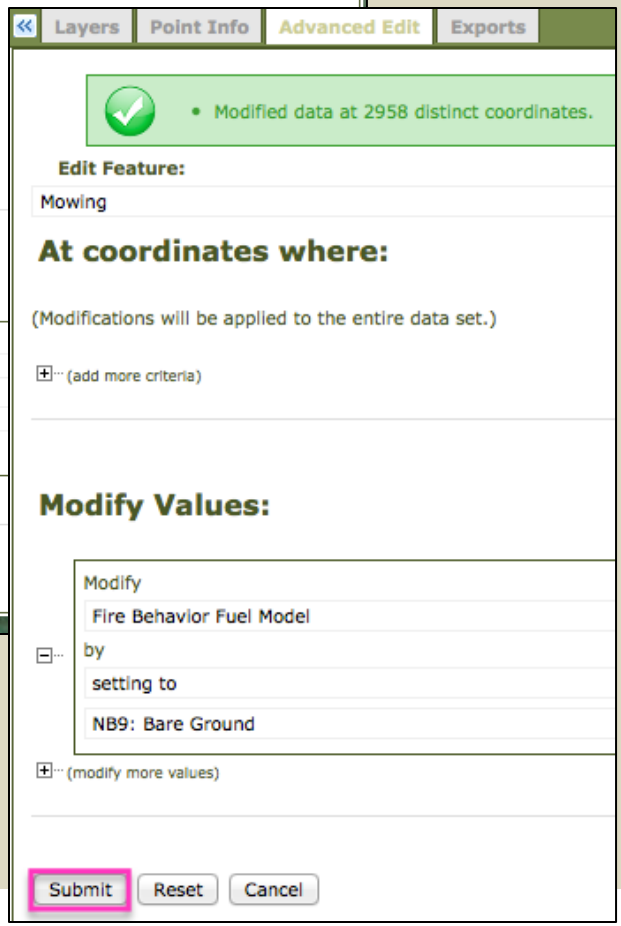
On the **Advanced Edit** panel, under the **Edit Feature** dropdown, select **Mowing**.

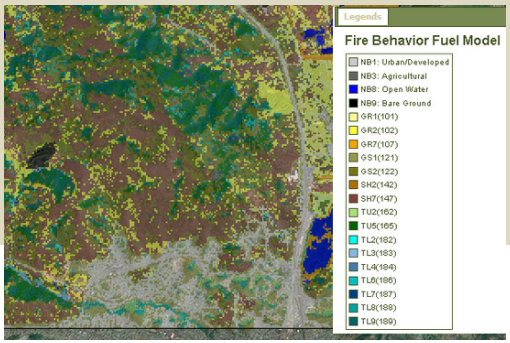
For this fuels treatment, we want to apply our edits to all pixels within the polygon. To do this, click on the minus sign (⊟) to the left of the **At coordinates where** box.

Now, the modifications will be applied to the entire polygon. For this **Mowing** fuels treatment, change the fire behavior fuel model to **NB9: Bare Ground**.

Choose **Submit**.







Editing LANDFIRE Data to Create Fuels Treatments

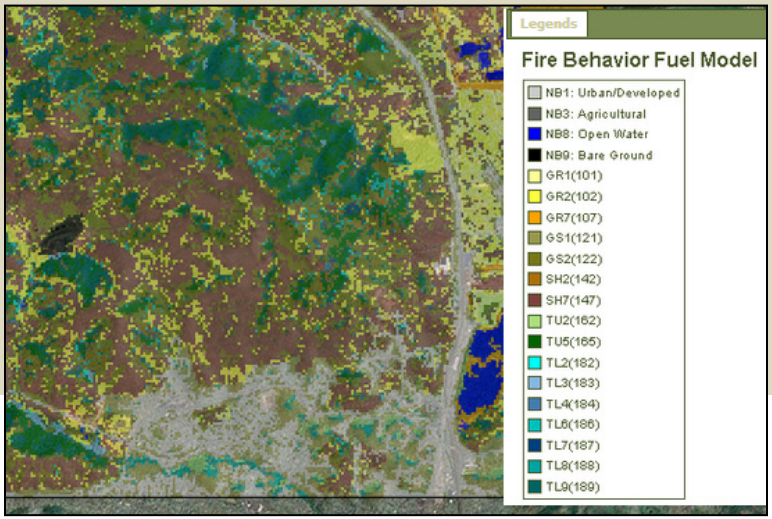
Next, we will modify the Prescribed Fire fuels treatment polygon.

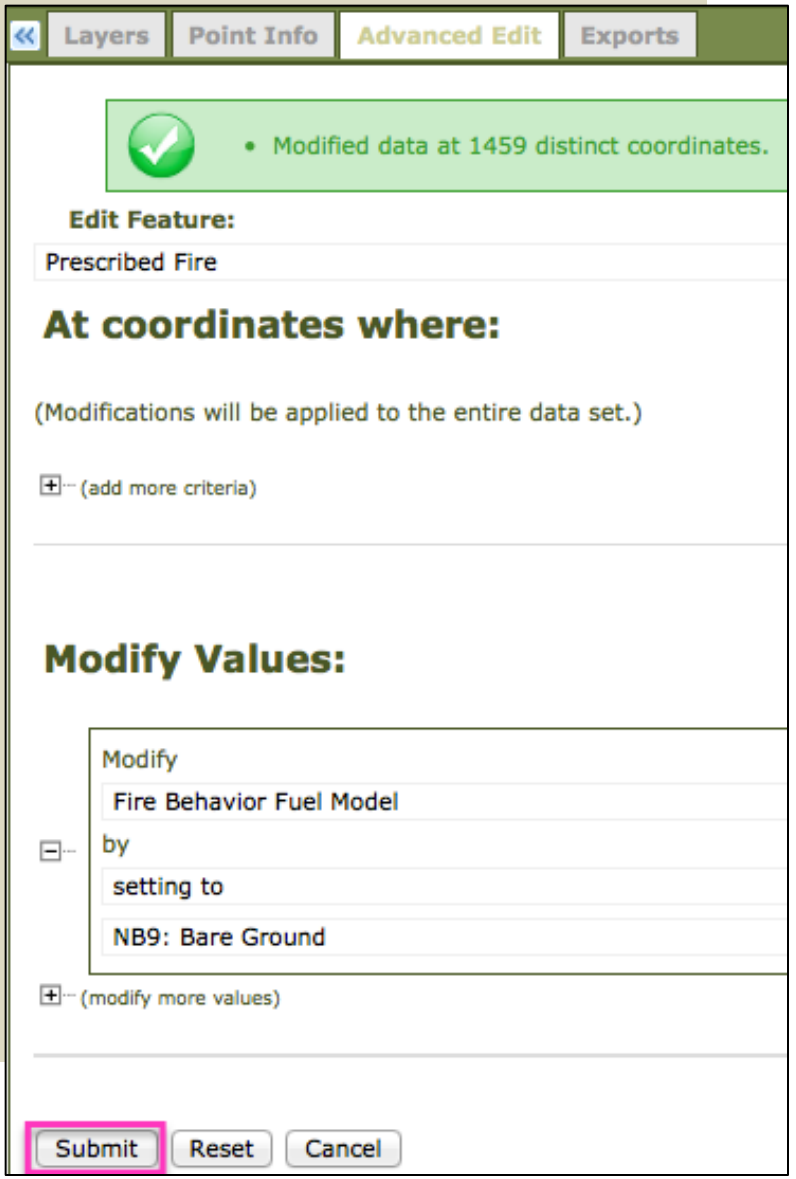
On the **Advanced Edit** panel, under the **Edit Feature** dropdown, select **Prescribed Fire**.

As you did for the **Mowing** fuels treatment, change all pixels within the prescribed fire polygon to **NB9: Bare Ground**.

Choose **Submit**.

Next, we will re-run the IFT-FlamMap model. This way, we can compare the pre- and post-treatment fire behavior outputs.





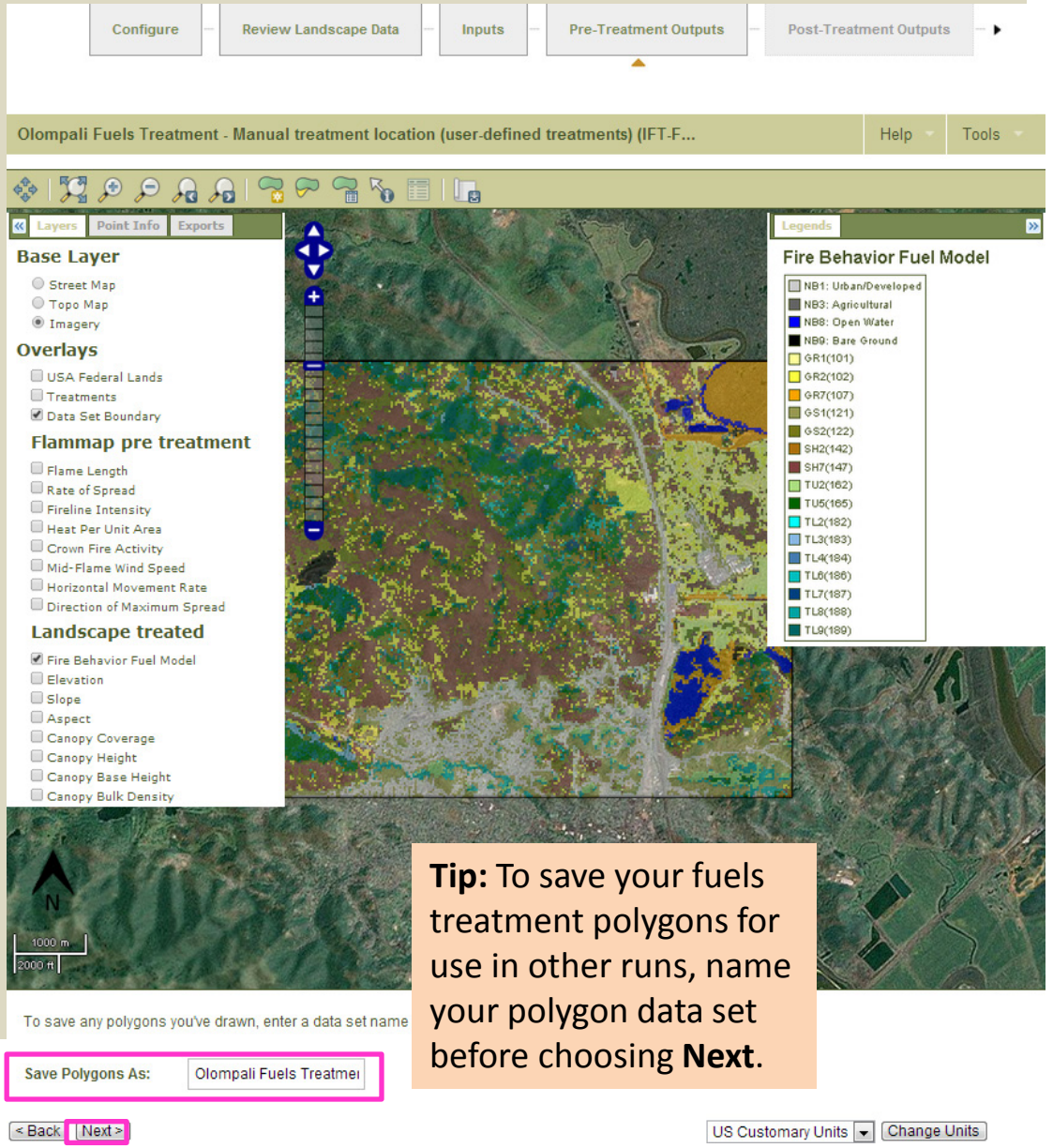
Reviewing Fuels Treatment Edits and Re-Running IFT-FlamMap

Review your fuels treatment edits. After you are done identifying and editing landscape data to create fuels treatments, choose **Next**.

This will re-run IFT-FlamMap under the same environmental conditions. In the next step, we will compare the pre- and post-treatment fire behavior outputs.

This way, we can evaluate the effectiveness of our fuels treatments.

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



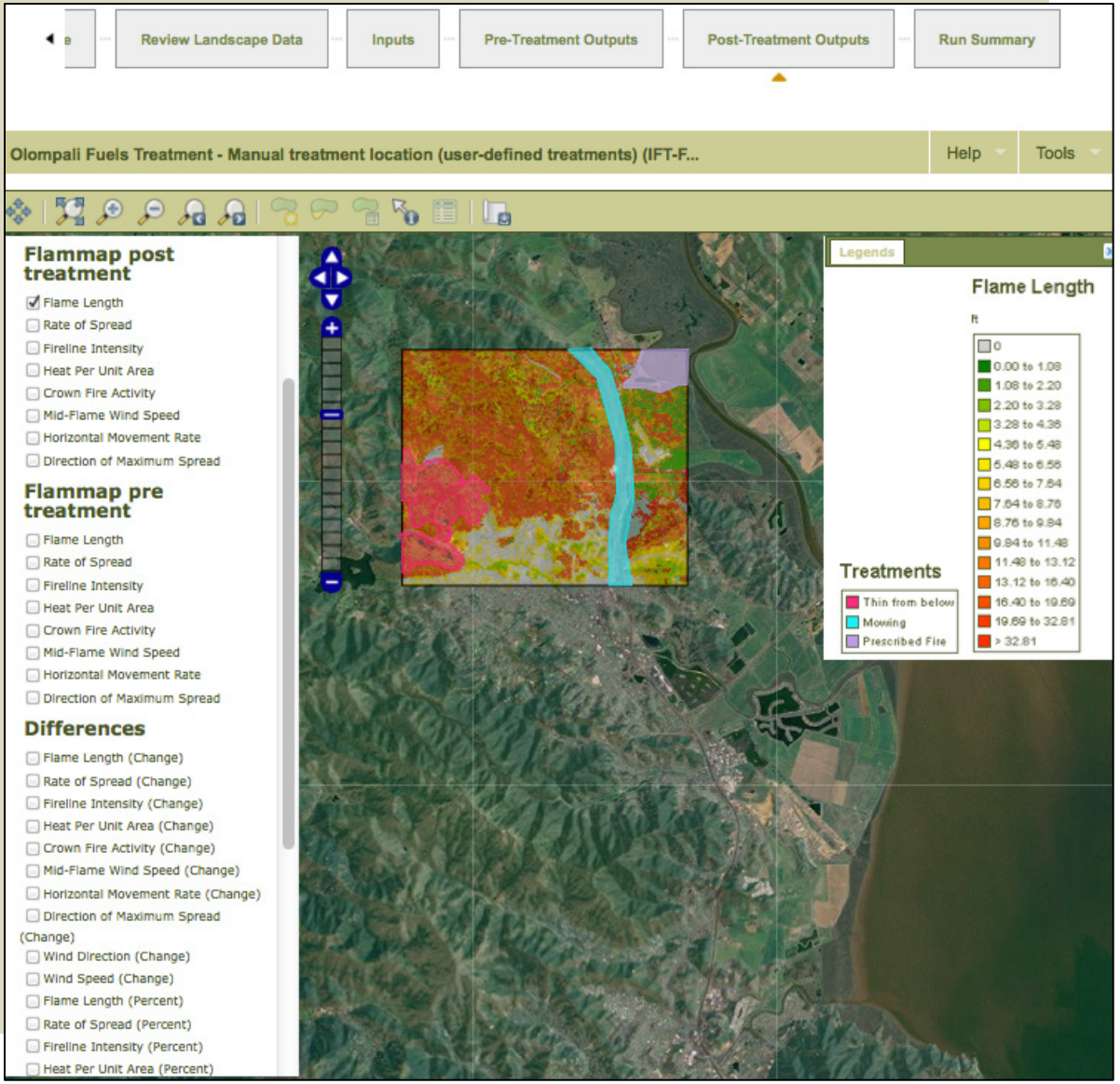
Tip: To save your fuels treatment polygons for use in other runs, name your polygon data set before choosing **Next**.

Evaluating Fuels Treatment Effectiveness

Now you are on the Post-Treatment Outputs step.

In this step, we will review the pre-treatment fire behavior, post-treatment fire behavior, and the differences between the pre- and post-treatment fire behavior (change and percent differences) to evaluate fuels treatment effectiveness based on the objectives defined on page 31.

We will review and evaluate fuels treatment effectiveness in the next few pages.



Evaluating Fuels Treatment Effectiveness

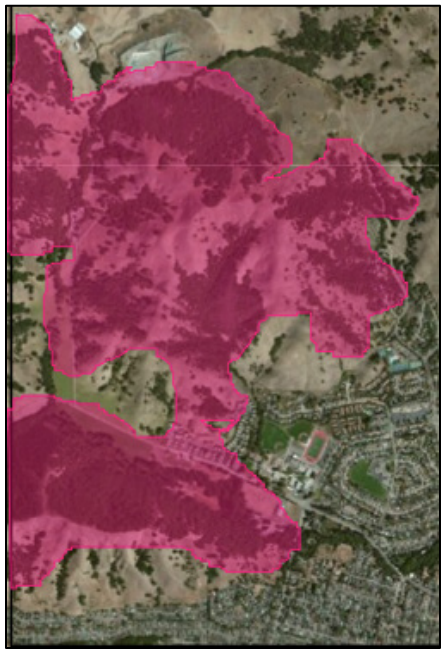
Fuels Treatment Objectives:

1. **Reduce canopy fire potential in the area surrounding the Wildland Urban Interface.**
2. Reduce the potential rate of spread adjacent to Highway 101.
3. Reduce the potential flame lengths near the Marin County Airport.

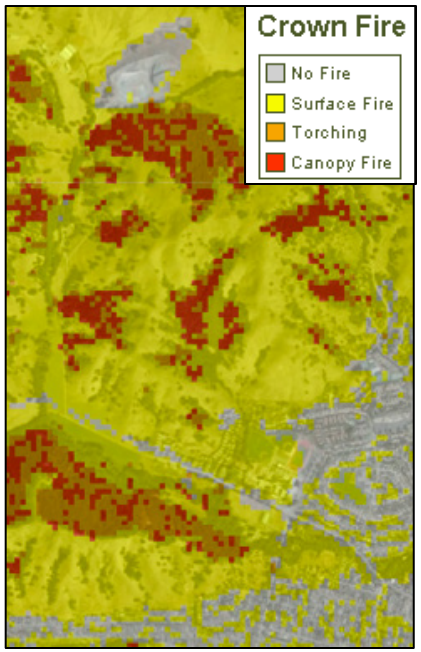
The Thin from Below fuels treatment was effective in reducing canopy fire potential surrounding the wildland urban interface.

A majority of the canopy fire (red) and torching (orange) pixels were reduced to surface fire (yellow) following the fuels treatment.

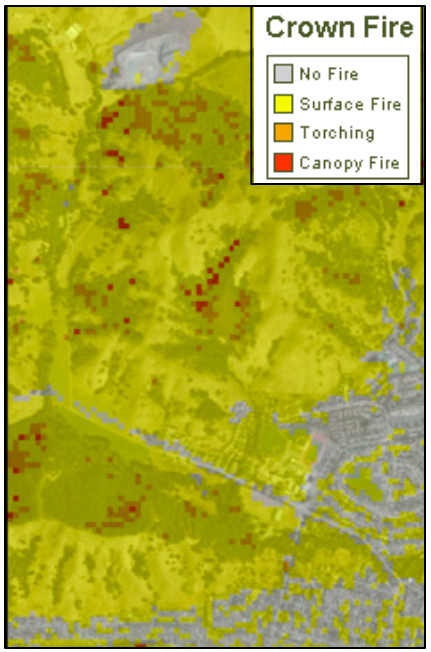
Thin from Below
Fuels Treatment Unit



Pre-Treatment
Crown Fire Activity



Post-Treatment
Crown Fire Activity



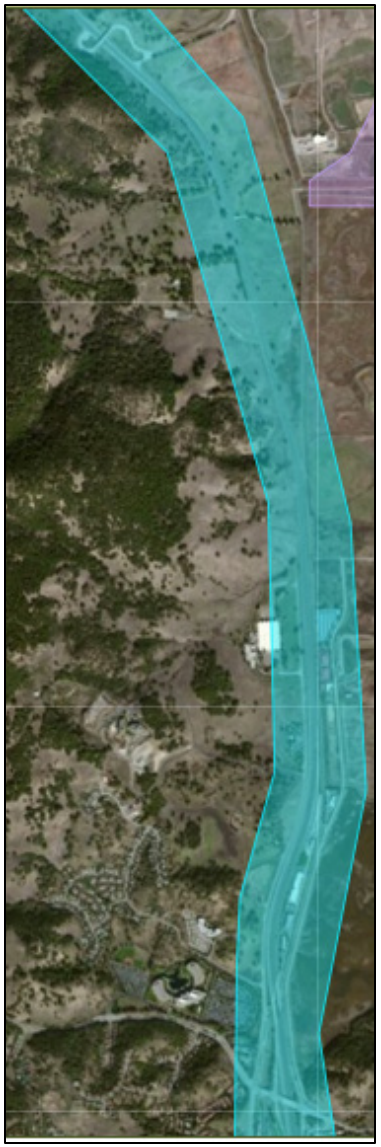
Evaluating Fuels Treatment Effectiveness

Fuels Treatment Objectives:

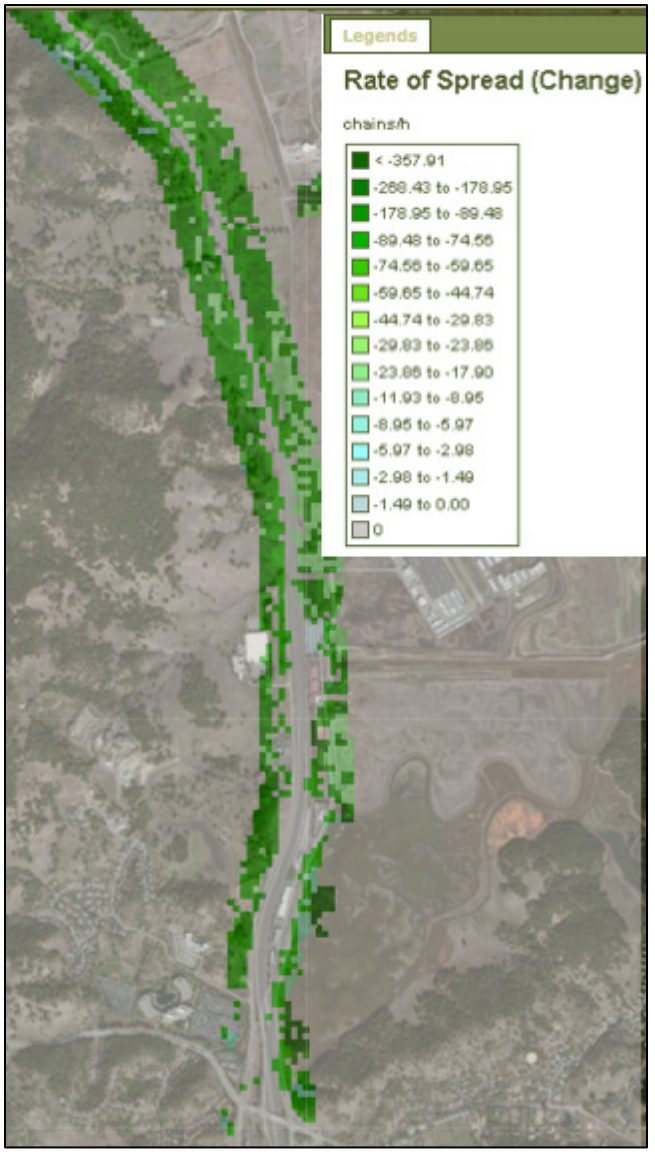
1. Reduce canopy fire potential in the area surrounding the Wildland Urban Interface.
2. **Reduce the potential rate of spread adjacent to Highway 101.**
3. Reduce the potential flame lengths near the Marin County Airport.

The map shows that the change in the rate of spread is negative. Therefore, the mowing fuels treatment was effective in reducing the potential rate of spread adjacent to Highway 101.

Mowing Fuels Treatment Unit



Rate of Spread (Change)



Evaluating Fuels Treatment Effectiveness

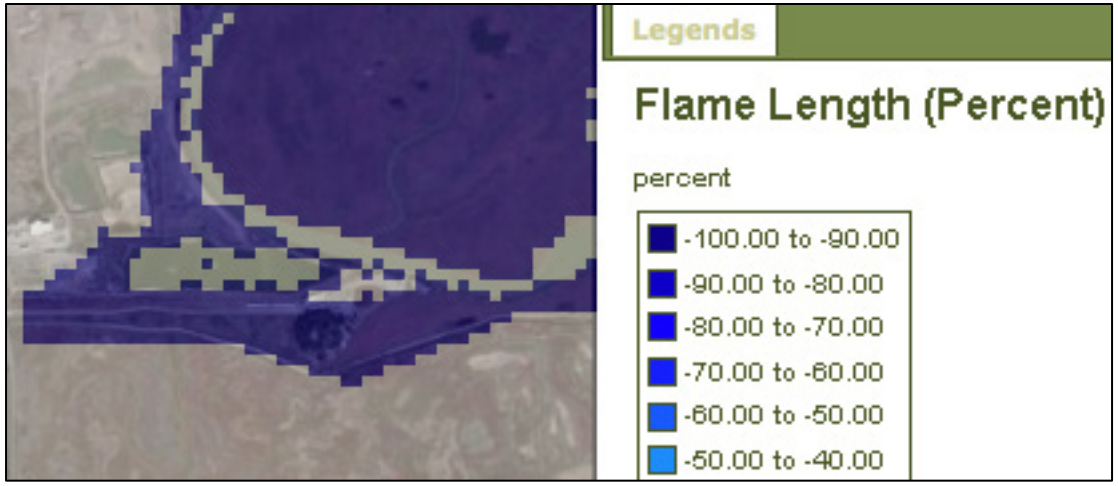
Fuels Treatment Objectives:

1. Reduce canopy fire potential in the area surrounding the Wildland Urban Interface.
2. Reduce the potential rate of spread adjacent to Highway 101.
3. **Reduce the potential flame lengths near the Marin County Airport.**

Prescribed Fire
Fuels Treatment Unit

The map shows a 90% to 100% reduction in flame length in the treatment unit. The Prescribed Fire fuels treatment was effective in reducing the potential flame lengths near the Marin County Airport.

Flame Length (Percent)

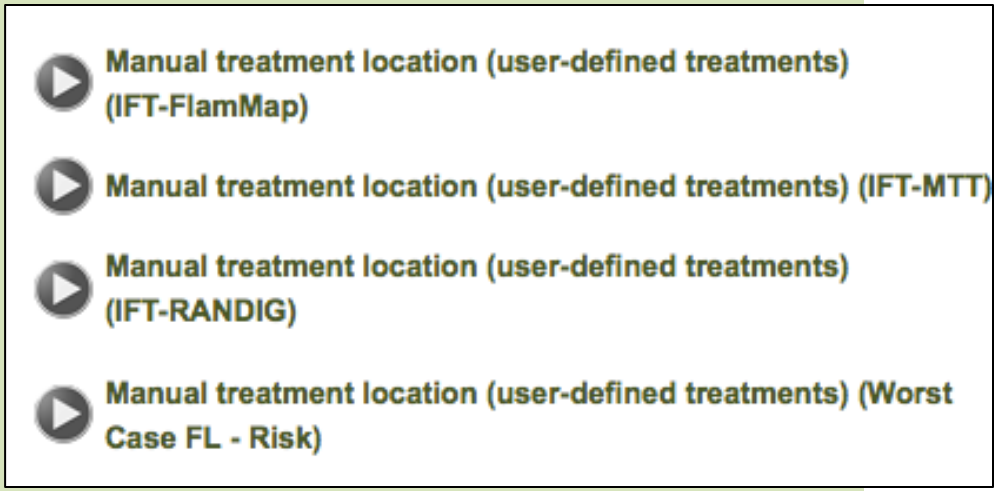


Next Steps: Assessing Further Needs

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

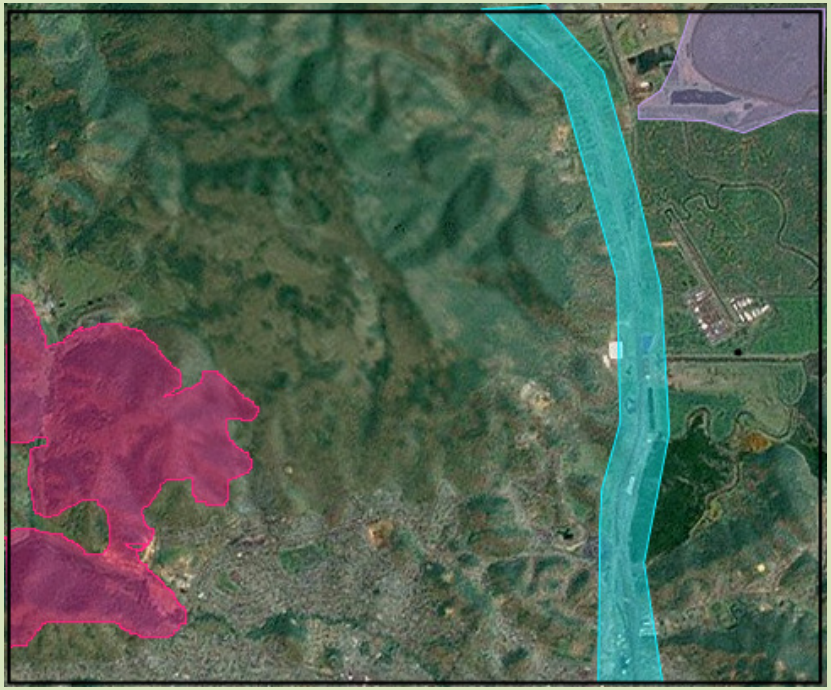
Next steps:

- Review aerial photography
- Make a site visit
- Continue to conduct additional fuels treatment analyses; for example,
  - Create additional fuels treatments and re-run model
  - Edit existing fuels treatments and re-run model
  - Model the same area using IFT-MTT, IFT-RANDIG, and/or the Worst Case Flame Length Risk pathways



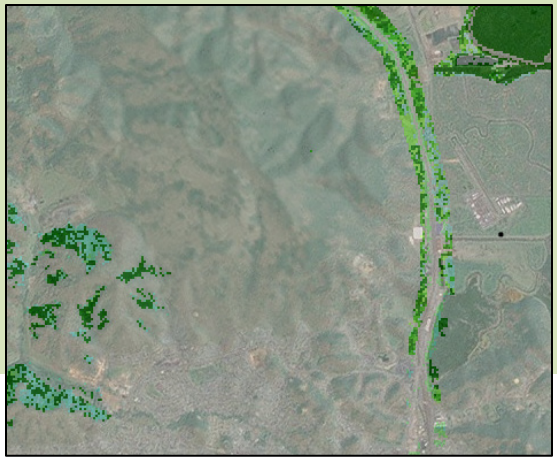
Information You Need to Know

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 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. In other words, fire behavior in pixels surrounding fuels treatment units will not be affected by the fuels treatments.

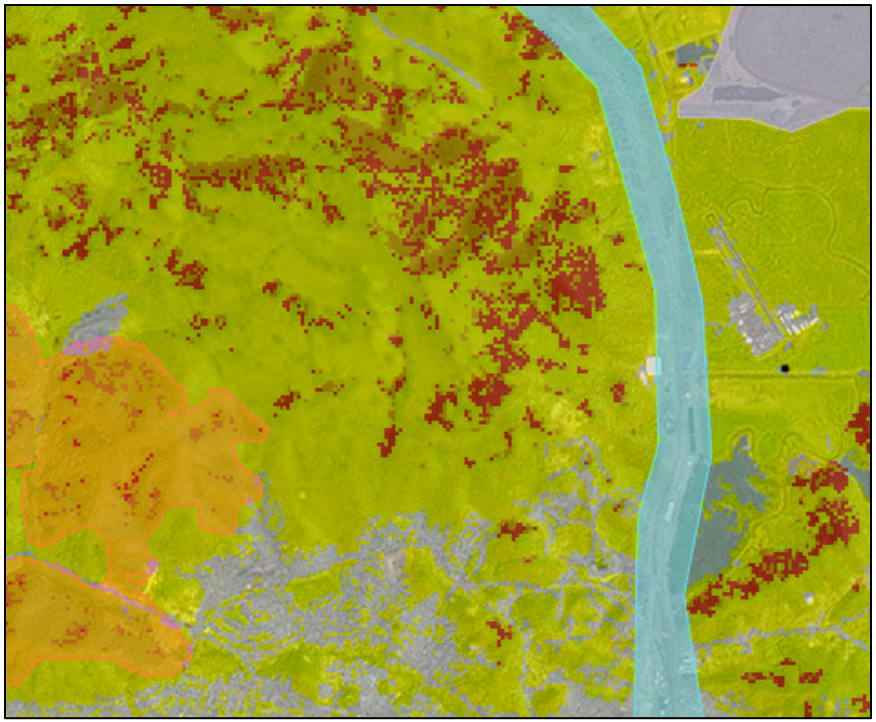
The LANDFIRE data resolution is coarse (30 x 30 m spatial resolution), which affects data interpretation.



Review

Using the Fuels Treatment workflow 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).
  - Establish environmental parameters.
  - Review spatial landscape data and fire behavior output data.
- Identify fuels treatment locations and manipulate the LANDFIRE data to reflect fuels treatments
- Review pre- and post-treatment fire behavior to evaluate fuels treatment effectiveness.



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.