Tutorial D

Creating a Risk Assessment Using the Worst-Case Flame Lengths Approach

Assessing Potential Risks Across a Landscape

Overview

In this risk assessment tutorial, you will learn how to

- Set up a project in IFTDSS and acquire LANDFIRE data.
- Create a run focusing on risk assessment using the worst-case flame lengths approach. The steps in creating this assessment are to
  - Develop a values-at-risk map.
    - Define values at risk and assign response functions
  - Establish environmental and simulation parameters.
    - IFT-FlamMap inputs
    - IFT-RANDIG inputs
  - Review/edit spatial landscape input data.
  - Analyze potential fire behavior output data.
  - Identify potential fire risks across a landscape.
    - Using relative net value change data
    - Export data to Google Earth

All references cited in this tutorial are in the IFTDSS online help bibliography.

At the end of this tutorial, we present and discuss risk assessment caveats.

Introduction

IFTDSS provides two approaches for assessing fire hazard and risk across the landscape based on the methods described in RMRS-GTR-235 *Wildfire Risk and Hazard: Procedures for the First Approximation* (Calkin et. al., 2010a).

1. Worst-Case Flame Lengths Approach
2. Flame Length Probabilities Approach (see Tutorial E)

The processes employed in IFTDSS use a quantitative risk framework to approximate the expected loss and/or potential ecological benefits to valued resources (values at risk) from wildfire.

In the risk assessment, burn probabilities and fire behavior potentials are estimated using the fire simulation modules IFT-FlamMap and IFT-RANDIG.

The modeled output is coupled with data on human and ecological values at risk using a set of fire-effects response functions, with the goal of estimating the expected loss or potential benefit resulting from fire.

In this tutorial, we focus on the **worst-case flame lengths approach**. This approach is referred to as the “worst case” estimation of fire risk because it is based on a single IFT-FlamMap run, where the areas represented by every pixel are all always assumed to burn under the worst case conditions (i.e., by a head fire).

Introduction

The two approaches for assessing fire risk across a landscape using the IFTDSS system are:

Approach 1: Risk assessment – worst-case flame lengths

Approach 2: Risk assessment – by flame length probabilities

This tutorial focuses on assessing potential fire risk across a landscape using the worst-case flame lengths approach.

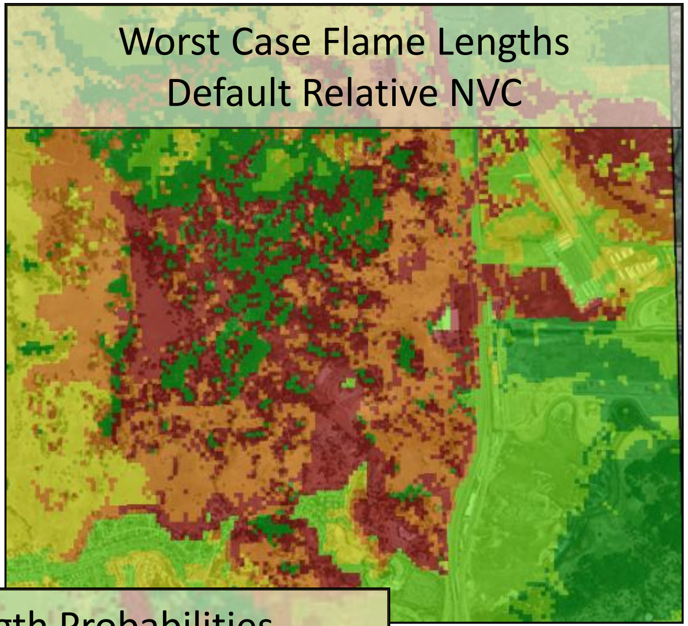
Differences Between Risk Assessment Approaches

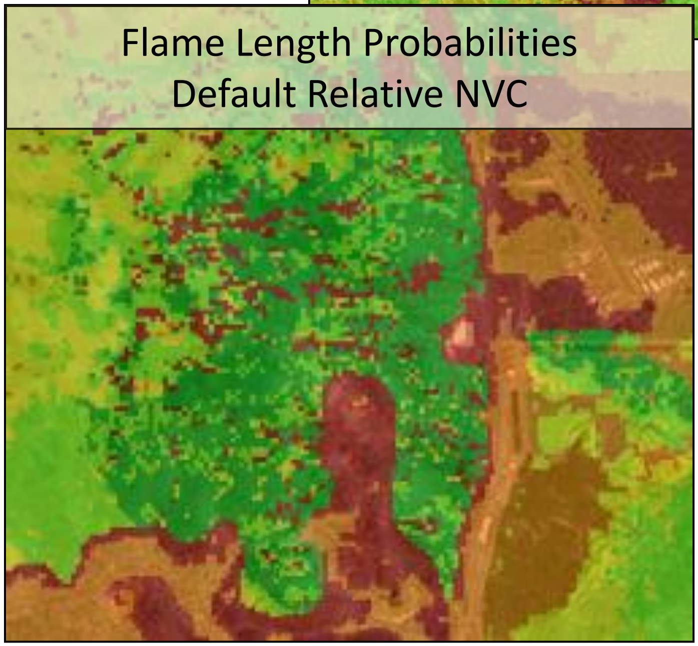
Worst Case Flame Lengths

- This approach is useful when the user is interested in identifying high fire hazard situations during **wind-driven wildfires**.
- In the future, this tool will be useful for assessing the effectiveness of a fuel treatment at reducing the hazard of a fire burning as a head fire.

Flame Length Probabilities

- This approach differs from the worst-case flame length approach in that it considers the likelihood of a fire burning as a backing fire, a flanking fire, or a head fire given a random ignition in the landscape when determining the potential losses or benefits for an area represented by a pixel burning.
- This approach is useful when the user is interested in identifying the potential consequences of an area represented by a pixel burning **under variable fire conditions** and/or assessing the potential ecological benefits of using fire as a management tool.





Tutorial Objectives

- Walk step-by-step through a risk assessment in IFTDSS.
  - There are multiple ways that fire risk can be addressed. This tutorial uses one possible set of criteria for assessing fire risk across a landscape. In the process, this tutorial introduces some of IFTDSS's functionality.

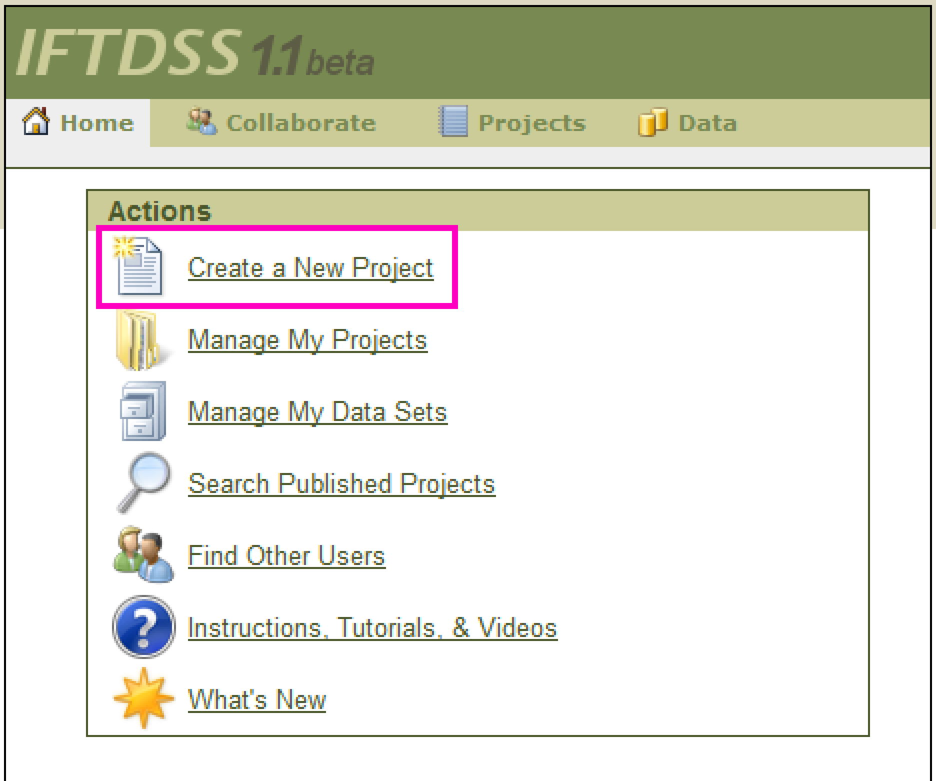
- Spatially identify areas surrounding the Olompali State Historic Park (located near Novato, California) where fire is likely to occur and view potential losses/benefits from a burn based on set environmental conditions.
  - This type of risk assessment should be used as a first approximation of how fire likelihood and fire behavior potentials across landscapes influence fire hazard and risk to social, economic, and ecological values within an area of interest.
  - The results can provide information useful for evaluating and prioritizing where to place treatments to reduce fire hazard and risk to valued resources.
- Discuss caveats to this approach.

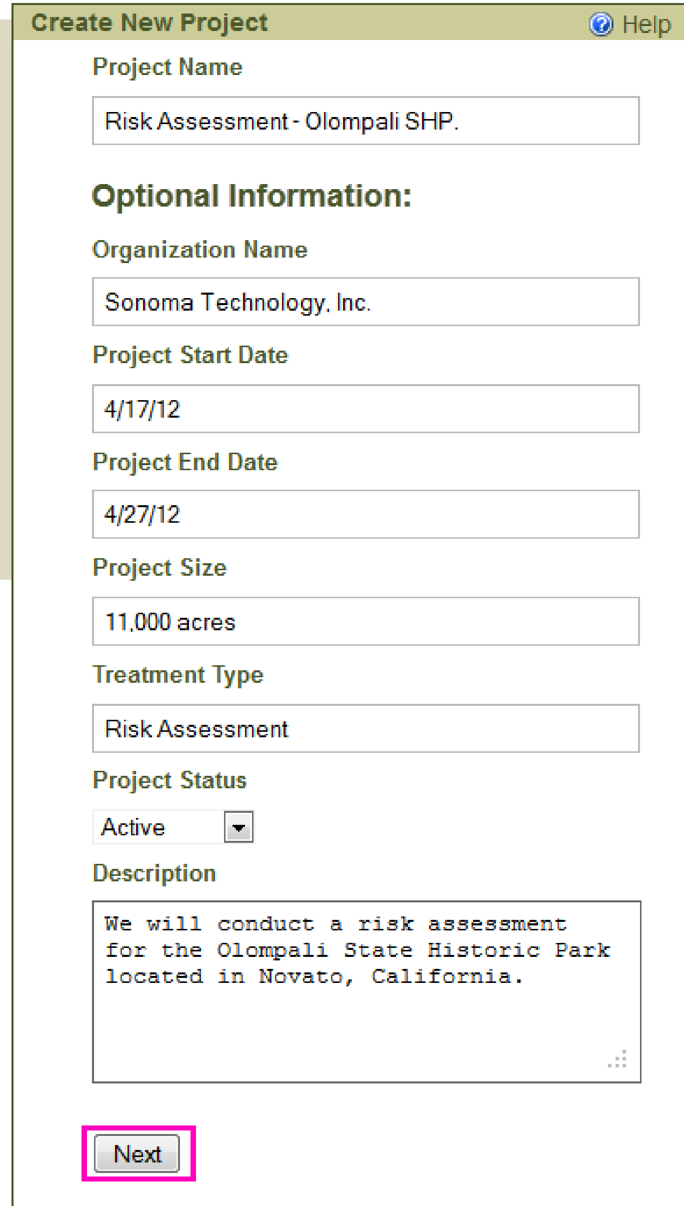
Getting Started

To begin, **Create a New Project.**

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

Choose **Next**.

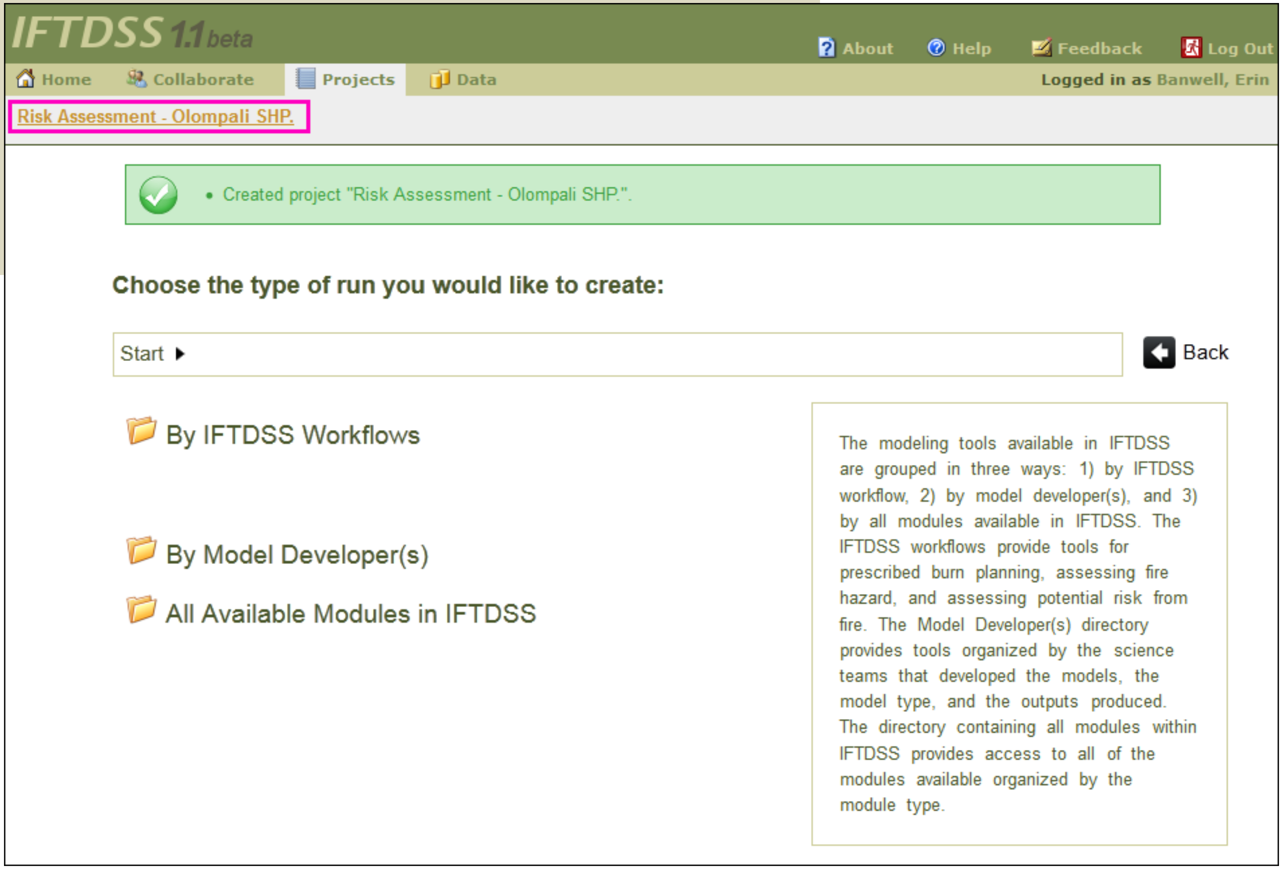




Getting Started

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.

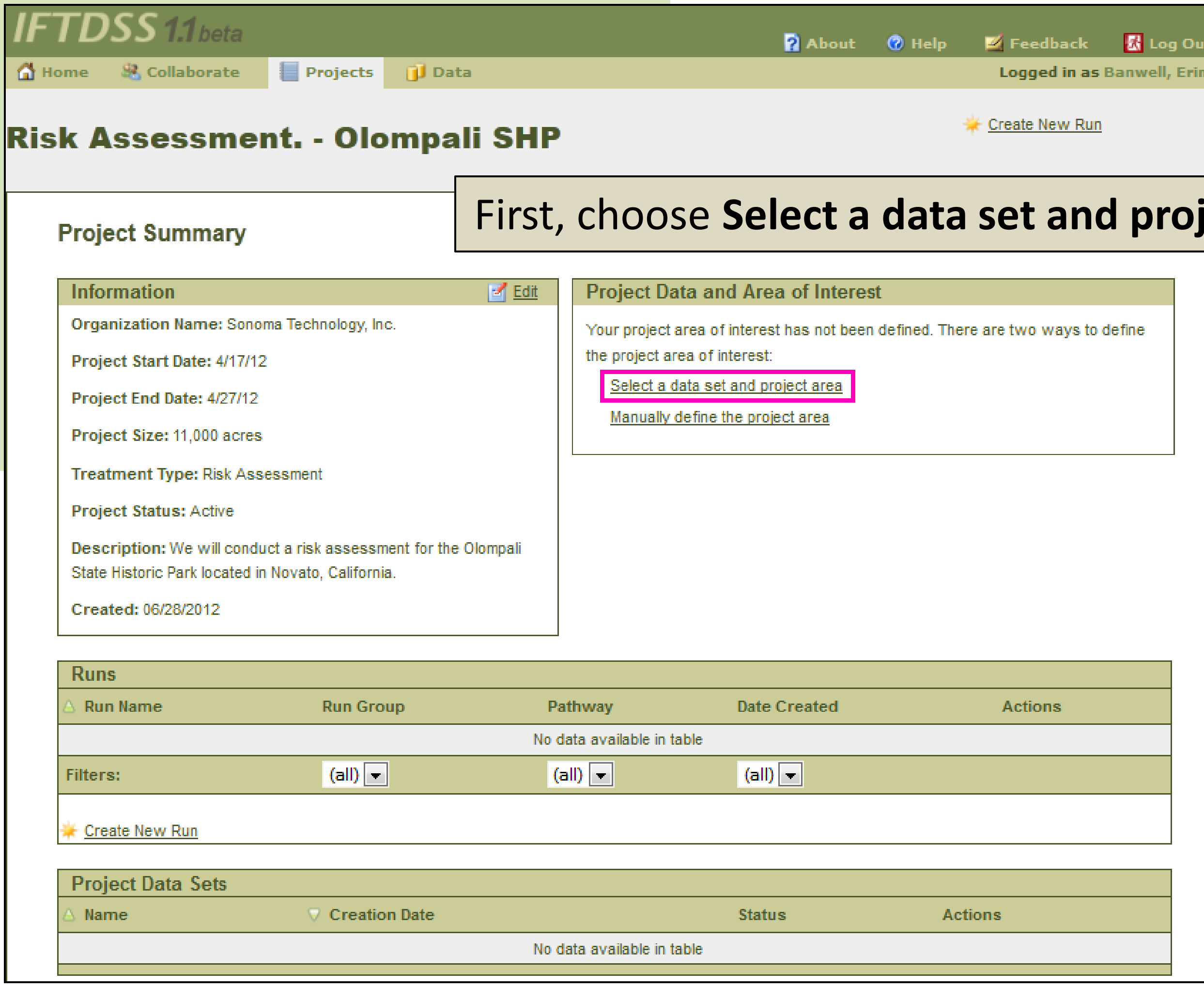
Access the project you created. In this example, we chose the **Risk Assessment – Olompali SHP** link.



Getting Started

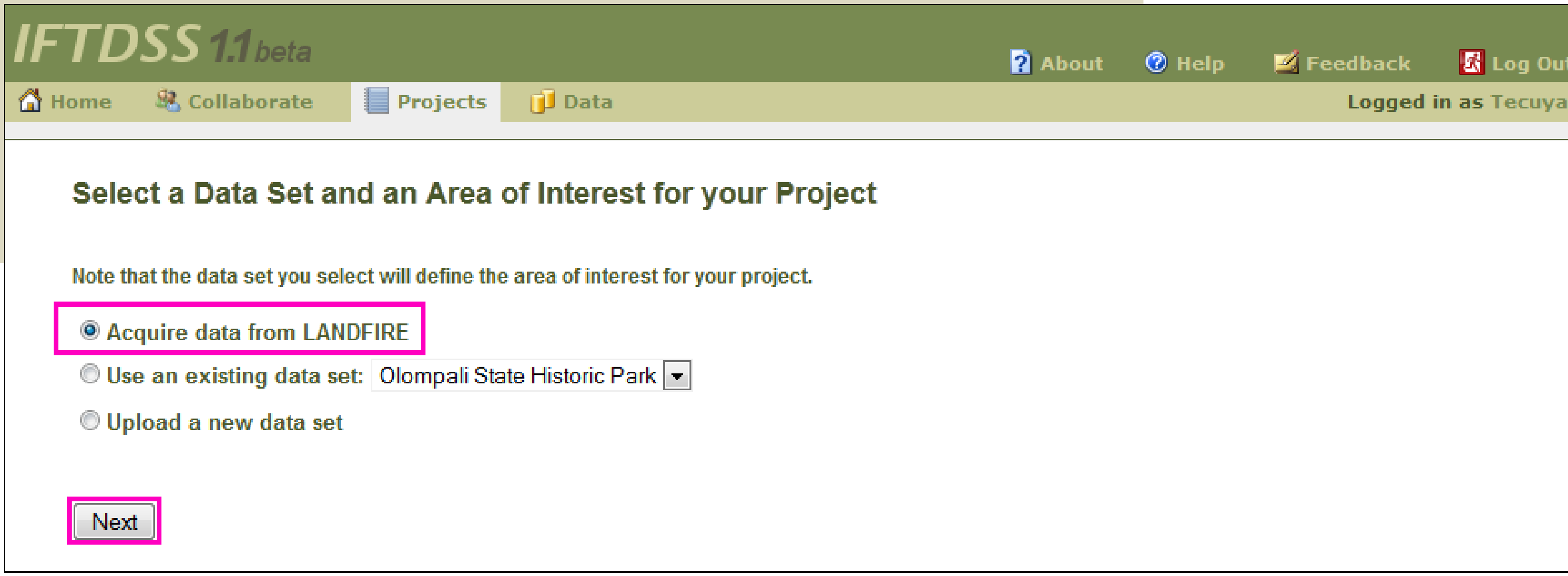
Now, we will acquire data from LANDFIRE.

First, choose **Select a data set and project area**.



Getting Started

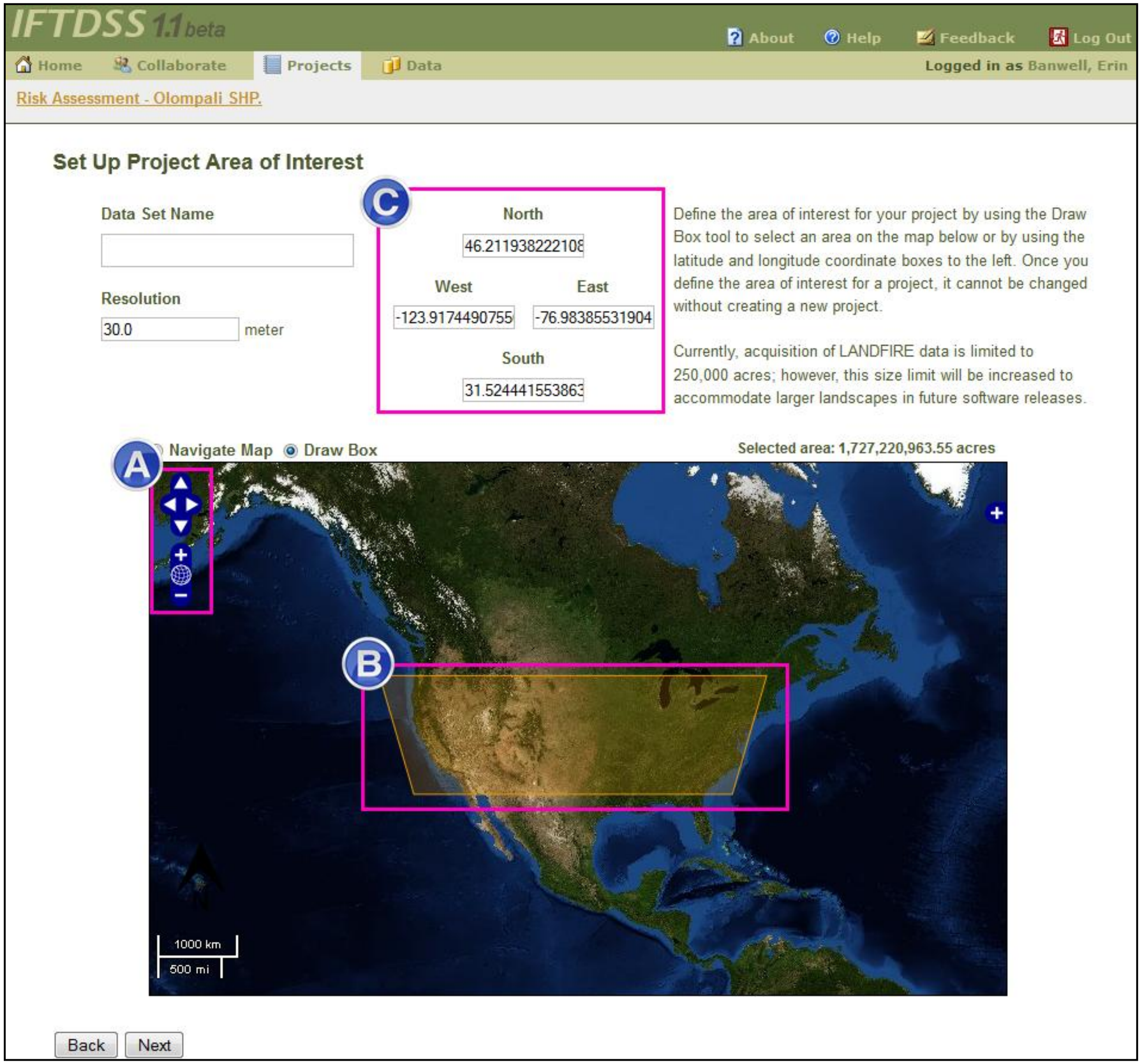
Next, select **Acquire data from LANDFIRE**, then choose **Next**.



Selecting a Project Area of Interest

Navigate to your desired location using one of these methods:

- **A** 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:**

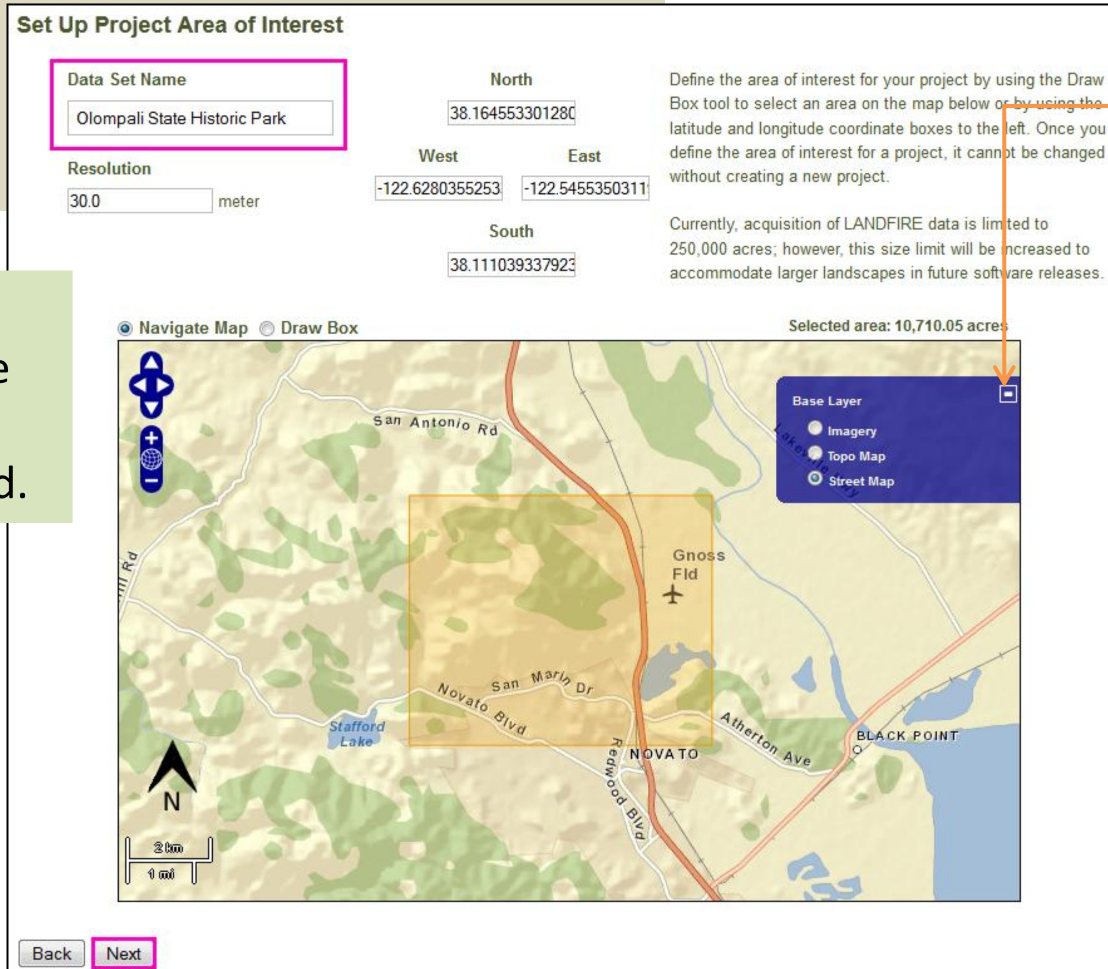
- **North:** 38.164505878997
- **East:** -122.54560796614
- **South:** 38.111039352952
- **West:** -122.62800542709

Selecting a Project Area of Interest

Name the data set.

Choose **Next** to import LANDFIRE data.

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



Tip: Click on the plus sign ( )in the upper right corner of the map to view different base layers.

Maximum area: Acquisition of LANDFIRE data is limited to 250,000 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.

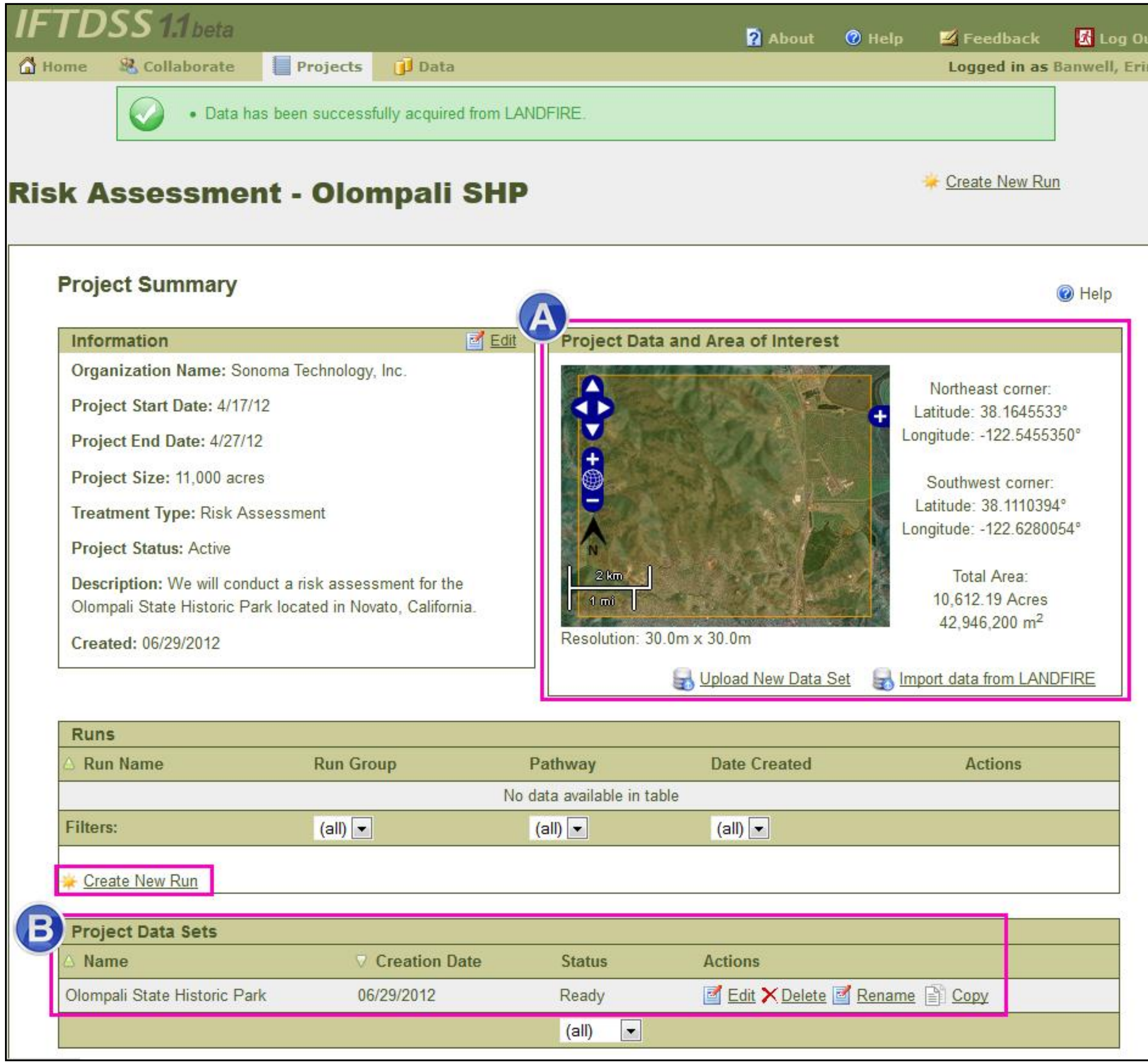
For use in spatial modules, you now have

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:**

By IFTDSS Workflows

→ Risk Assessment

→ Risk Assessment – Worst Case Flame Length

In this **run**, you will

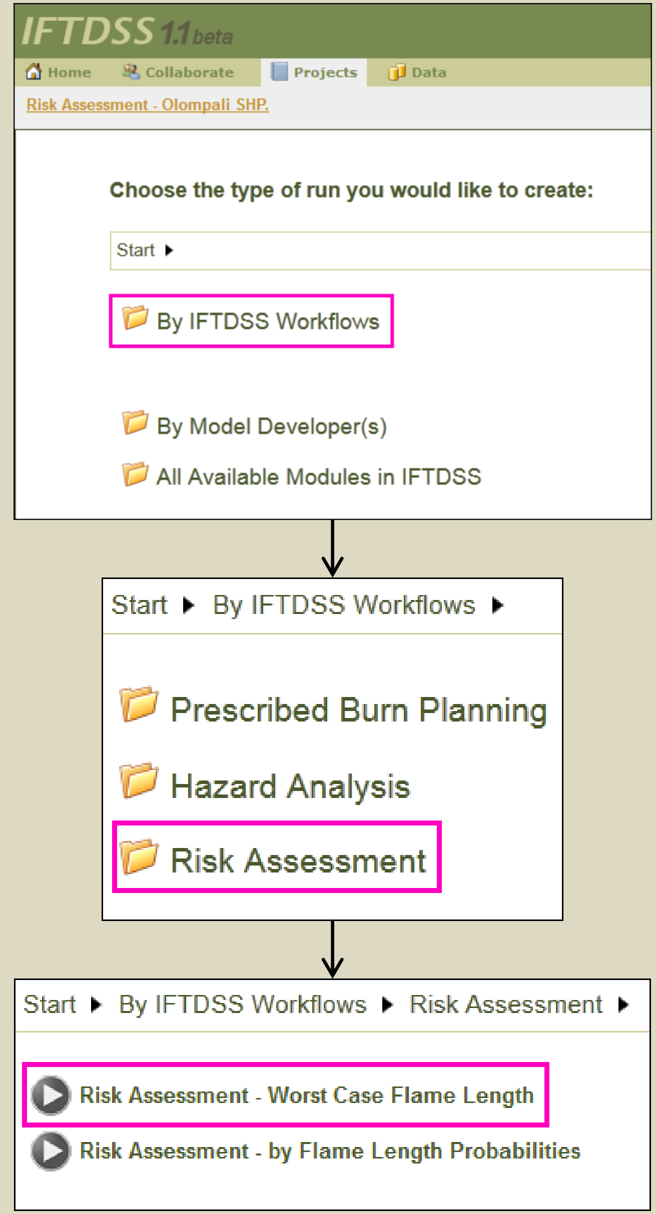
a. Select an area of interest.

b. Input your environmental parameters.

c. Review/edit the spatial landscape data.

d. Analyze potential fire behavior output data.

e. Identify potential fire risks across a landscape.



Selecting an Area of Interest

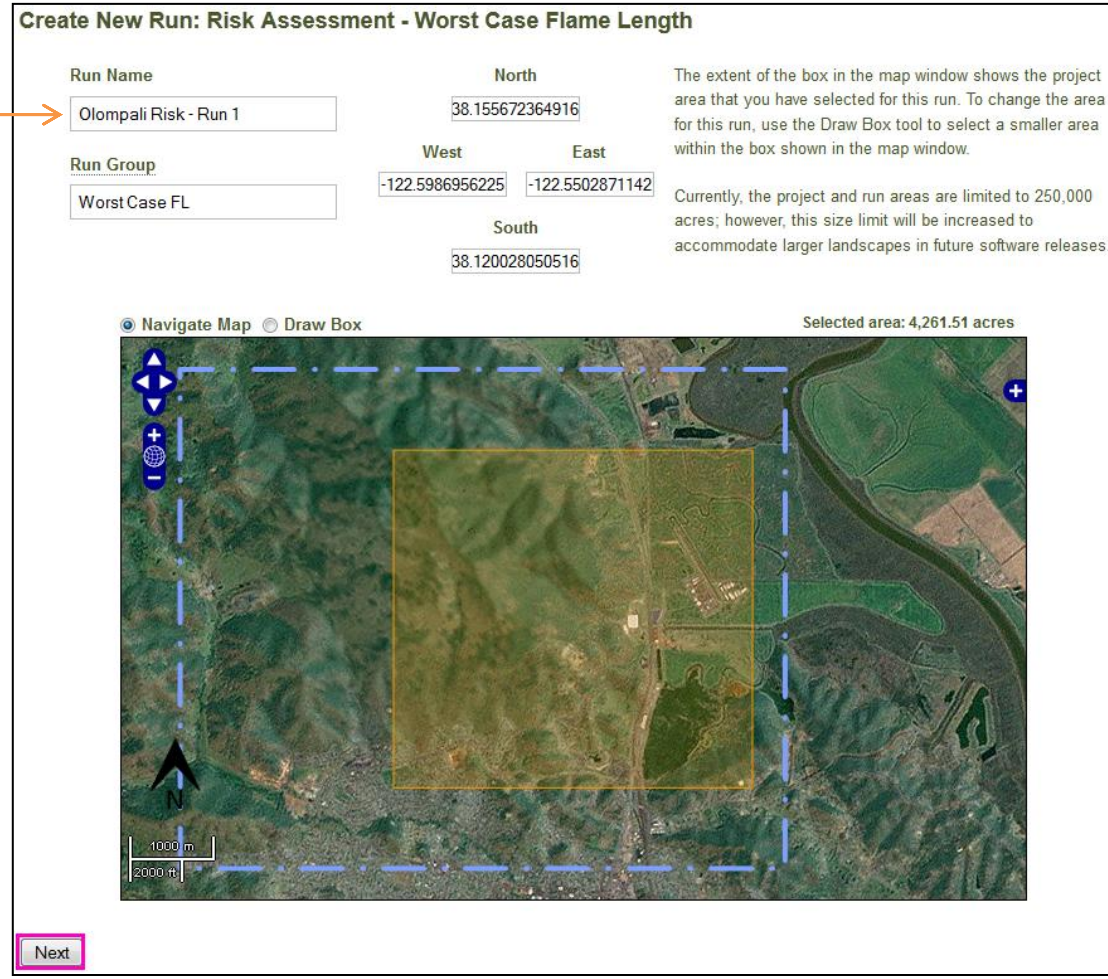
Tip: You must name your run. For future reference, give your run a descriptive name.

In this step, select an area of interest within the project boundary. For this example, we selected a smaller area within the project boundary.

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

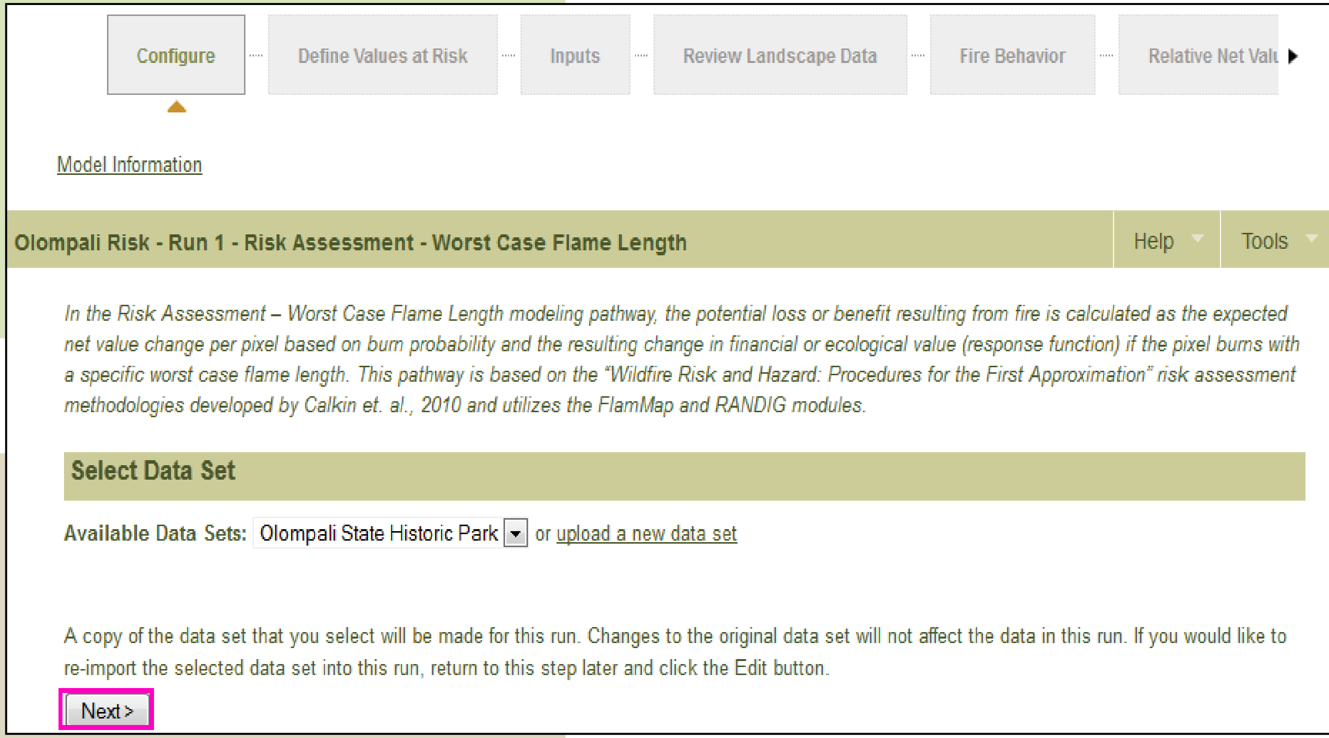
- **North:** 38.155672364916
- **East:** -122.5502871142
- **South:** 38.120028050516
- **West:** -122.5986956225

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



Selecting a Data Set

You are now on the **Configure** step.



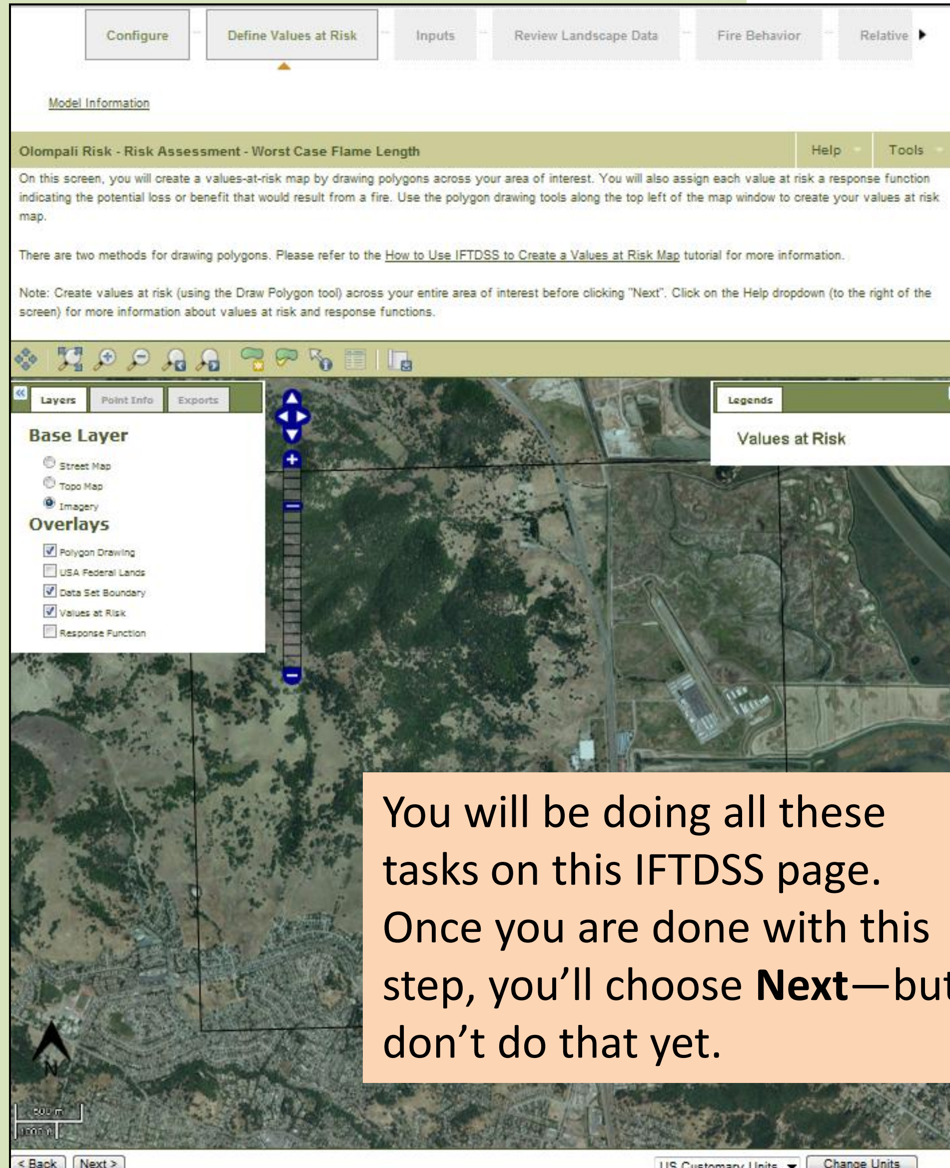
Under **Select Data Set**, select the "Olompali State Historic Park" data set and choose **Next**, which takes you to the **Define Values at Risk** step.

Defining Values at Risk

You are now at the **Define Values at Risk** step. In this step, you will define your values at risk (using the **Draw Polygon** tool) across your entire area of interest.

On pages 19 through 29, this tutorial

- Provides definitions for the terms “values at risk” and “response functions” (page 18)
- Describes the map toolbar (page 19)
- Describes how to define values at risk (pages 20 through 29) by
    - Drawing polygons (using two different methods)
    - Assigning response functions
    - Editing polygons



You will be doing all these tasks on this IFTDSS page. Once you are done with this step, you’ll choose **Next**—but don’t do that yet.

Values at Risk and Response Functions

Values at risk (also known as highly valued resources [HVR]) are features on the landscape that are influenced positively and/or negatively by fire.

A value at risk can have ecological, economic, or social importance.

Some examples of values at risk include

- Airports
- Archeological sites
- Conifer forests
- Highway buffers
- Historic buildings
- Wildland-urban interface

Response Function	Description	Net Value Change Multiplier Based on User-Defined Flame Length Classes			
		Low	Moderate	High	Very High
1	All fire is beneficial; strong benefit at low and moderate fire intensities and moderate benefit at high and very high intensity.	+80	+80	+40	+40
2	All fire is beneficial; moderate benefit at low fire intensity and mild benefit at higher intensity.	+50	+20	+20	+20
3	Strong benefit at low fire intensity, decreasing to a strong loss at very high fire intensity.	+60	+20	-20	-60
4	Moderate benefit at low fire intensity, decreasing to a moderate loss at very high fire intensity.	+30	+10	-10	-30
5	Slight benefit or loss at all fire intensities.	0	0	0	0
6	Mild increasing loss from slight benefit or loss at low intensity to a moderate loss at very high intensity.	0	-10	-20	-30
7	Moderate increasing loss from mild loss at low intensity to a strong loss at very high intensity.	-10	-30	-50	-80
8	Slight benefit or loss at all fire intensities, except a moderate loss at very high intensity.	0	0	0	-50
9	Slight benefit or loss at low and moderate fire intensities and a mild loss at high and very high intensities.	0	0	-20	-20
10	Mild loss at all fire intensities.	-20	-20	-20	-20
11	Moderate loss from fire at all fire intensities.	-50	-50	-50	-50
12	Strong loss from fire at all fire intensities.	-80	-80	-80	-80
13	Loss increases from slight loss at low intensity to strong loss at very high intensity.	-10	-60	-70	-80
14	Slight benefit or loss from fire at low and moderate intensities and a strong loss from fire at high and very high intensities.	0	0	-80	-80

(Table modified from Calkin et al, 2010a.)

Response functions describe the effect of fire on the values at risk.

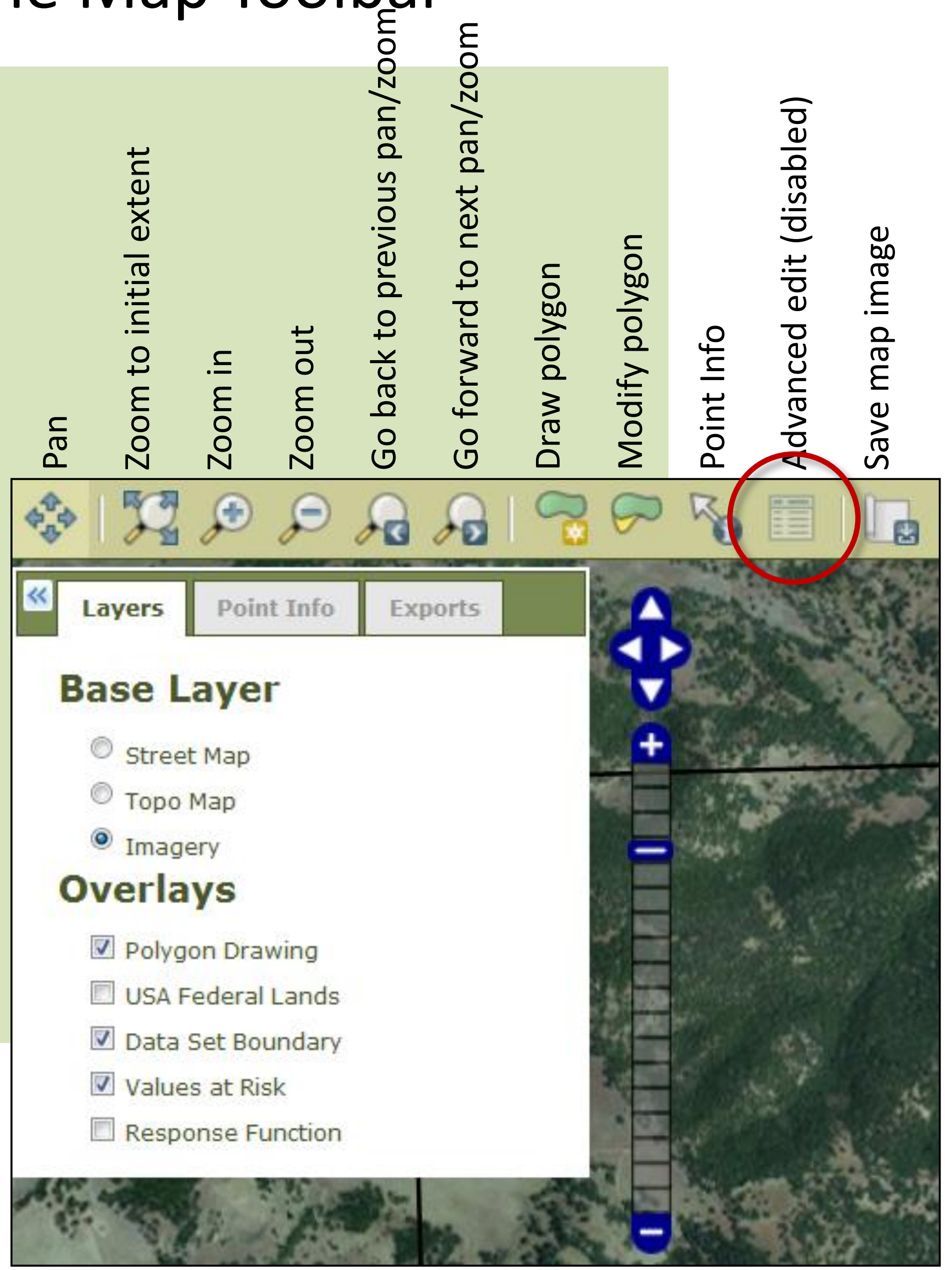
Response functions are mathematical relationships between fire characteristic (e.g., flame length) and fire outcome (see the table above; this table is also available in the online help). There are 14 pre-defined response functions.

Introducing the Map Toolbar

The map toolbar, located at the top of the map, provides tools for drawing your values at risk.

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

Tools that are disabled are faded out (for example, the **Advanced Edit** tool, circled here in red).

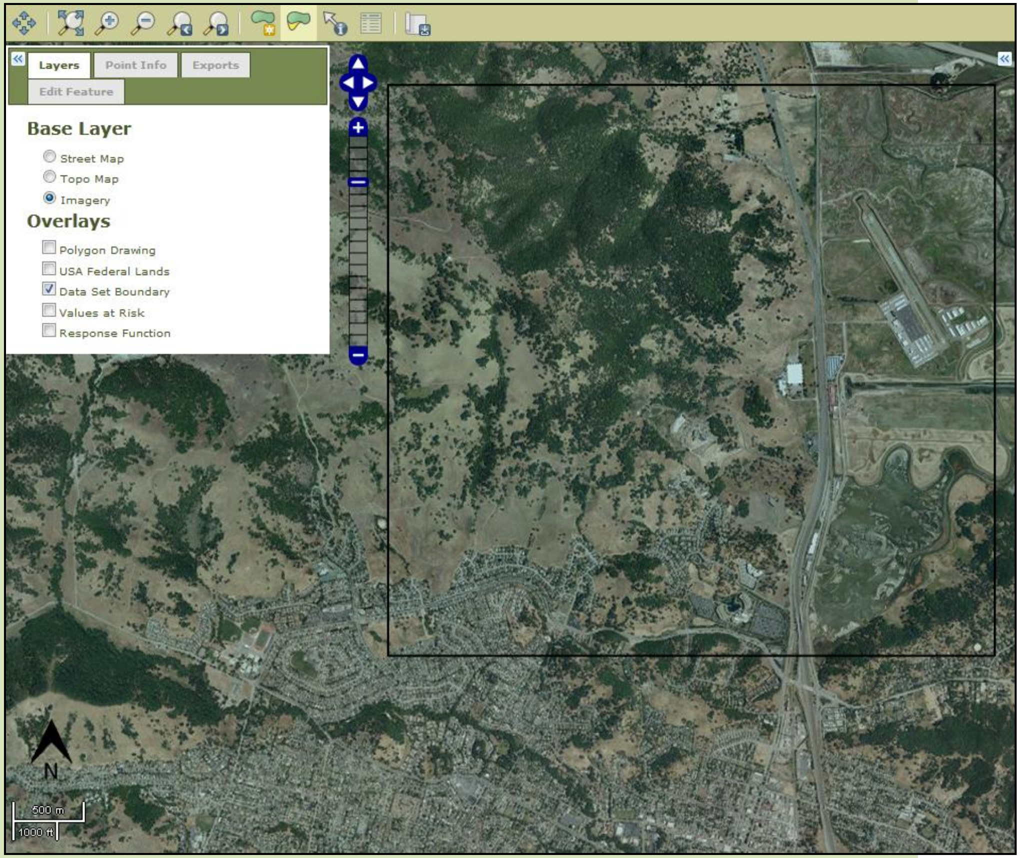


Defining Values at Risk

In the next few steps, you will create a values-at-risk map by drawing and assigning response functions to polygons across the landscape.

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 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.

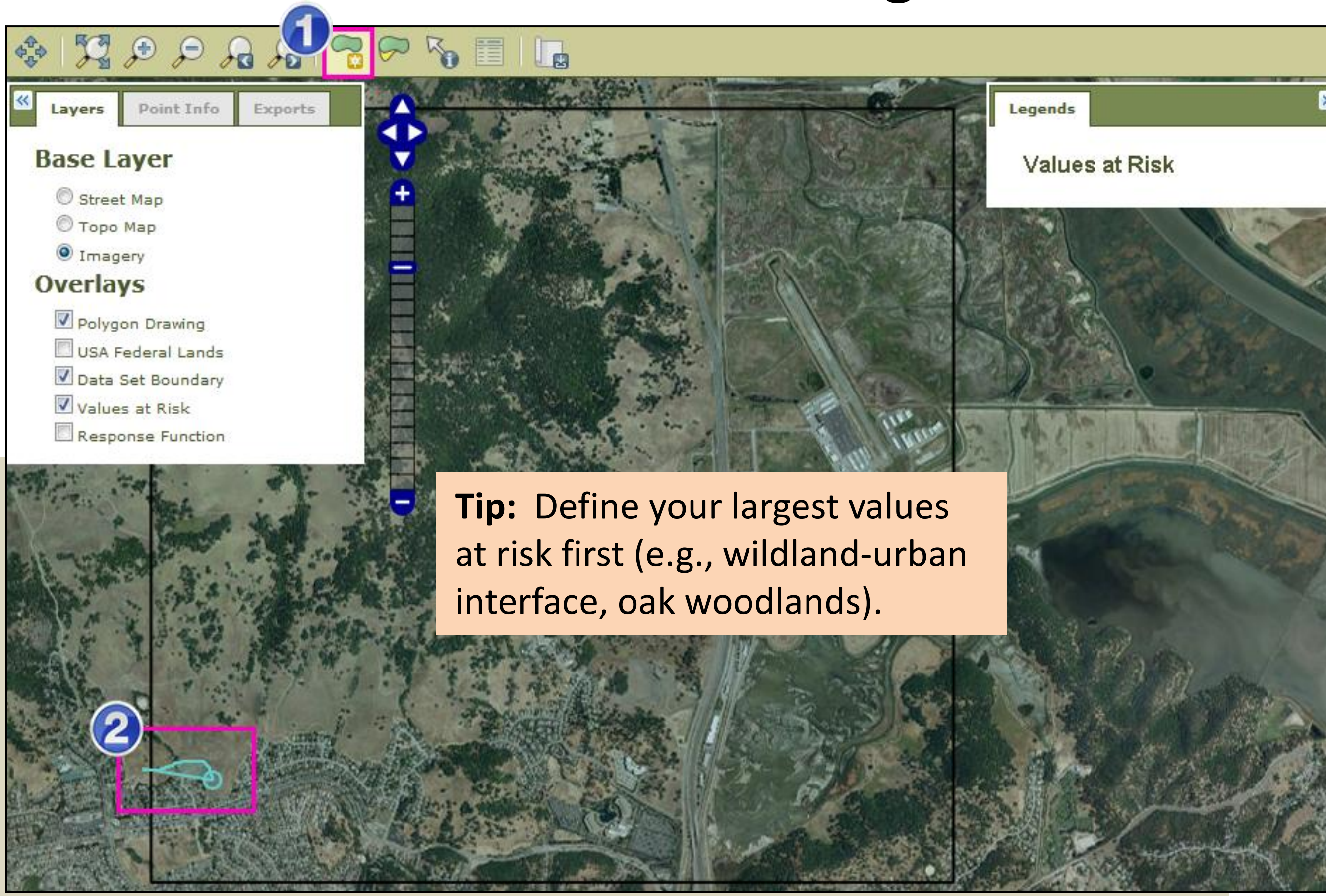


These polygon drawing methods are discussed on pages 21 through 24.

Defining Values at Risk – Freeform Drawing Method

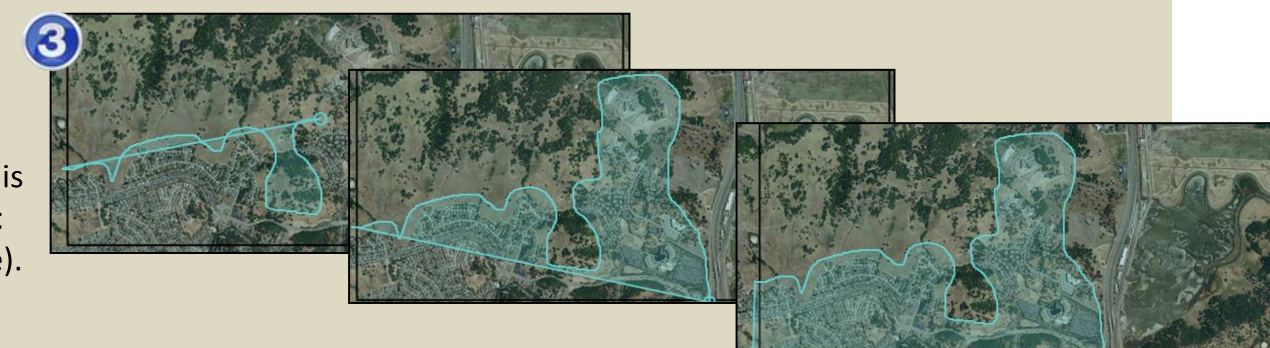
In this step, you use the freeform drawing method to **define values at risk** and assign each value at risk a response function.

In this example, you draw a polygon over the wildland-urban interface.



Tip: Define your largest values at risk first (e.g., wildland-urban interface, oak woodlands).

1. 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 wildland-urban interface).

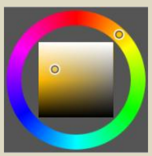


Let go of the left mouse button when you are done drawing the polygon. This creates the polygon and opens the **Edit Feature** panel (shown on the next page).

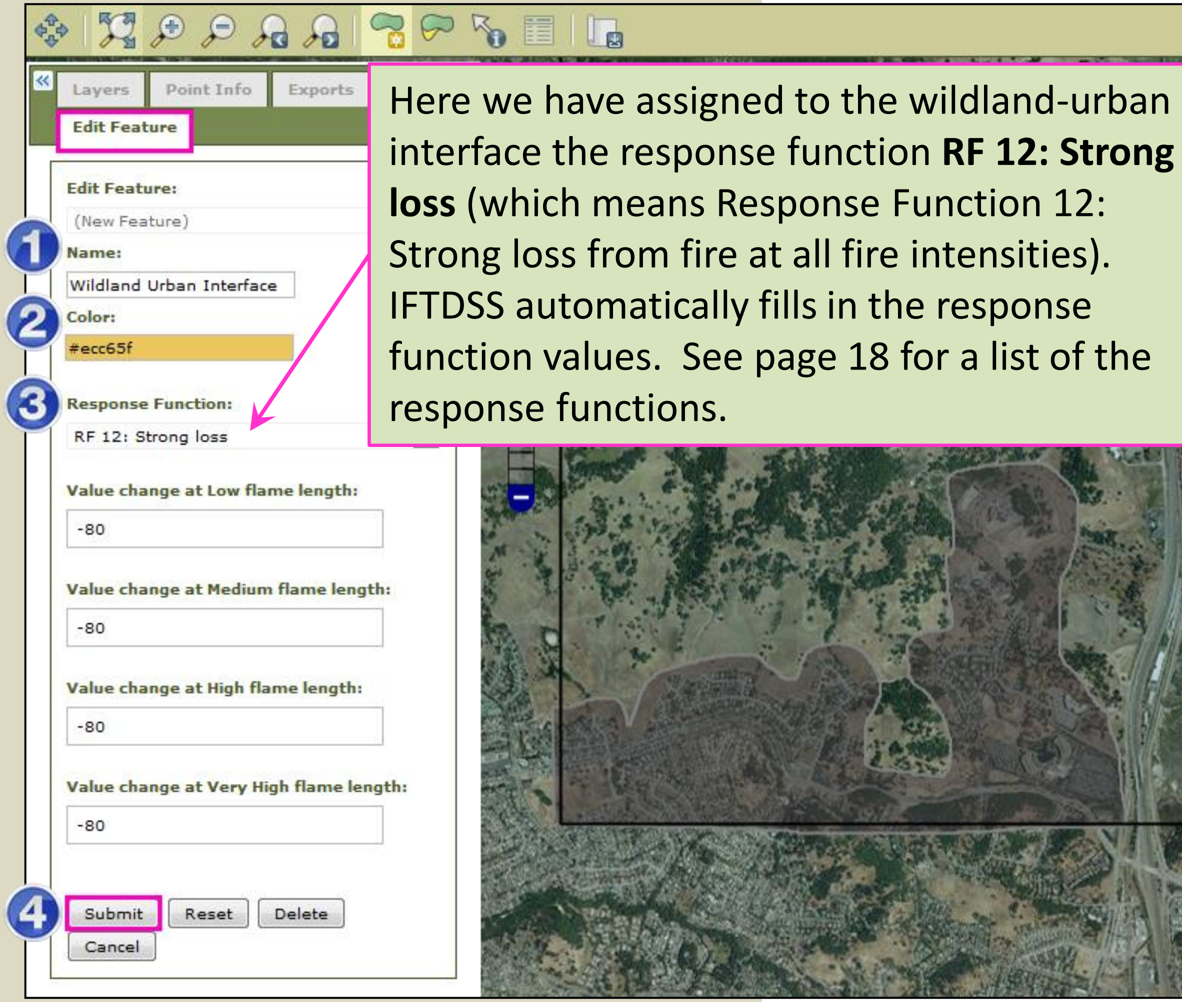
Using the Edit Feature Panel to Define Values at Risk

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. Assign a response function to the polygon (see page 18 and the box to the right on this page).
4. Choose **Submit** to save the polygon data.



Here we have assigned to the wildland-urban interface the response function **RF 12: Strong loss** (which means Response Function 12: Strong loss from fire at all fire intensities). IFTDSS automatically fills in the response function values. See page 18 for a list of the response functions.

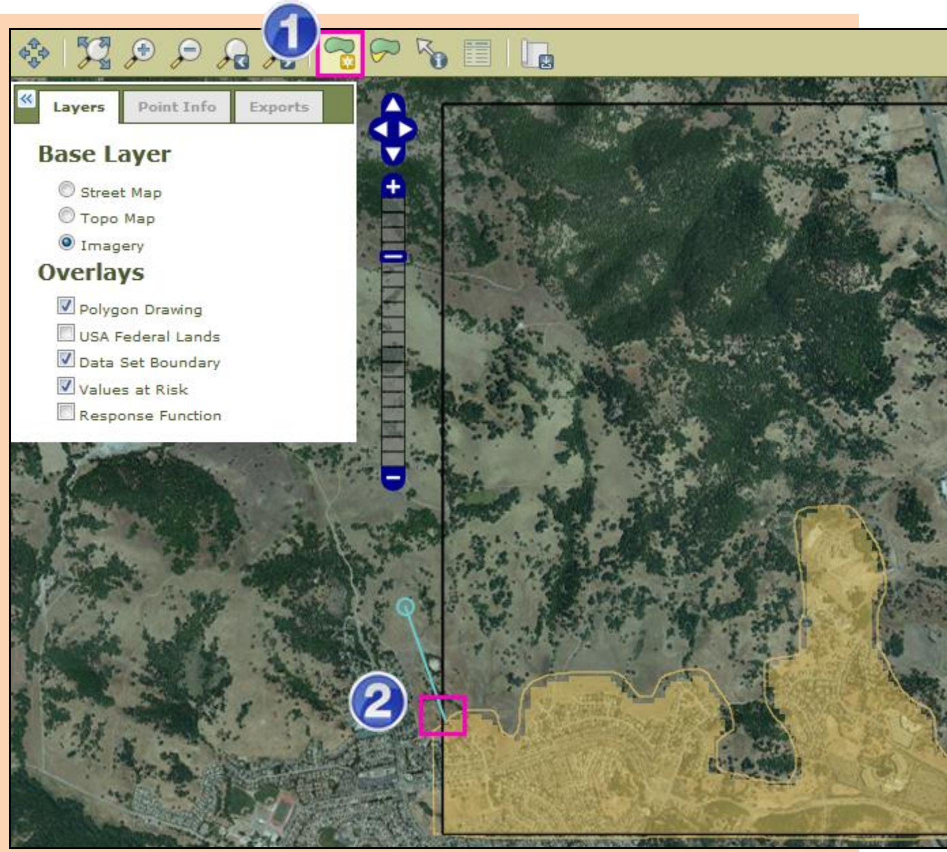
Defining Values at Risk – Point and Click Method

Next, define another value at risk.

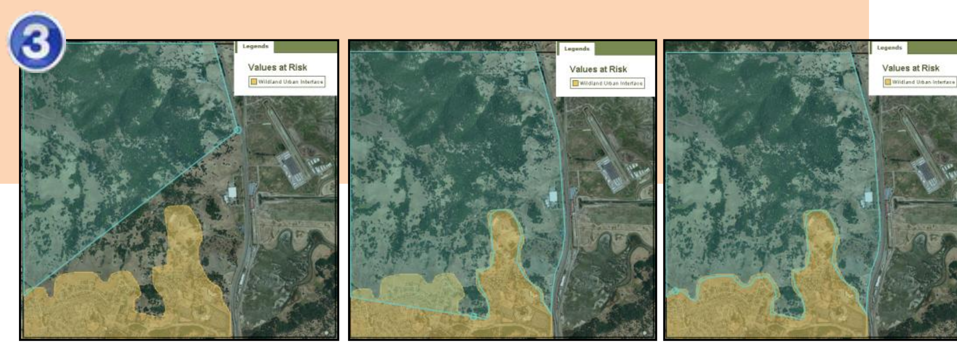
In this example, use the **point and click method** to draw a polygon over the private land (oak woodlands).

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).



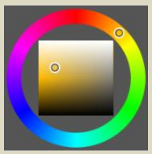
Tip: Overlap your polygons. This insures that all pixels in your project area will be assigned a response function.



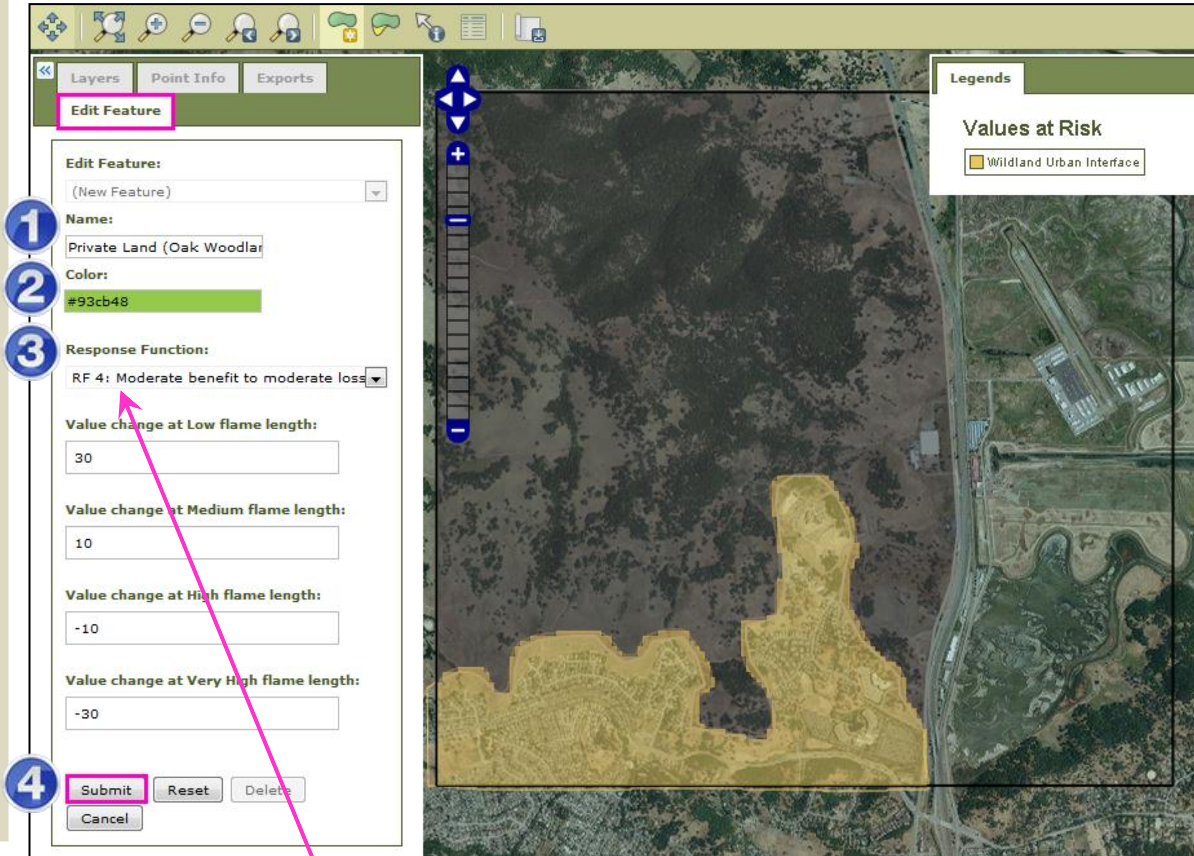
Using the Edit Feature Panel to Define Values at Risk

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.



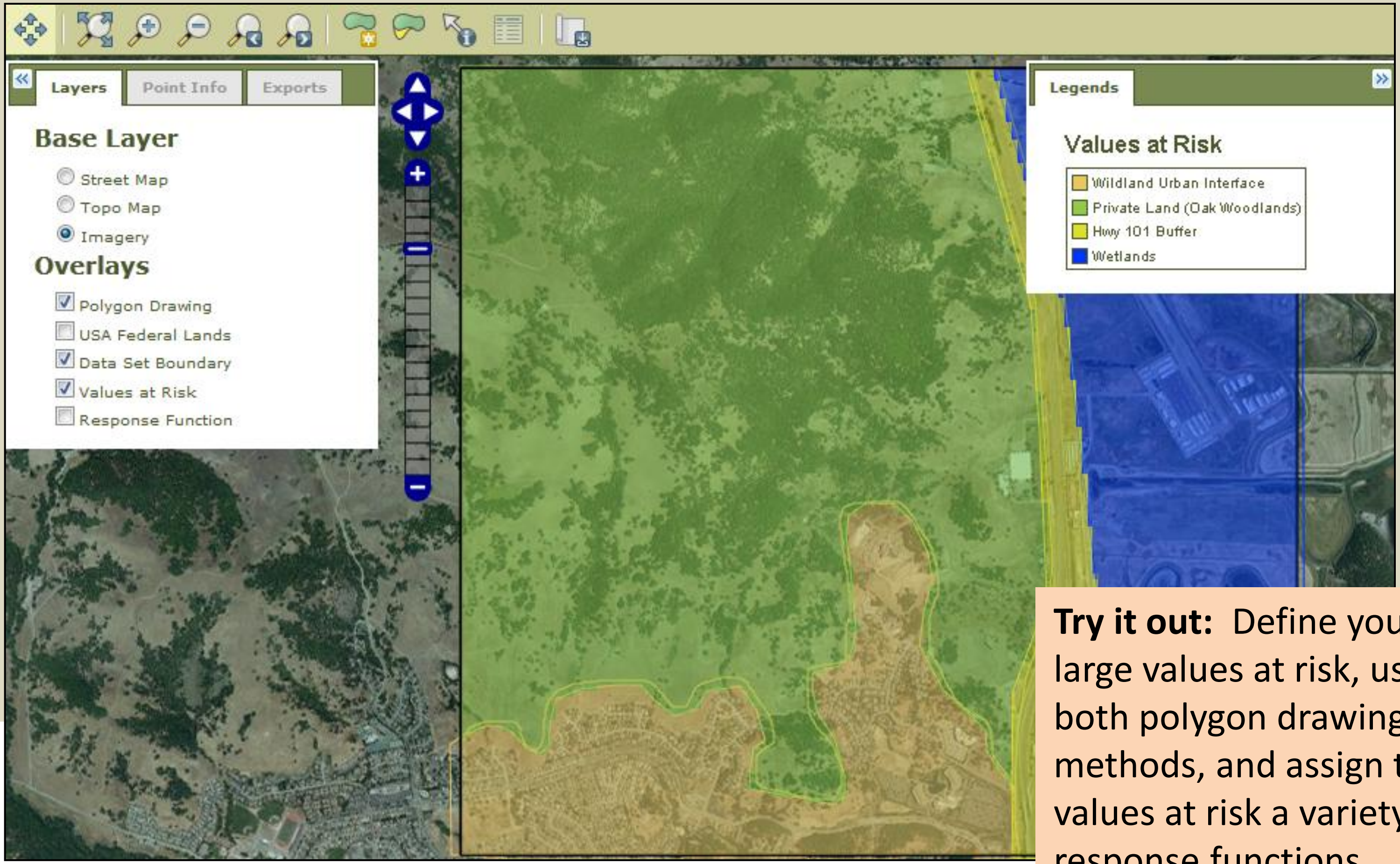
3. Assign a response function to the polygon (see page 18 and the box to the lower right on this page).
4. Choose **Submit** to save the polygon data.



Here we have assigned to the oak woodland the response function **RF 4: Moderate benefit at low fire intensities to moderate loss at high fire intensities**. As before, IFTDSS automatically fills in the response function values.

Defining Larger Values at Risk

Continue the steps on pages 21 through 24 until you fill your entire area of interest with polygons representing the larger values at risk. **Define your largest values at risk** first (e.g., wildland-urban interface, oak woodlands).



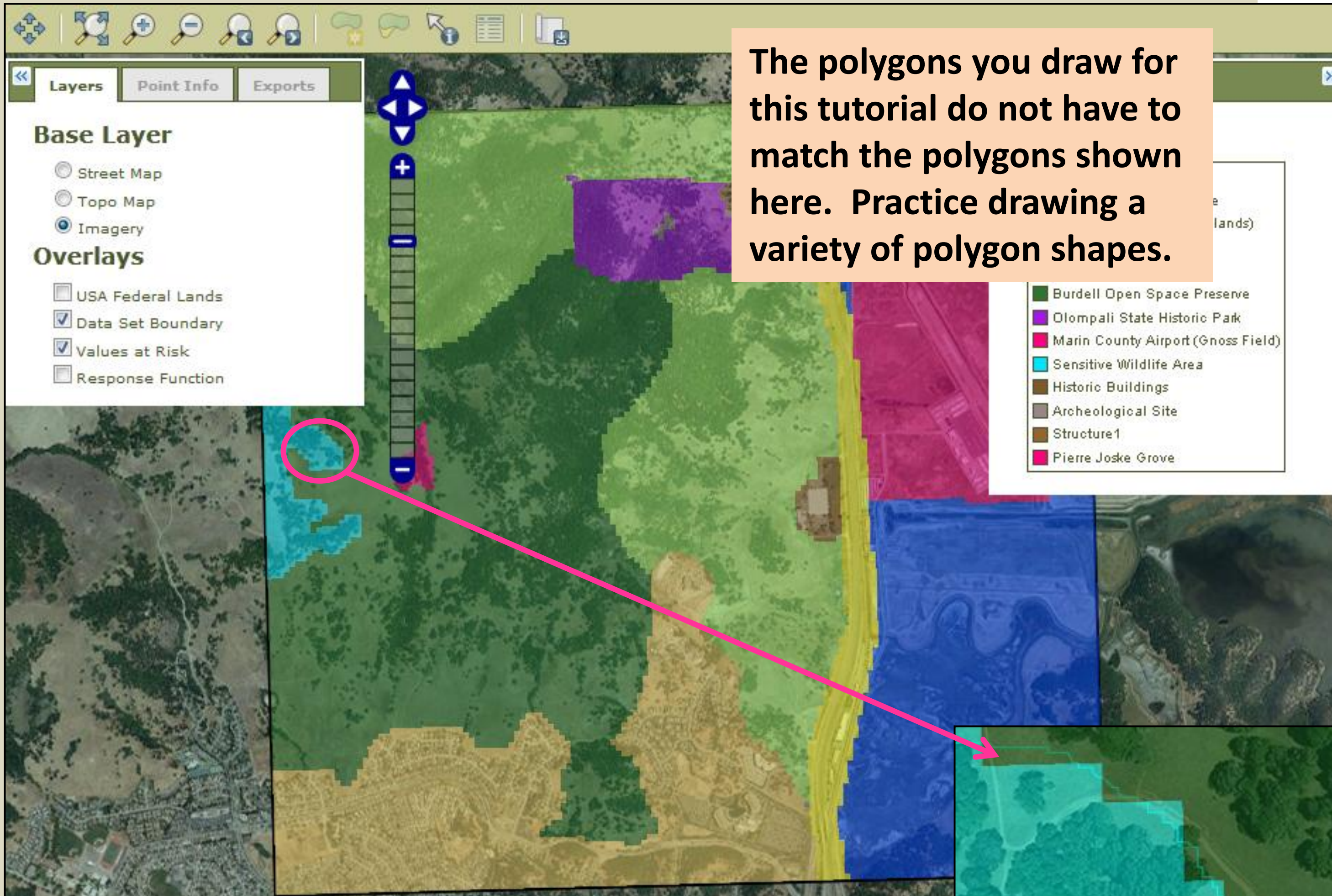
Try it out: Define your own large values at risk, using both polygon drawing methods, and assign those values at risk a variety of response functions.

Defining Smaller Values at Risk

After defining your larger values at risk, **draw smaller values of risk** (e.g., archeological sites, endangered species habitat, structures) on top of the larger values at risk.

The smaller polygons replace the larger polygons beneath.

Tip: Creating a detailed values-at-risk map (with multiple response functions) produces better outputs.



The polygons you draw for this tutorial do not have to match the polygons shown here. Practice drawing a variety of polygon shapes.

Once you create a polygon, the data area is rasterized. If your polygon line encompasses less than half of a pixel, that pixel will not be included in your polygon. If your polygon line encompasses more than half of a pixel, that pixel will be included in your polygon.

Defining Values at Risk – Assigning a Background

In order for IFTDSS to calculate an output in the risk pathways, all grid cells within an area of interest need a response function. To fill this requirement without having to define values at risk for every pixel, you can **assign a background to your values-at-risk map.** The following steps show how to do so. Any grid cells not captured within a polygon will be assigned the response function assigned to the background.

1. Select the **Modify Polygon** tool.

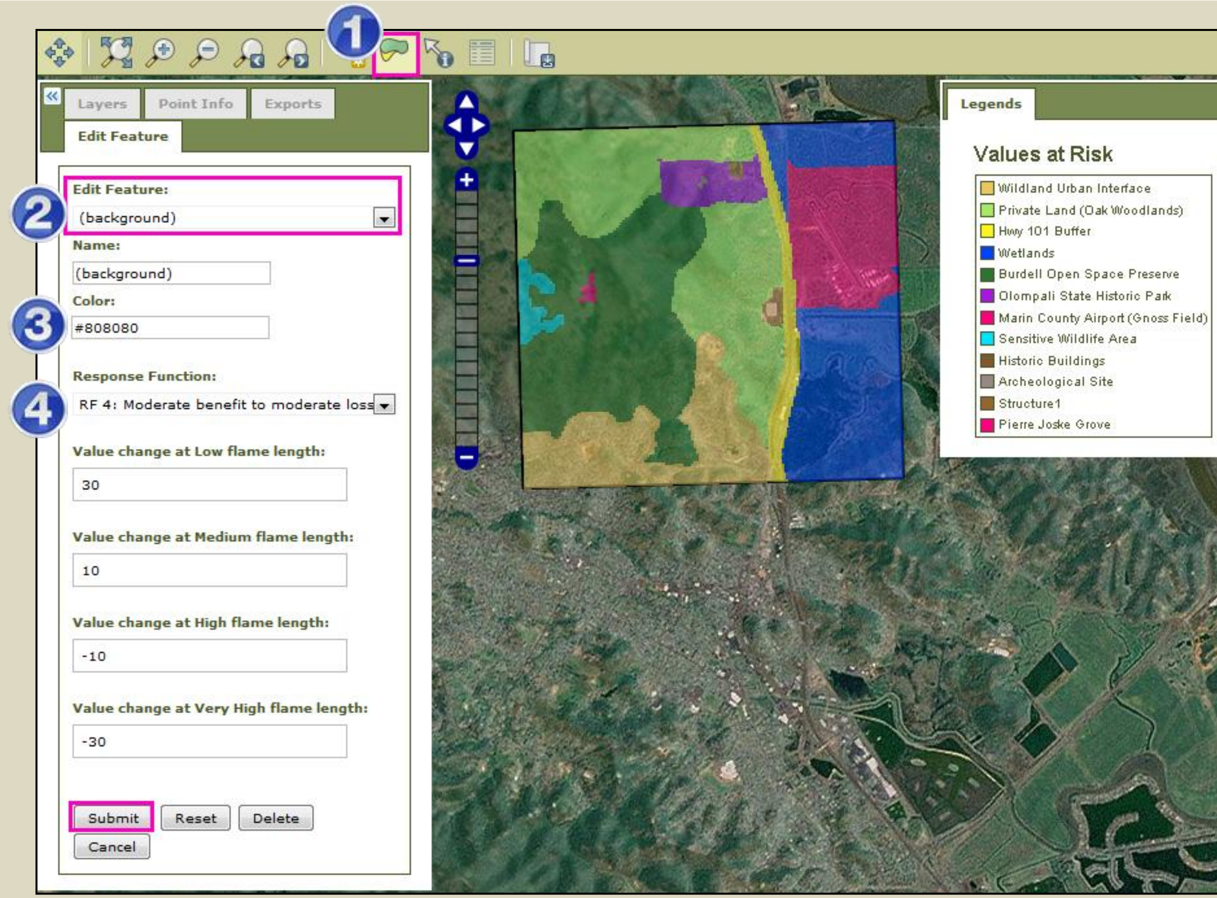
2. Under the **Edit Feature** drop-down, (background) is automatically selected.

   If you prefer, you can change the background's name from (background).

3. Assign the background a color.

4. Assign the background a response function.

   Assigning the background a response function of 4 tells IFTDSS to assume that the areas without a polygon will burn with a moderate benefit under low flame lengths to a moderate loss under very high flame lengths.



Editing Values at Risk

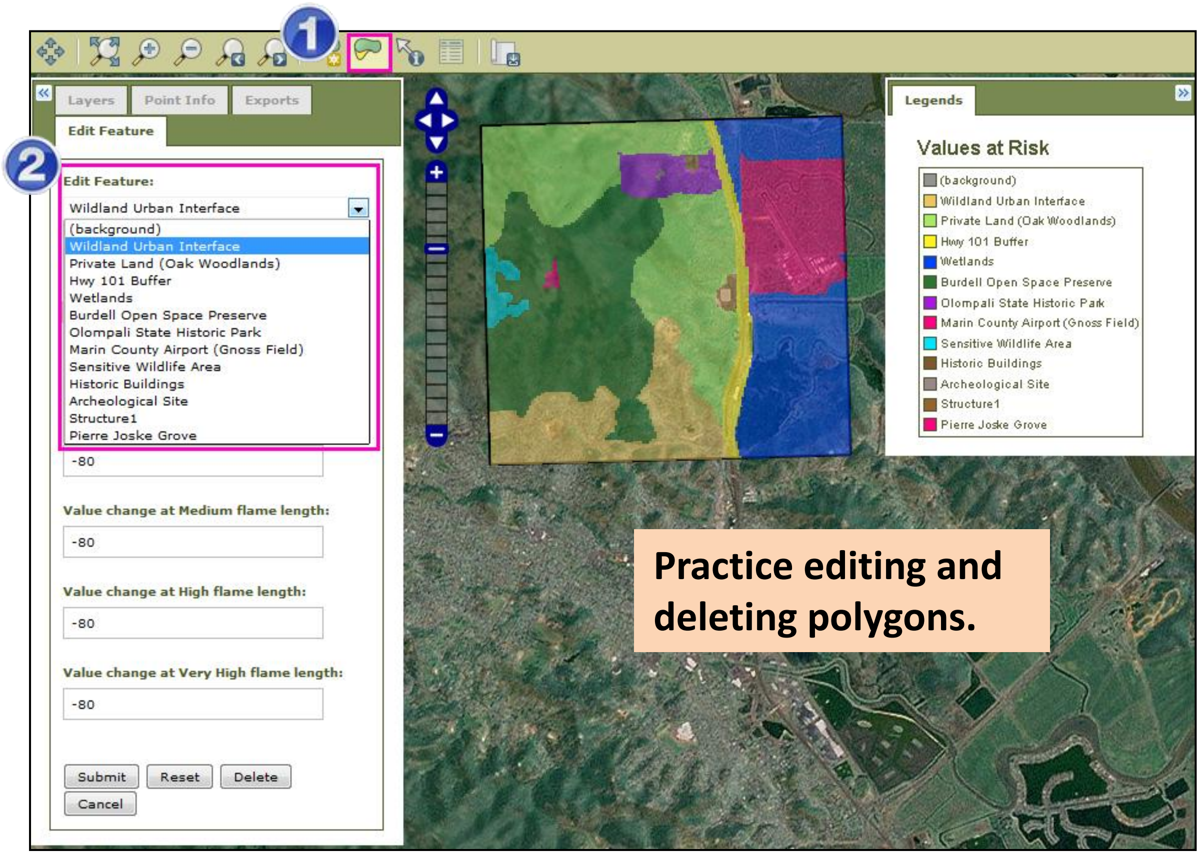
You can also edit your polygons using the **Modify Polygon** tool.

1. Select the **Modify Polygon** tool.
2. Select the feature (value at risk) you would like to edit using the **Edit Feature** drop-down list.

In the **Edit Feature** panel, you can edit the polygon's name, color, or response function.

You can also delete a polygon using the **Delete** button at the bottom of the panel.

If you delete a polygon, the assigned background will replace the deleted polygon.



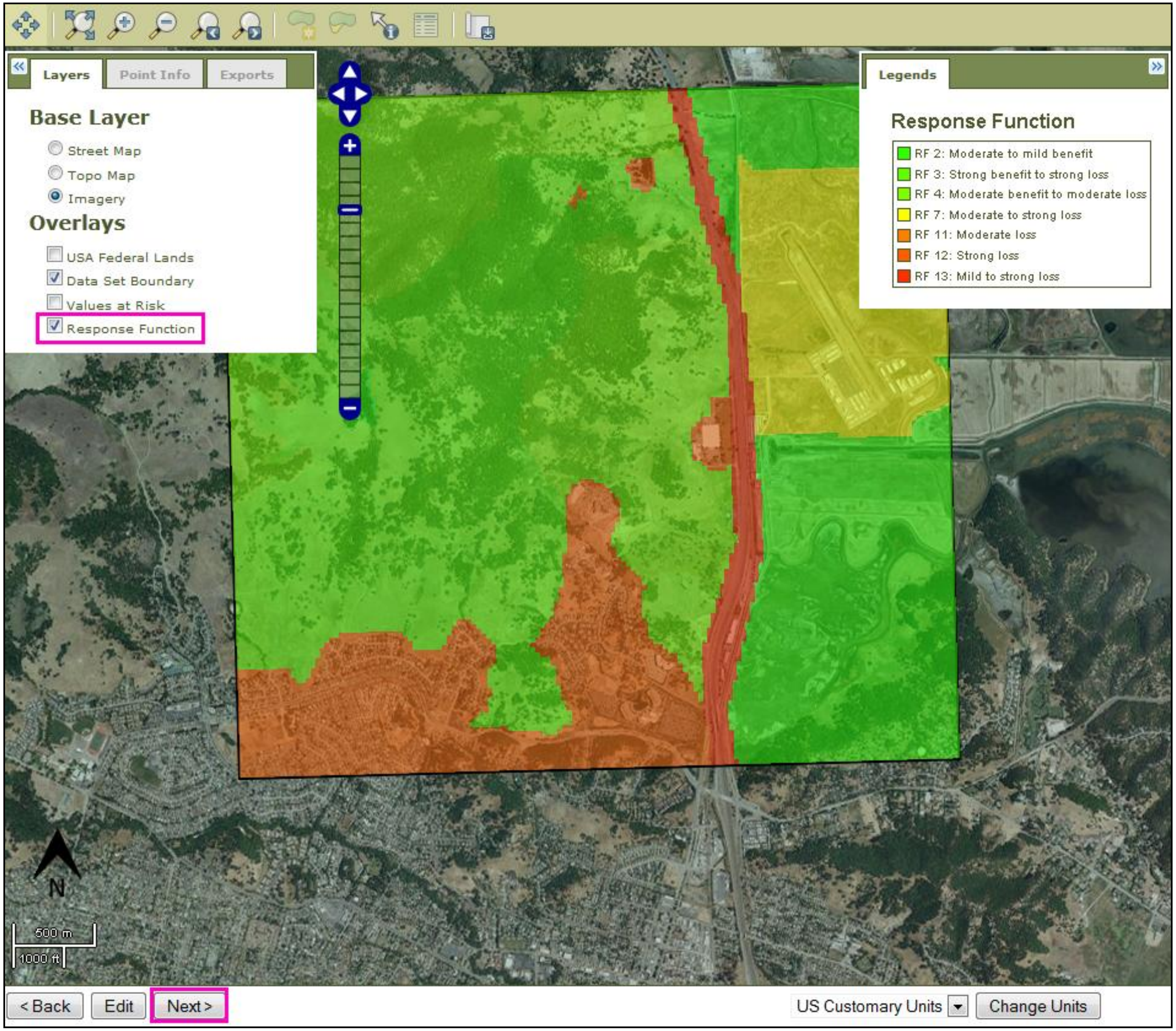
Practice editing and deleting polygons.

Reviewing Your Values-at-Risk Map

You can use the **Layers** panel to view your values at risk or the response functions that you assigned to your values at risk.

The response function layer is shown on the right.

To continue the risk assessment pathway, when your values-at-risk map is complete, choose **Next**.



Inputting Environmental and Simulation Parameters

Now that you have created a values-at-risk map, the next step is to input fuel moisture, weather, and IFT-RANDIG simulation information, and set your flame length classes.

Each of these inputs is covered in the next few pages.

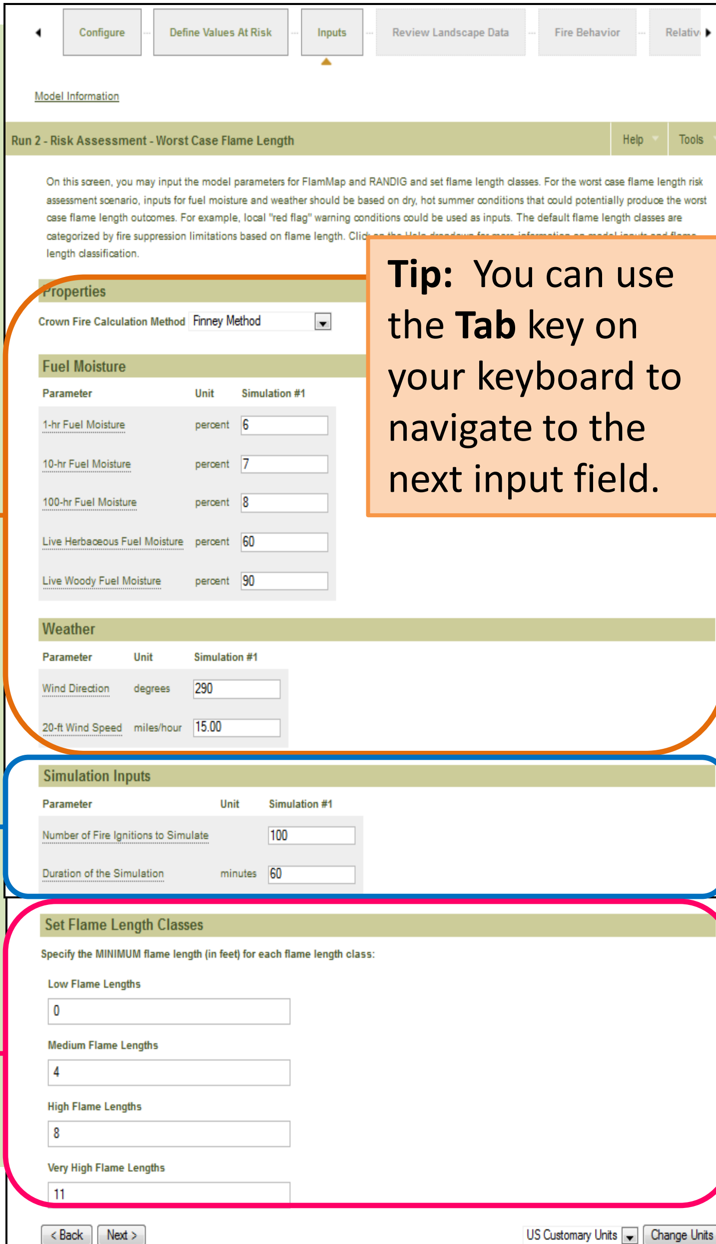
The input fields are pre-populated with default values.

Pages 31 through 33 walk you through customizing these input fields.

IFT-FlamMap Inputs

IFT-RANDIG Inputs

Set Flame Length Classes



Tip: You can use the **Tab** key on your keyboard to navigate to the next input field.

IFT-FlamMap Inputs

Fuel moisture and weather inputs should be based on dry, hot summer conditions that could potentially produce the worst-case flame length outcomes.

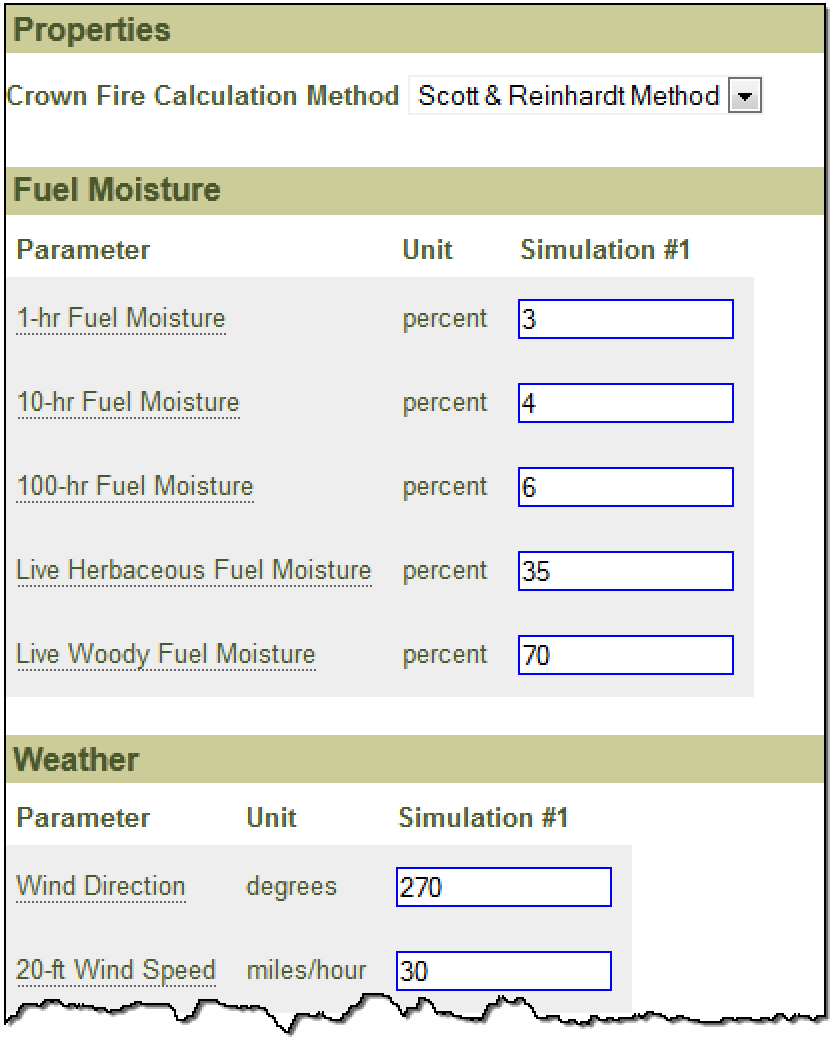
Tip: When assessing fire risk across large landscapes, especially in mountainous terrain, be aware that weather conditions can vary across diverse topographic settings.

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 low relative humidity, high/erratic winds, and lightning activity.



IFT-RANDIG Inputs

Next, define the IFT-RANDIG simulation inputs.

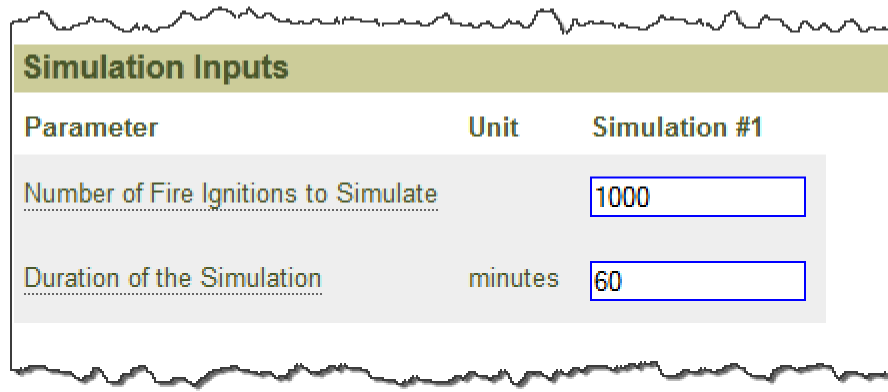
- Specify the **Number of fire ignitions to simulate**. This value refers to the number of randomly located ignition points across your run area.

  The literature states that every pixel should have a chance of igniting; therefore, the larger the run area, the more random ignitions you will want to simulate.

- Specify the **Duration of the simulation** in minutes. This value refers to the duration of the fire growth calculations for the set of constant fuel moisture and weather conditions.

  In this example, we chose to run the simulation for 60 minutes, which is the estimated response time for fire resources to be on scene at the Olompali State Historic Park.

  You can use shorter and longer duration times to answer a variety of questions.



Using a large data set (approximately 250,000 acres), the run time for the IFT-RANDIG module is estimated to be an hour per 2,000 ignitions. This is just an estimate; the module could take longer to run based on user load.

Tip: Create multiple runs to model burn probability using

- Low, medium, and high numbers of fire ignitions
- Short and long simulation durations

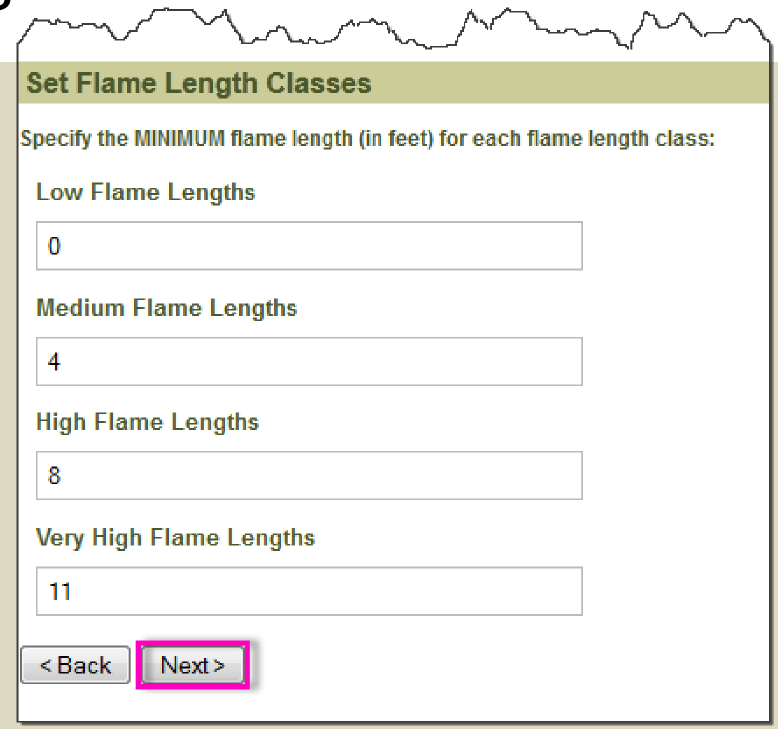
The results will help you understand how these inputs are affecting your specific area of interest.

Setting Flame Length Classes

Now **enter flame lengths for your flame length classes, or accept the default values**. The default flame length classes are categorized by fire suppression limitations based on flame length (see table below).

The low flame lengths parameter is not directly editable. The minimum flame length for the low flame length class will always be zero. The upper limit for low flame lengths is determined by the value you enter for medium flame lengths.

For example, if you enter 4 for medium flame lengths, the range for low flame lengths becomes 0 to 4 feet.



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.

Choose **Next** to submit the inputs. You are taken to the **Review Landscape Data** step.

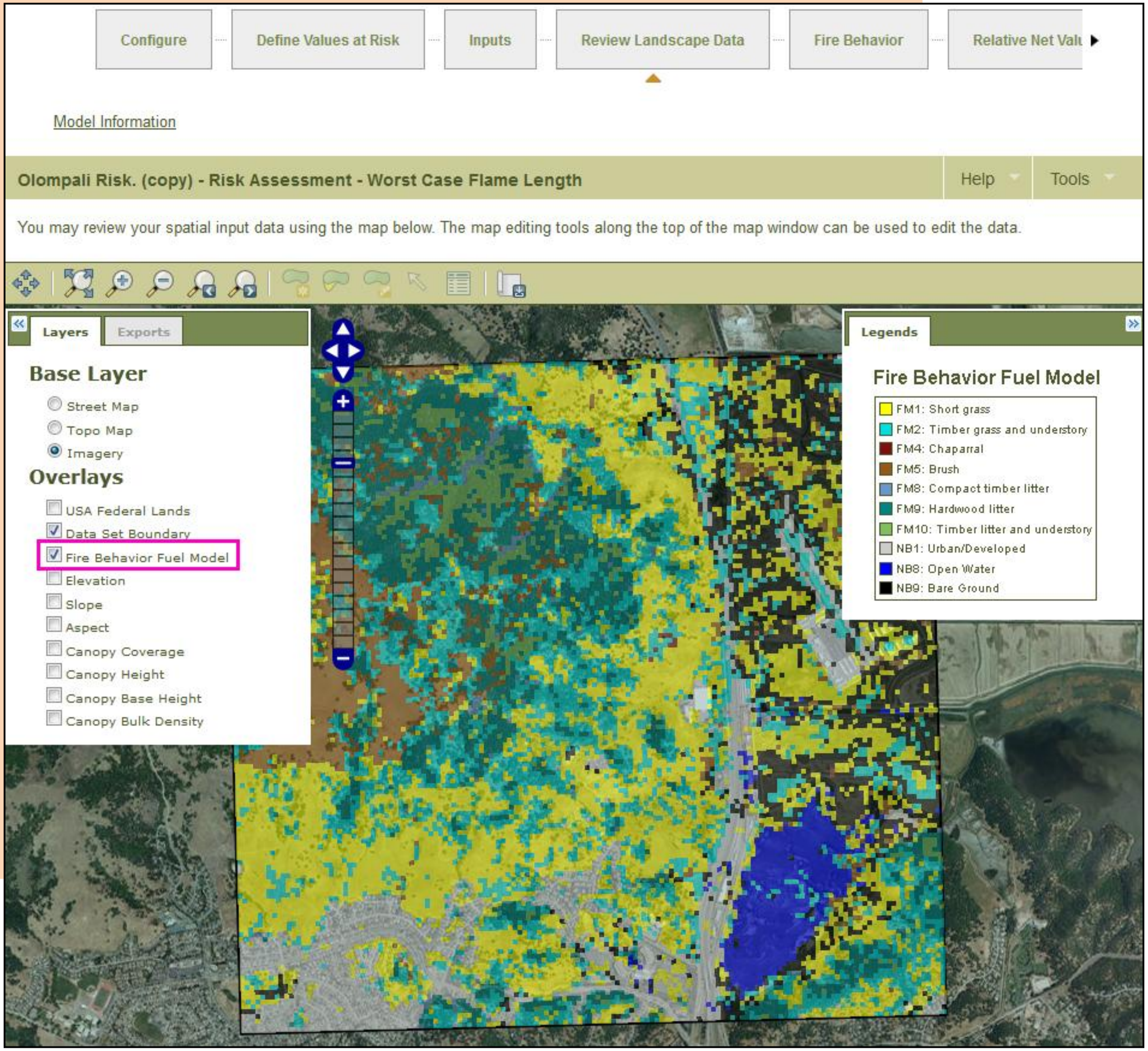
(Table modified from the National Wildfire Coordinating Group, 2004.)

Reviewing Spatial Landscape Data

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

You can choose one of three base layers (different graphical representations of the area), and one or more overlays. Overlays provide visual representations of different types of data.

In this example, you can see the area of interest with data from the **Fire Behavior Fuel Model**.

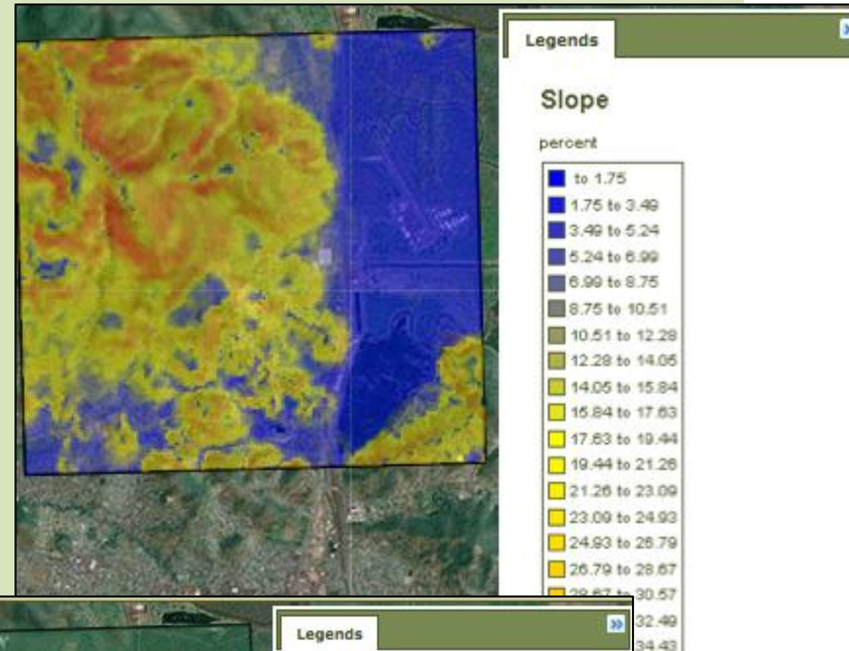


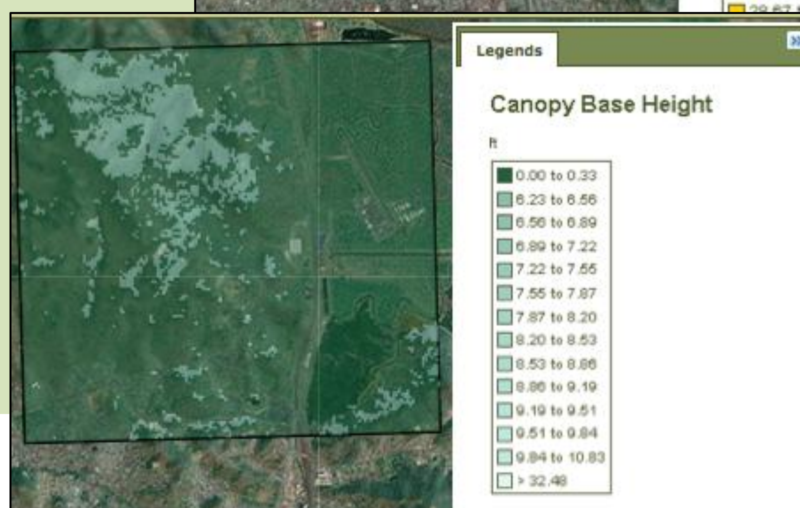
Reviewing Spatial Landscape Data

You can view the area of interest 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 area of interest graphically; your choices are street maps, topography, or imagery.





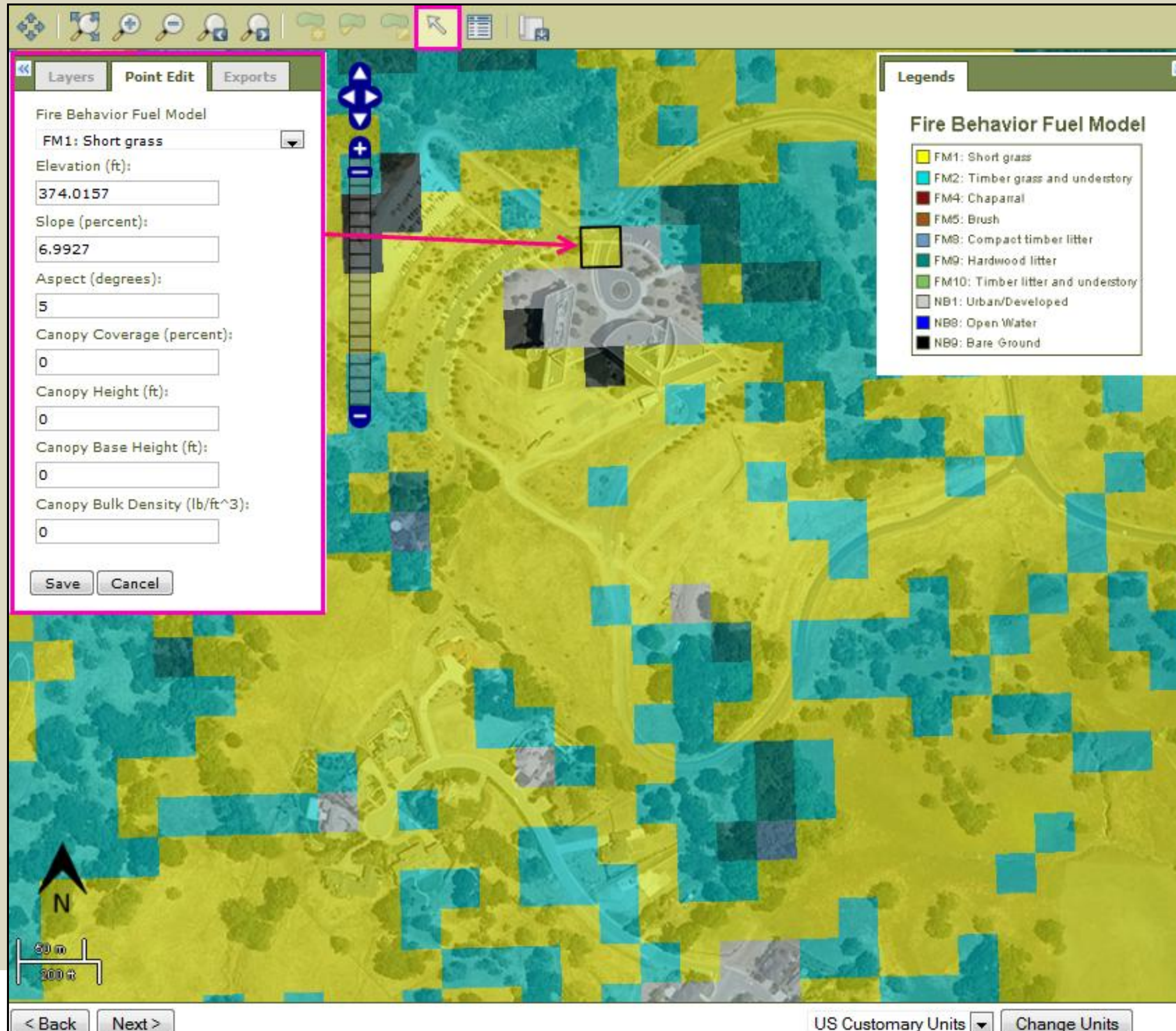
Editing Spatial Landscape Data (One Grid at a Time)

If you need to edit the spatial landscape data, select the **Point Edit** tool. Using this tool, you can edit one grid cell at a time. (Or, you can edit multiple grid cells at a time using the **Advanced Edit** tool, as shown on the next page.)

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

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

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



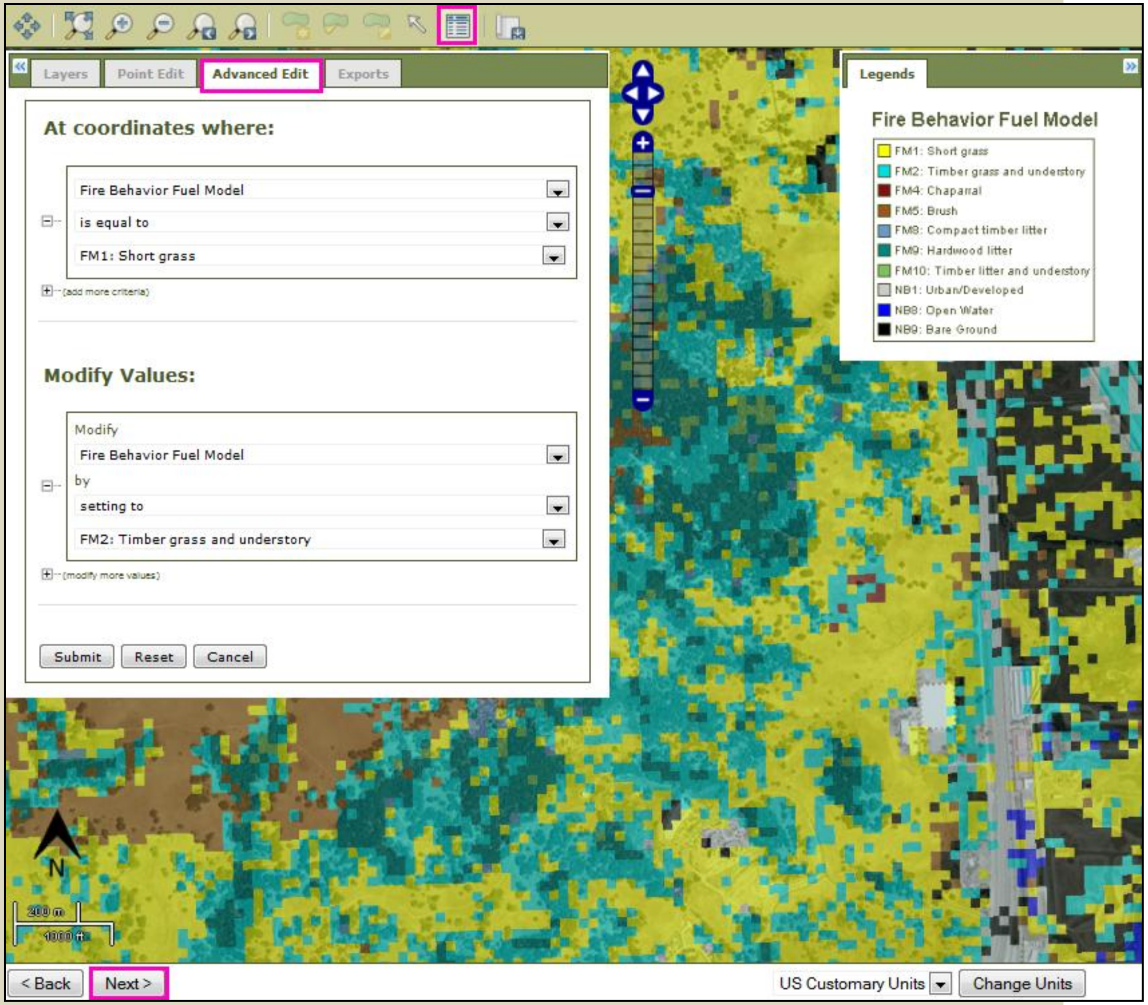
Editing Spatial Landscape Data (Multiple Grids at a Time)

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.

After you are done reviewing and editing your spatial data, choose **Next** to run the IFT-FlamMap and IFT-RANDIG modules.



Analyzing Fire Behavior Output Data

Both the IFT-FlamMap and IFT-RANDIG modules are now running. The more random ignitions you place across a landscape, the longer this step takes to complete.

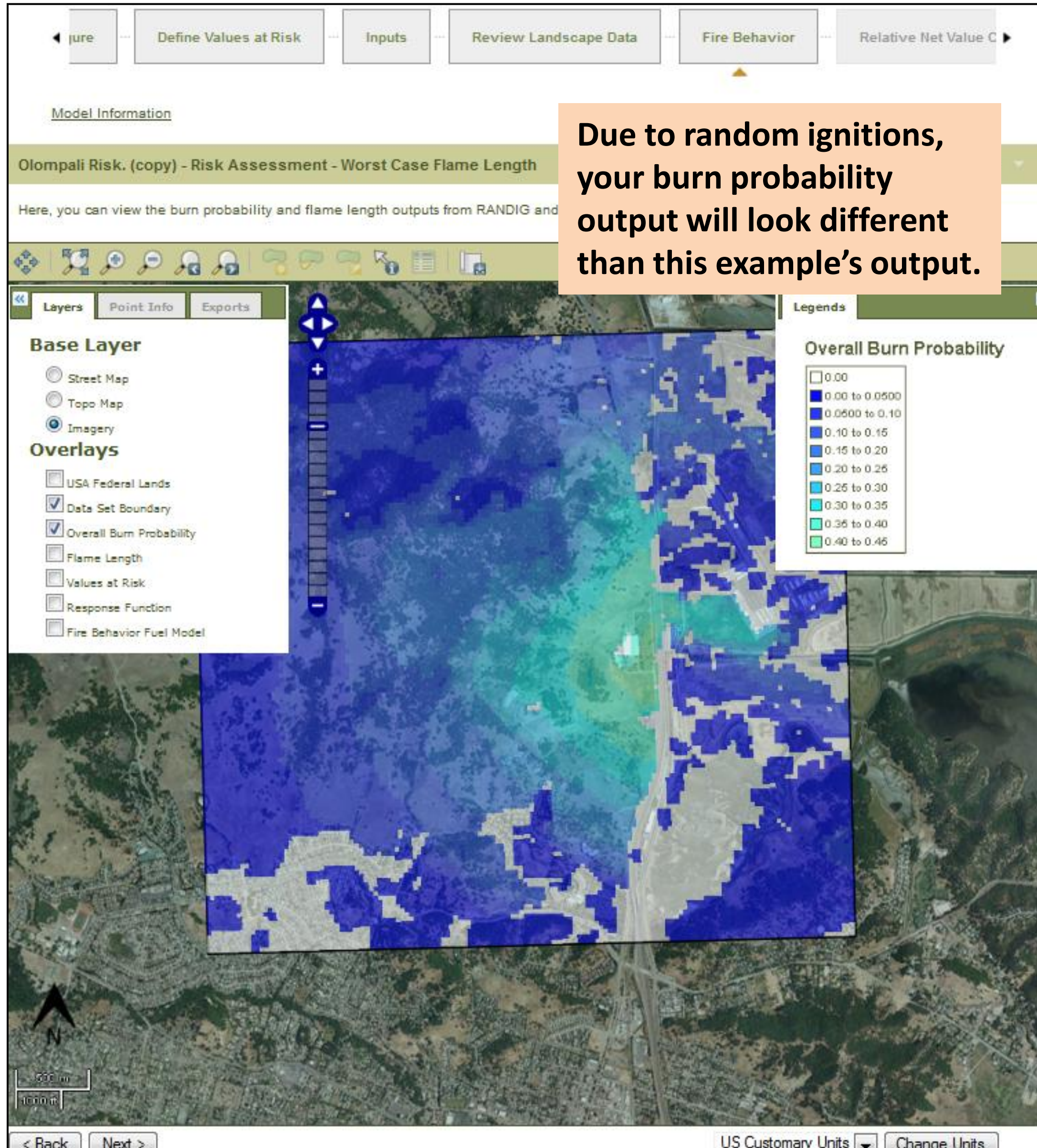
After the IFT-FlamMap and IFT-RANDIG modules finish running, you can review your fire behavior output variables using the map.

The fire behavior output variables include

- Overall burn probability
- Flame length

You can also review the values at risk, response function, and fire behavior fuel model layers.

The next page discusses these outputs in more detail.

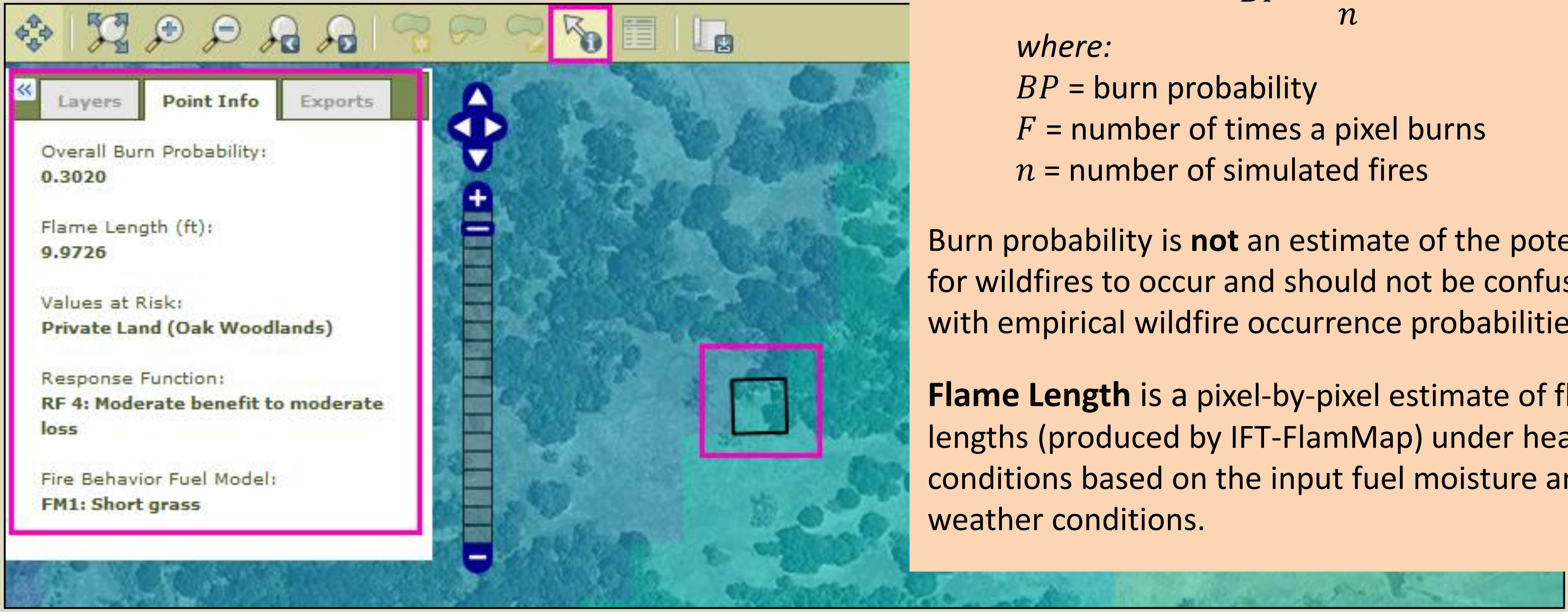


Due to random ignitions, your burn probability output will look different than this example's output.

Analyzing Fire Behavior Output Data

You can review the fire behavior data at a specific grid cell by selecting the **Point Info** tool.

Click on the grid cell you would like to review, and the **Point Info** panel appears.



Overall Burn Probability is an estimate (produced by IFT-RANDIG) for a given 30 x 30 m pixel of the likelihood that the area represented by a pixel will burn given a random ignition within the area of interest (for a specific set of environmental conditions). The formula is

$$BP = \frac{F}{n}$$

where:

BP = burn probability

F = number of times a pixel burns

n = number of simulated fires

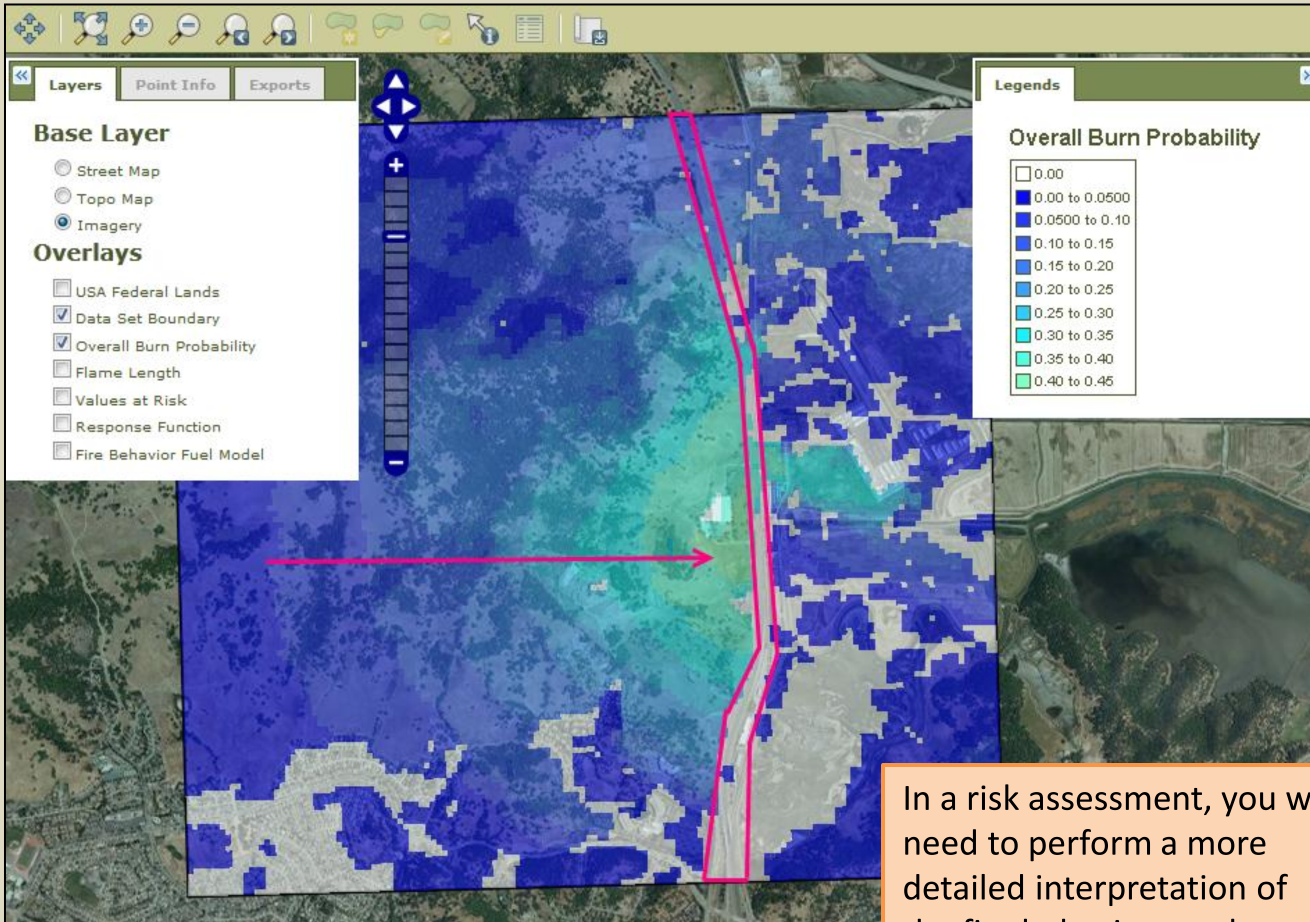
Burn probability is **not** an estimate of the potential for wildfires to occur and should not be confused with empirical wildfire occurrence probabilities.

Flame Length is a pixel-by-pixel estimate of flame lengths (produced by IFT-FlamMap) under head fire conditions based on the input fuel moisture and weather conditions.

Analyzing Fire Behavior Output Data

Taking a simple first look at the **Overall Burn Probability** output, it is clear that the westerly wind (blowing from the west to the east) is pushing the fire to the east (indicated by the pink arrow). Highway 101 (outlined in pink) would potentially stop a majority of the fire spread.

Next, we will review the flame length output.



In a risk assessment, you will need to perform a more detailed interpretation of the fire behavior results.

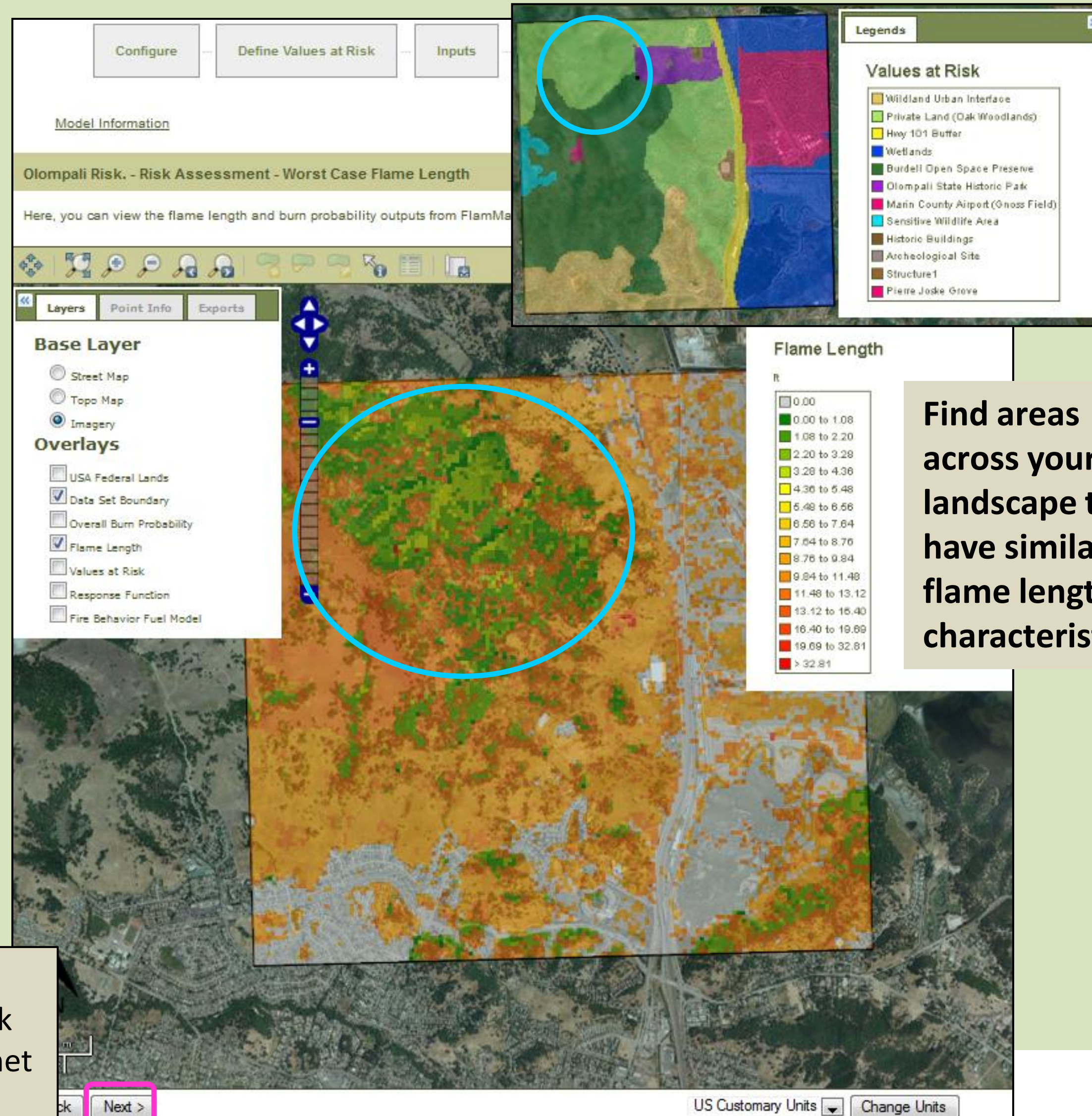
Analyzing Fire Behavior Output Data

Taking a simple first look at the flame length output, it is clear that the red flag warning environmental conditions (page 31) predicted high flame lengths for a majority of the area of interest.

Use the **Values at Risk** overlay and the **Point Info** tool to determine potential flame length variability across the landscape.

- In this example, the lowest predicted flame lengths are located in a portion of private land (oak woodlands) and the north end of the Burdell Open Space Preserve (outlined in blue).
- Flame lengths for the surrounding areas are predicted to be >9 ft.

In the next step in the pathway (Relative Net Change), you will bin these flame lengths by your pre-set flame length classes (page 33).



Find areas across your landscape that have similar flame length characteristics.

After reviewing the fire behavior data, the next step is to run the risk model and then view the relative net value change for the area. Choose **Next** at the bottom of the page to run the model.

About Relative Net Value Change

After the risk model runs, you can view the **Relative Net Value Change**.

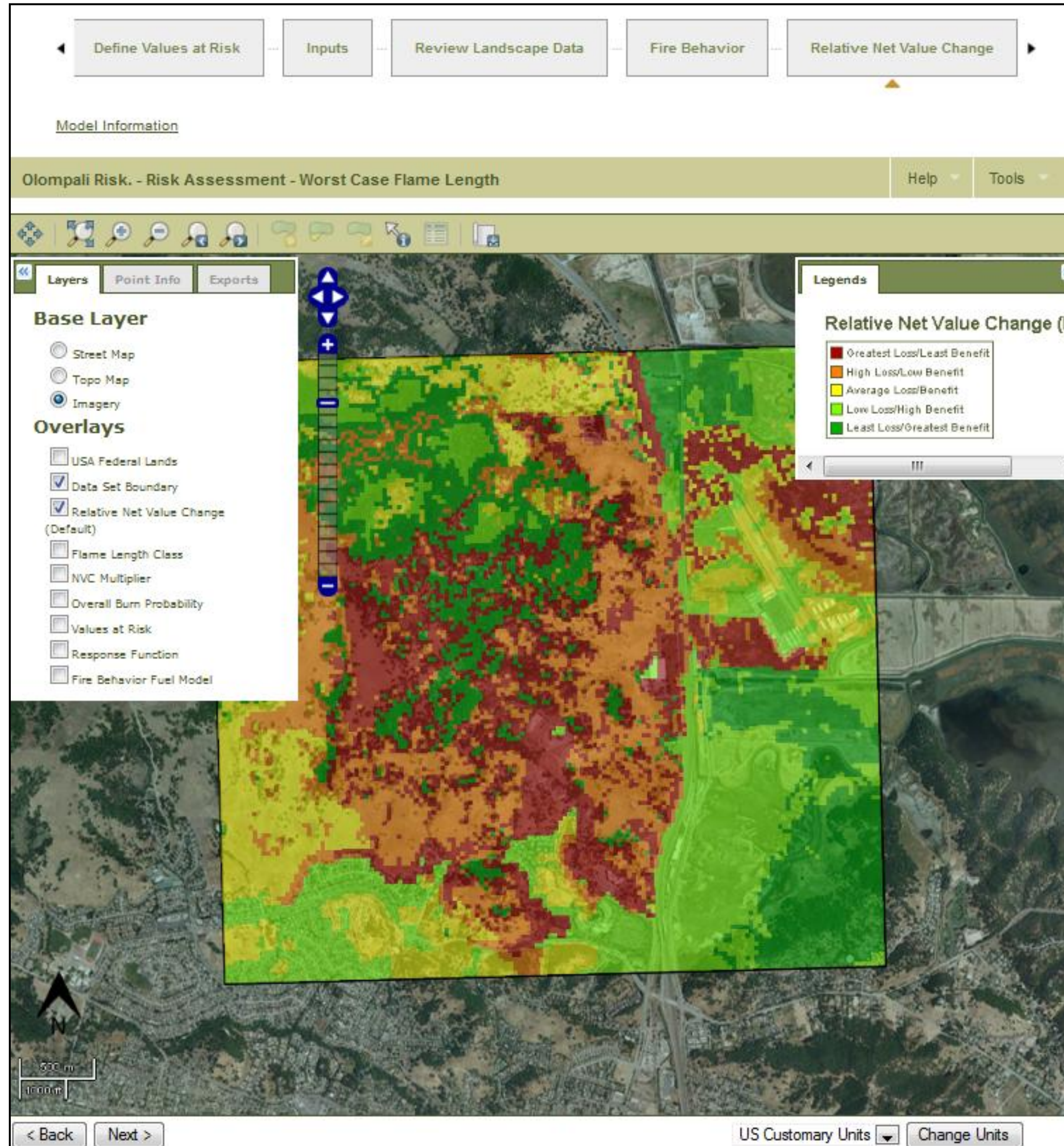
Risk is defined as the expected net value change per pixel calculated as the product of

(1) The probability that the area represented by the pixel burns given a random ignition within the project area, and

(2) The resulting change in financial or ecological value (response function) if the the area represented by the pixel burns with a specific flame length for a single static IFT-FlamMap run.

The next page uses a real example to show how net value change is calculated.

Your output will look different than this example's output due to differences in values at risk, as well as random ignitions across the landscape.



Defining Relative Net Value Change

For this tutorial, we are going to **select a pixel using the Point Edit tool**.

The pixel below is assigned a Response Function 3, and the pixel was predicted to have burned with a “High” flame length (8 to 11 ft); therefore the pixel is assigned a Net Value Change (NVC) multiplier of -20 (see table to the right and page 18).

The overall burn probability for the grid cell is 0.199, so the burn probability of 0.199 is multiplied by the NVC multiplier of -20 to obtain a net value change value of -3.98.

$$Net\ Value\ Change = BP \times NVC\ Multiplier$$
$$Net\ Value\ Change = 0.199\ \times\ -20 = -3.98$$

Response Function	Description	Midpoint of relative net value change by flame length class			
		Low	Medium	High	Very High
3	Strong benefit at low fire intensity decreasing to a strong loss at very high fire intensity	+60	+20	-20	-60

Next, we discuss how the default relative net value change is binned into the five data subsets (listed in the Relative Net Value Change legend).

Classifying Relative Net Value Change Data

The relative net value change parameter is classified into five data subsets.

- Greatest Loss/Least Benefit
- High Loss/Low Benefit
- Average Loss/Benefit
- Low Loss/High Benefit
- Least Loss/Greatest Benefit

For the default relative net value change parameter, **the output value range is binned by 20%** for all of the categories.

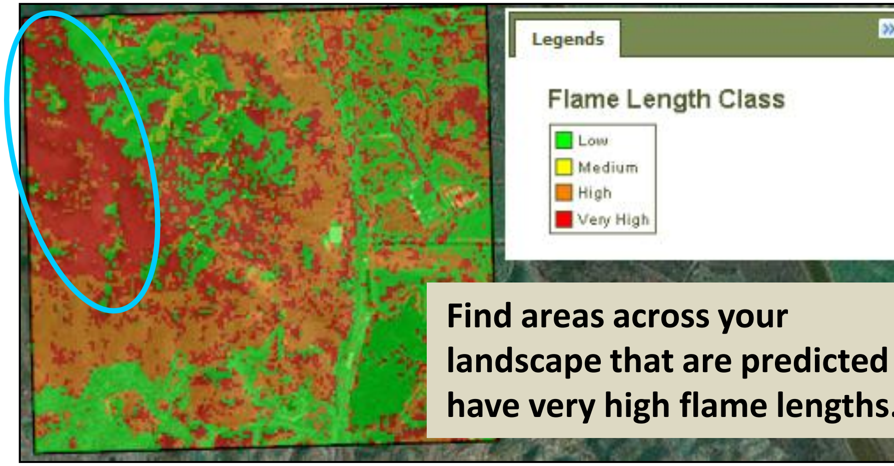
For example, if your data ranges from a numerical value of -20 to +40, the data subsets will be binned into the following data ranges: -20 to -8, -8 to 4, 4 to 16, 16 to 28, and 28 to 40.

Using the example from the previous page (see image below), the relative net value change number (-3.98) for that specific grid cell was binned into the High Loss/Low Benefit category.

Reviewing Relative Net Value Change Data

On the Relative Net Value Change step, you can view your area of interest by flame length class (binned by the flame length classes you defined on page 33).

In this example, very high flame lengths (>11 ft) are predicted for the northeast corner (outlined in blue: Burdell Open Space Preserve, Pierre Joske Grove, and private oak woodlands).

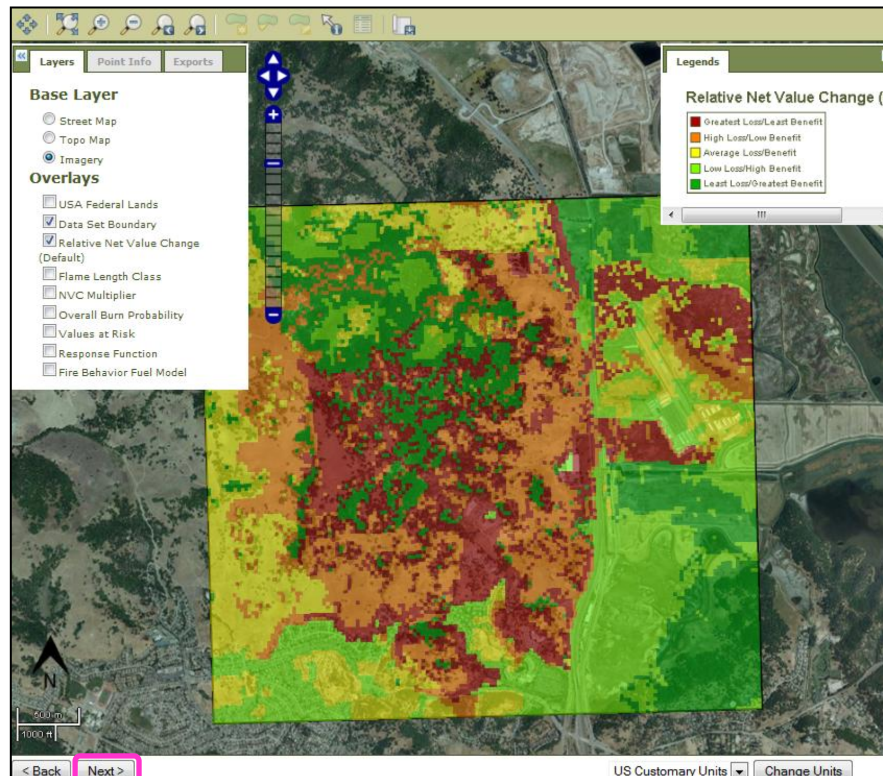


Find areas across your landscape that are predicted to have very high flame lengths.

Taking a first look at the default relative net value change parameter, we can see that there are many pixels classified in the “Greatest Loss/Least Benefit” category (pixels representing areas at the highest risk of loss based on the values at risk and the overall burn probability).

In this example, we cannot apply fuel treatments to all of the areas represented by the “Greatest Loss/Least Benefit” pixels, so we would like to refine the area of interest to find the areas that have the greatest potential loss.

To classify these categories into different data ranges, choose **Next**.

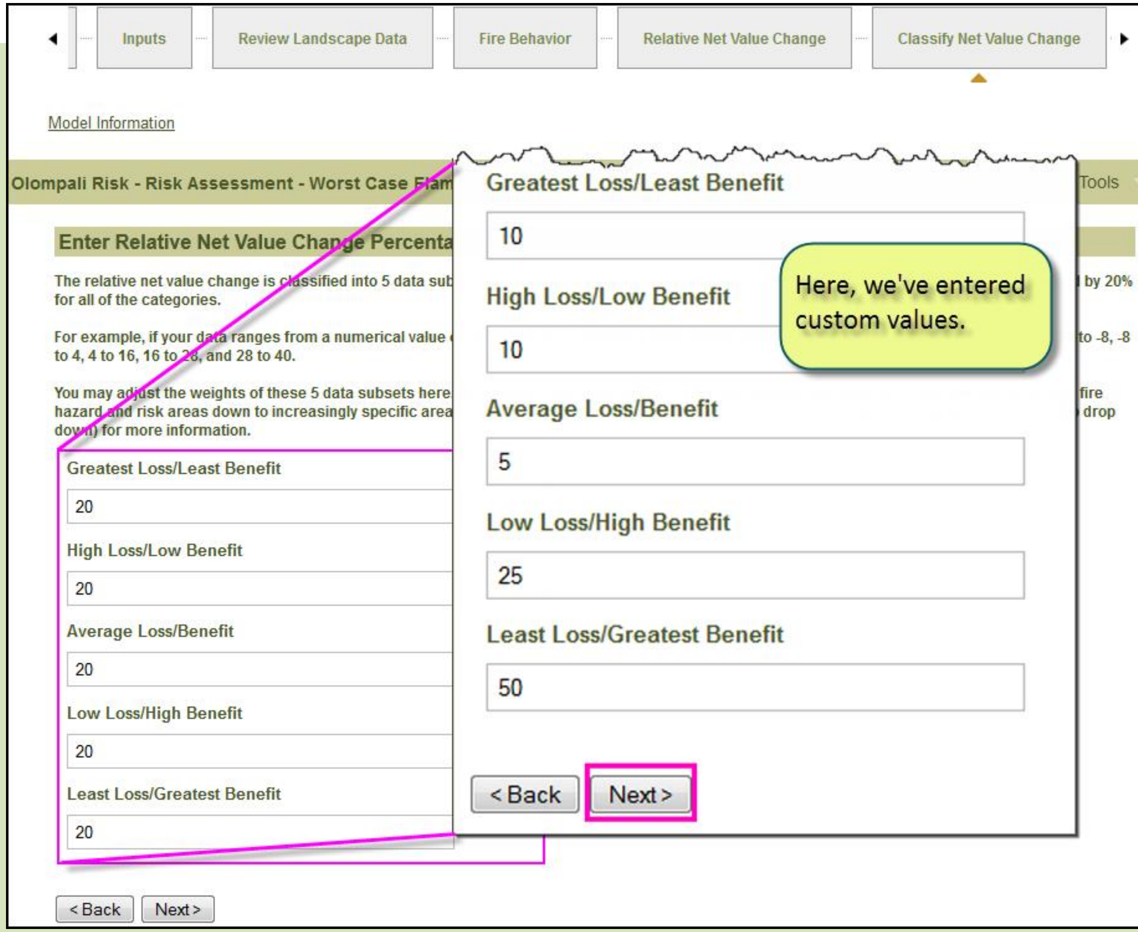


Classifying Relative Net Value Change Data

On the Classify Relative Net Value Change step, you can adjust the weights of the five data subsets.

Using this functionality, you can narrow your search of high fire hazard and risk areas to areas with the greatest potential loss.

In this example, we will reduce the output range for the Greatest Loss/Least Benefit category from 20% to 10%.



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

To view the user-binned relative net value change, choose **Next**.

Reviewing Map Summary Data

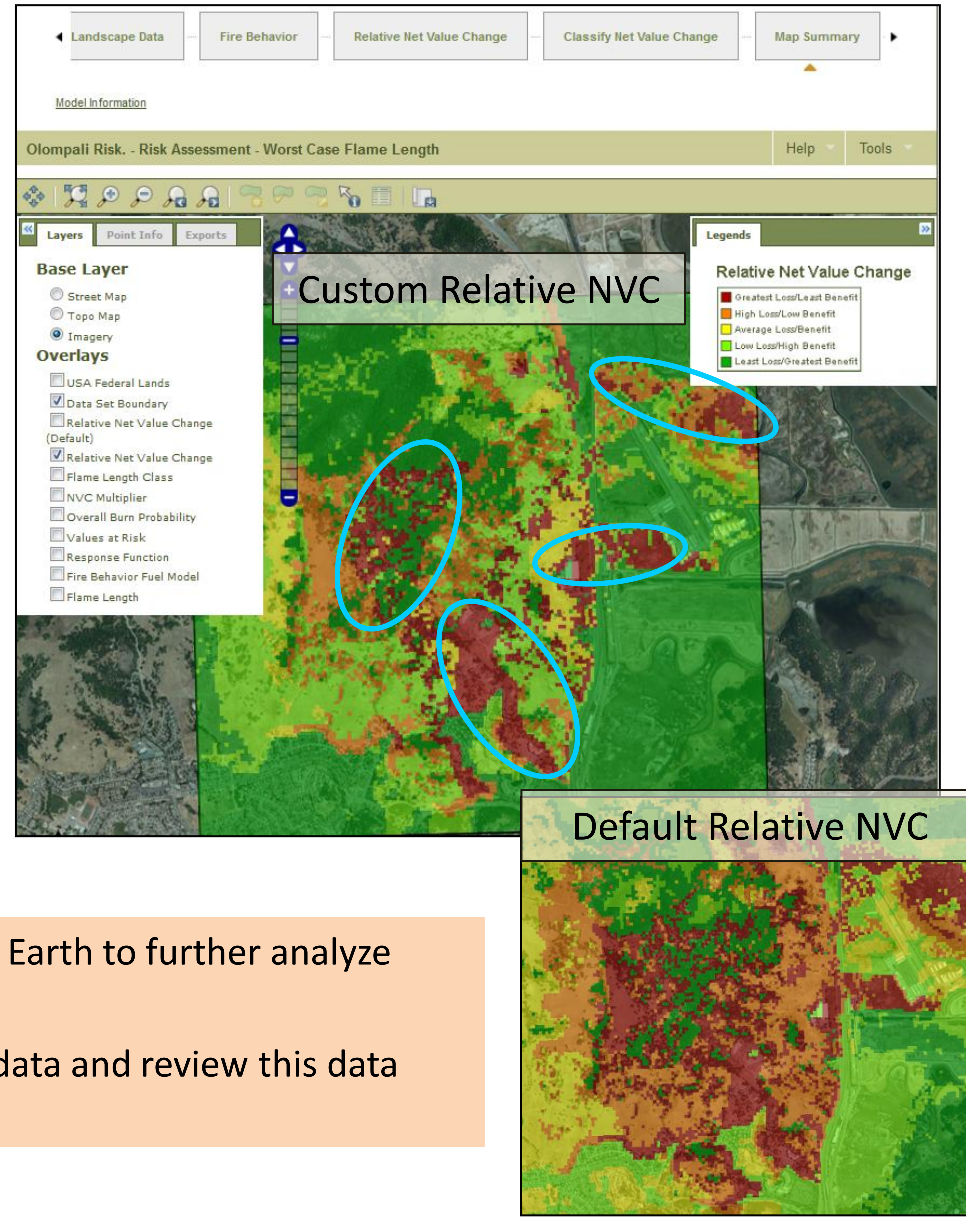
You are now on the Map Summary step, and your custom relative net value change distribution is the active layer.

You can compare your relative net value change distribution to the default relative net value change distribution.

In this example, you can see that the custom relative net value change reduced the amount of pixels in the Greatest Loss/Least Benefits category.

Now we can focus our attention on the highest risk areas across our area of interest (outlined in blue).

Find areas across your landscape that are predicted to have the greatest loss/least benefit due to fire.



You can export IFTDSS inputs and outputs to Google Earth to further analyze potential fire hazard and risk.

In the next steps, we will export our map summary data and review this data using Google Earth.

Exporting Map Summary Data

Access the **Exports** tab (located in the upper left panel).

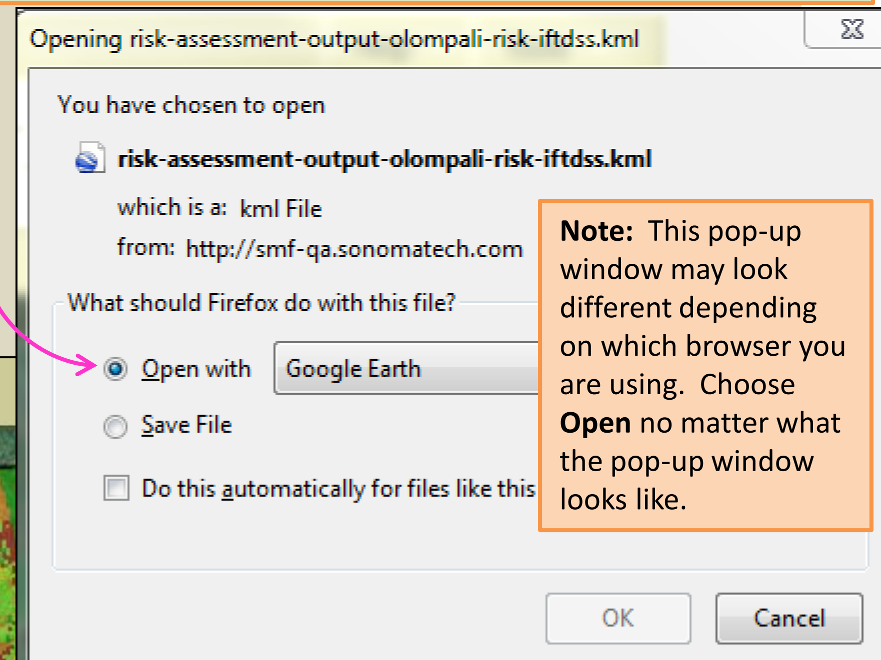
Select **Download Map Summary Data (KML)**.

Select **Open with Google Earth** in the pop-up window.

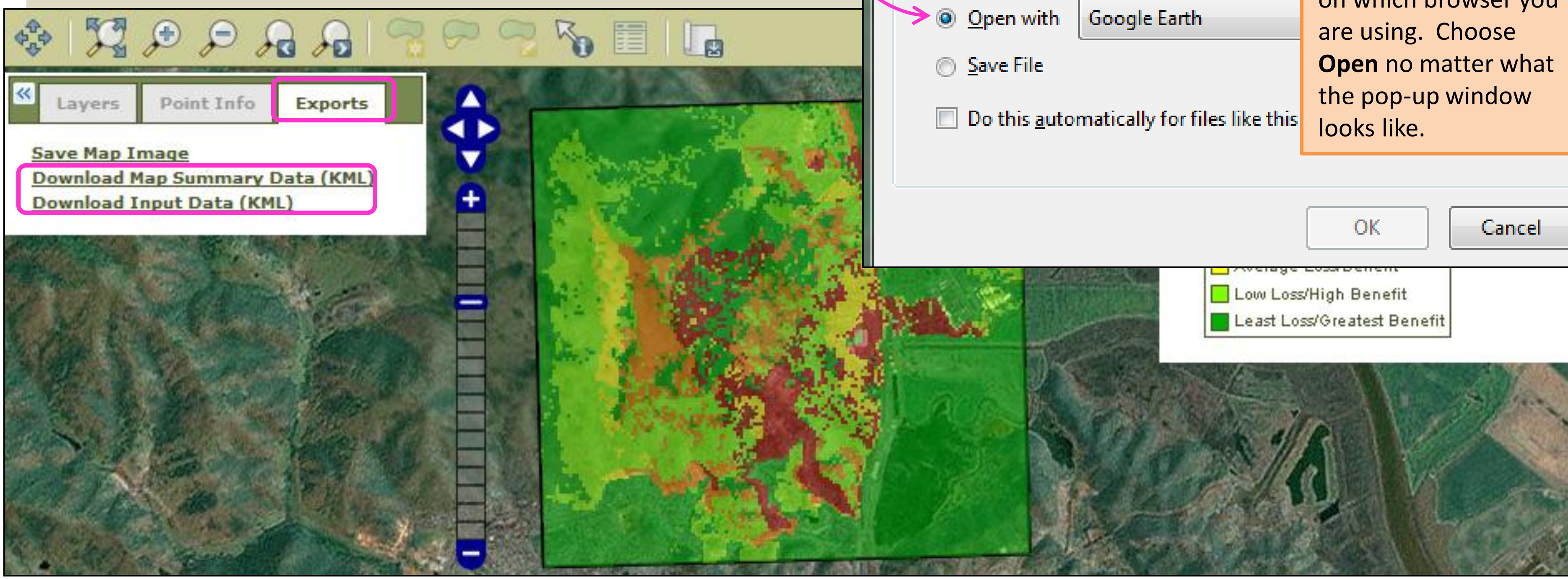
Repeat these steps to **Download Input Data (KML)**.

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

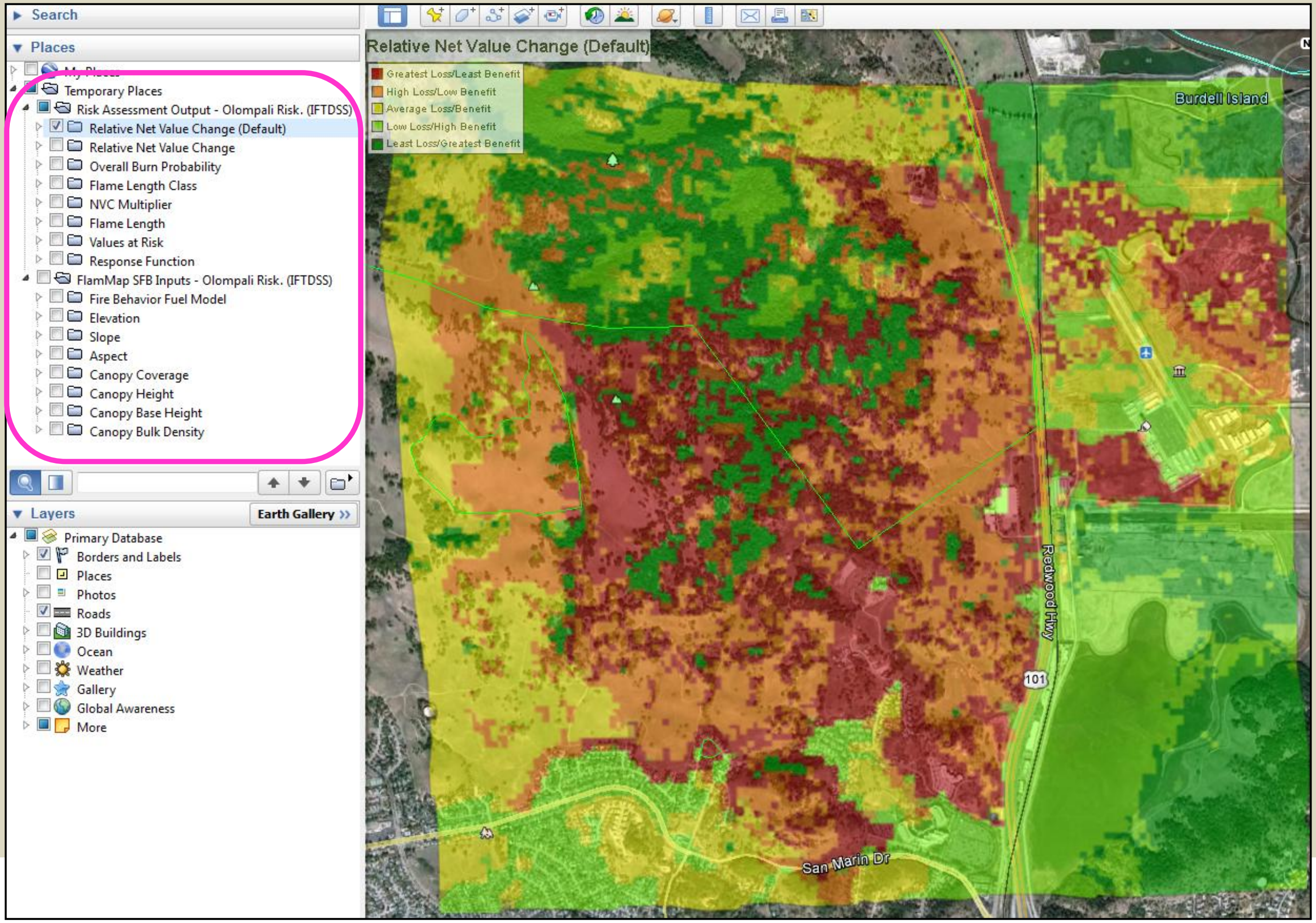


Note: This pop-up window may look different depending on which browser you are using. Choose **Open** no matter what the pop-up window looks like.



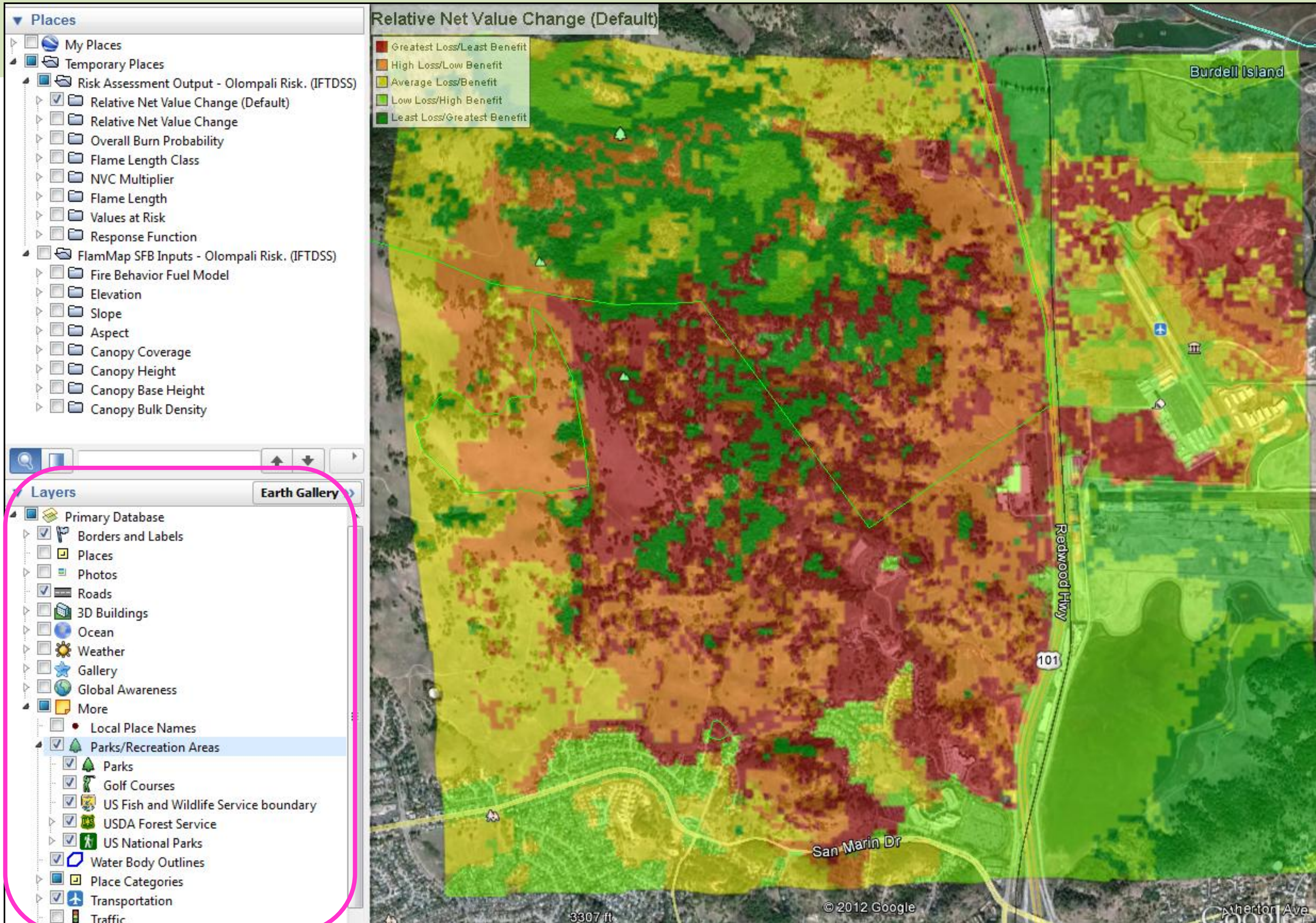
Evaluating Results in Google Earth

The map summary parameters are now stored as layers in the **Temporary Places** folder within Google Earth. Unselect the Fire Behavior Fuel Model layer. The default relative net value change parameter is the active layer.



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(s).

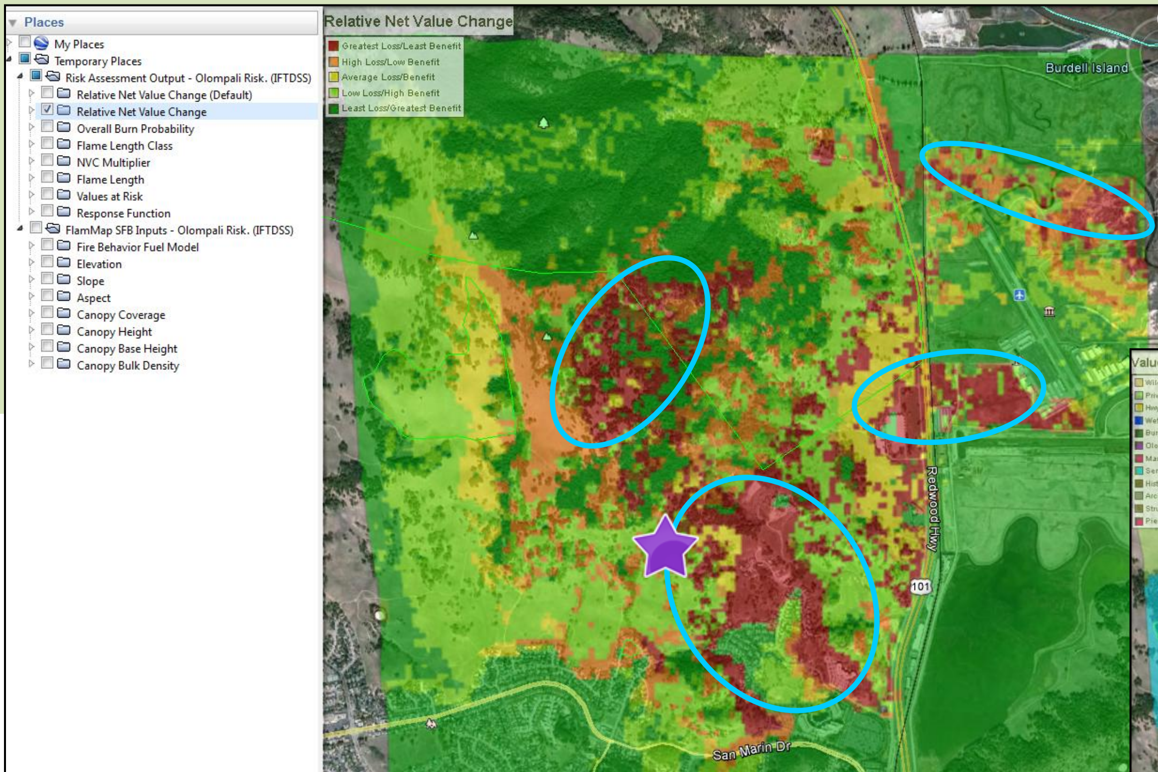


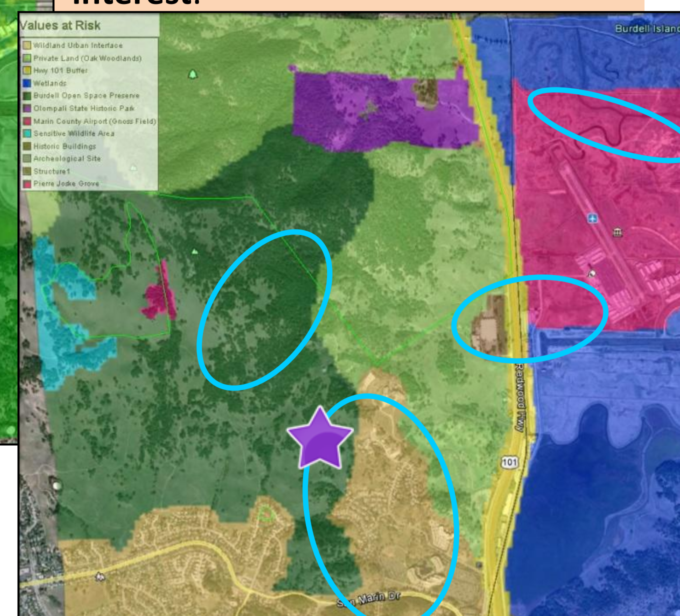
Identifying Potential Fire Hazards and Risk

While still in Google Earth, using information derived from the modeled fire behavior, as well as the spatial landscape data, you can identify potential fire hazard and risk areas surrounding the Olompali State Historic Park (see outlined areas).

In this example, we selected the custom relative net value change distribution to view highest risk areas across our area of interest (outlined in blue).

View the Values at Risk layer to see what valuable resources are of most concern across your area of interest.

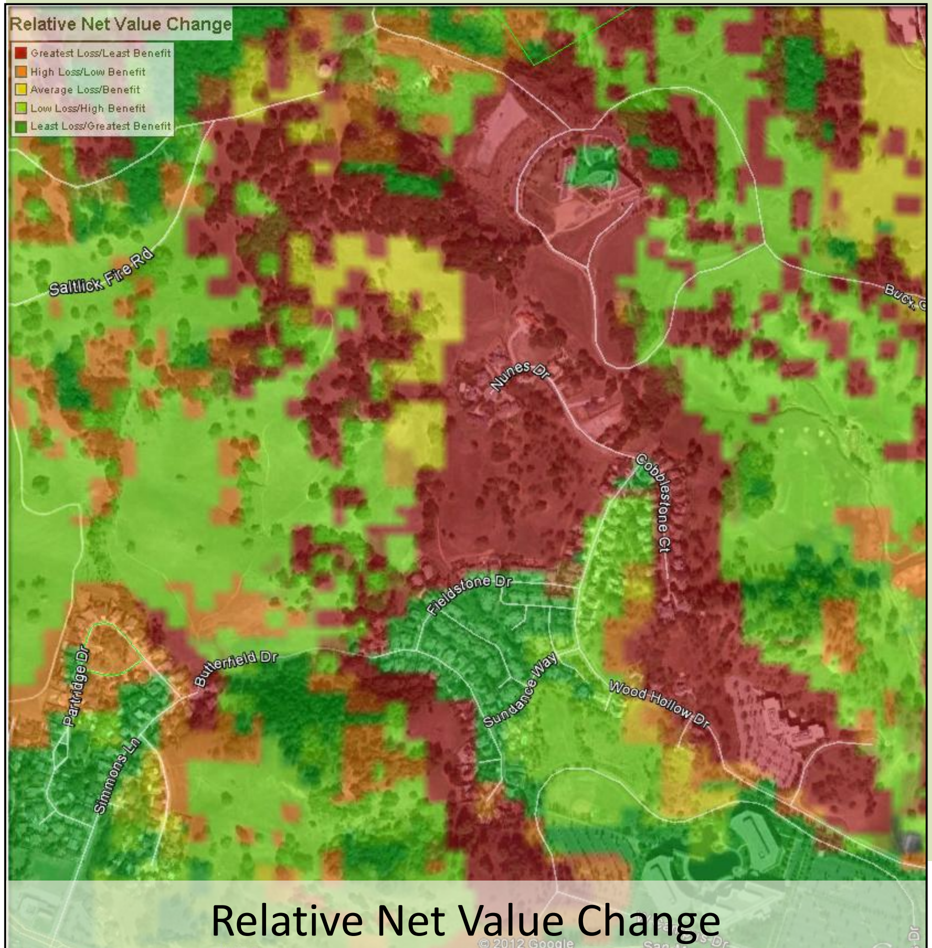




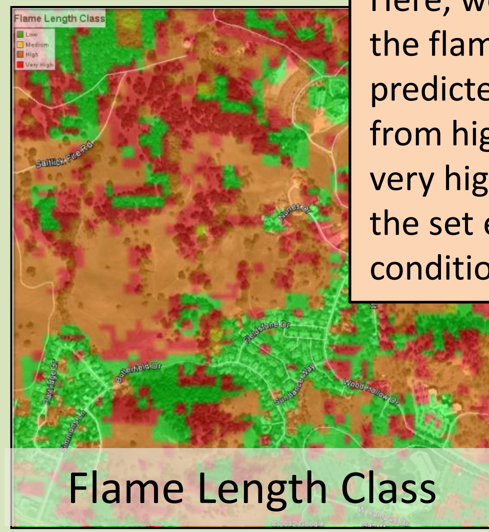
Next, we will take a more in-depth look at the wildland-urban interface (identified by the purple star ★).

Identifying Potential Fire Hazards and Risk

In this example (still in Google Earth), we focus in on one of our highest risk areas, the wildland-urban interface. It is important to review a number of different fire behavior descriptor variables, such as flame length class and overall burn probability.

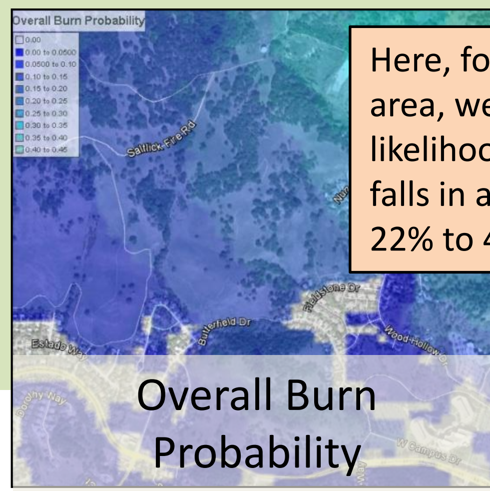


Relative Net Value Change



Flame Length Class

Here, we can see that the flame lengths are predicted to range from high (8 to 11 ft) to very high (>11 ft) under the set environmental conditions.



Overall Burn Probability

Here, for each pixel area, we see that the likelihood of burning falls in a range from 22% to 44%.

This example uses the risk assessment output layers.

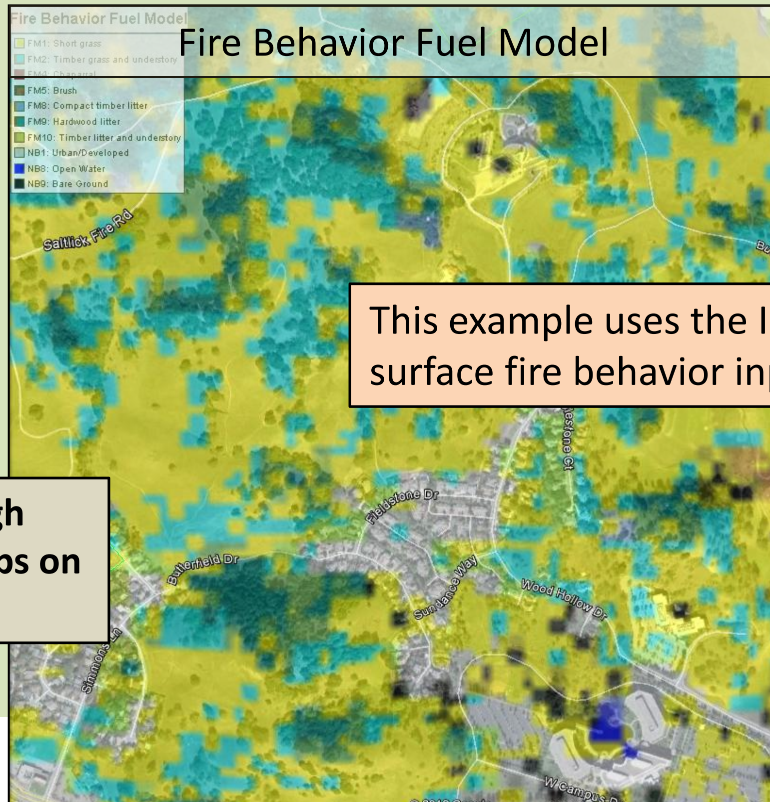
Identifying Potential Fire Hazards and Risk

This area is at risk for high potential loss from fire. Under the red flag warning conditions, which predicted high to very high flame lengths, the likelihood this area will ignite is moderate.

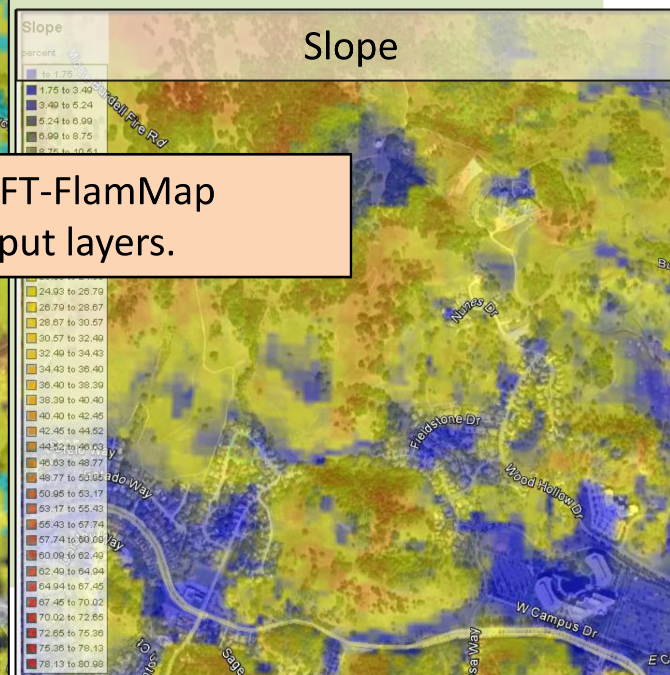
It is also important to r**eview the landscape data in your area of interest.** This location is dominated by flashy fuels: Fuel Model 1: Short Grass (indicated in yellow) and Fuel Model 2: Timber Grass and Understory (light blue). The wildland-urban interface has moderate, south- to southwest-facing slopes.

After reviewing the modeled fire behavior, fire risk, and spatial landscape data, the areas outlined on page 51 may warrant further analyses and may require site visits and/or fuels treatments.

Continue to analyze high risk areas using the steps on pages 51 and 52.



This example uses the IFT-FlamMap surface fire behavior input layers.



Saving Data Sets for Future Use

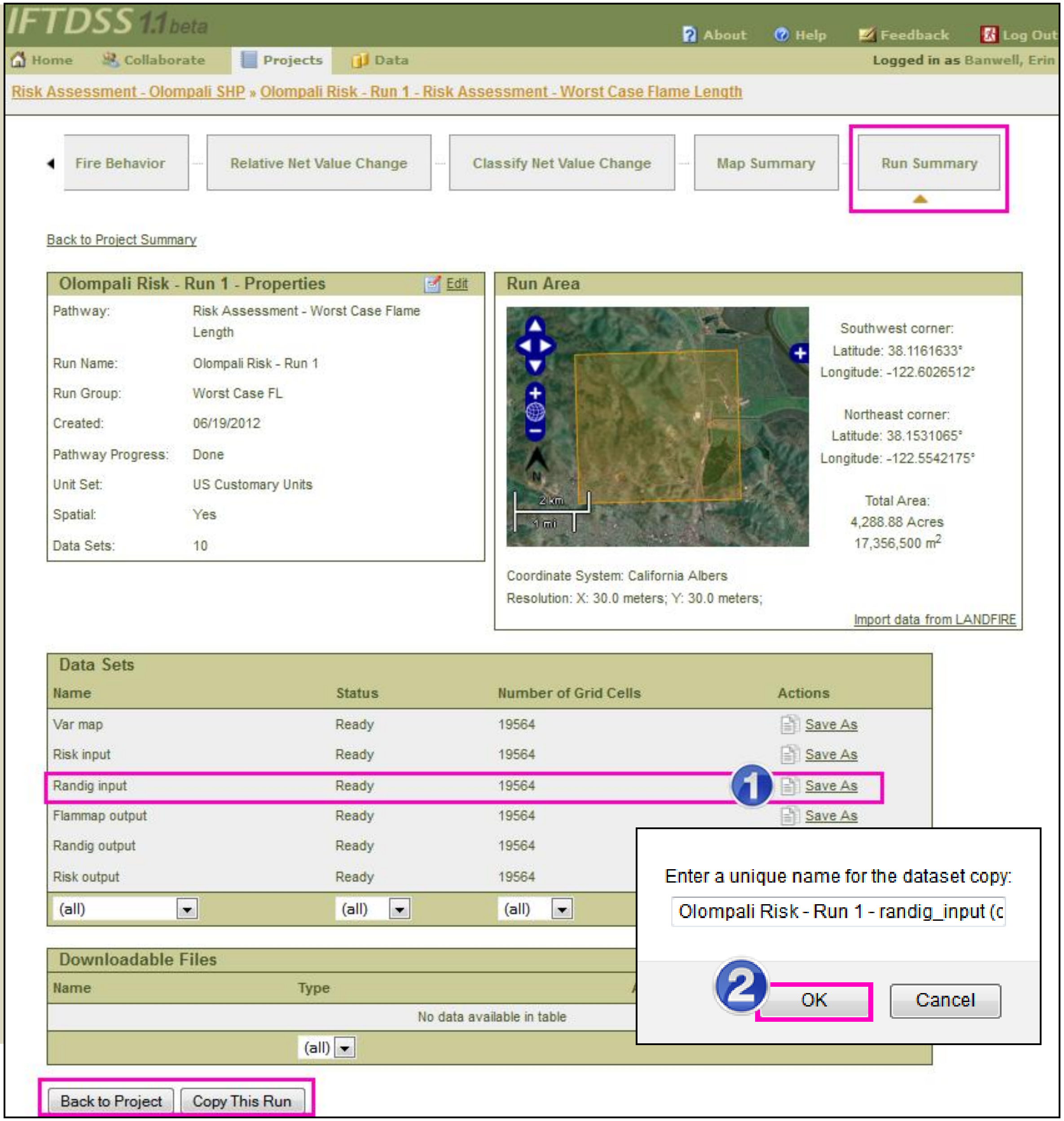
Navigate back to your risk assessment run in IFTDSS.

From the **Map Summary** page, choose **Next**. You are taken to the **Run Summary** page.

At this step, you can save your input and output data sets for future use in other runs. Saving your data sets is useful; for example, if you edited the spatial landscape data, you can reuse the data you edited.

You can also **Copy This Run**. This feature is useful if you want to rerun the same run with different inputs.

1. Select **Save As** on the risk input data set.
2. Enter a unique name for the data set copy and choose **OK**.



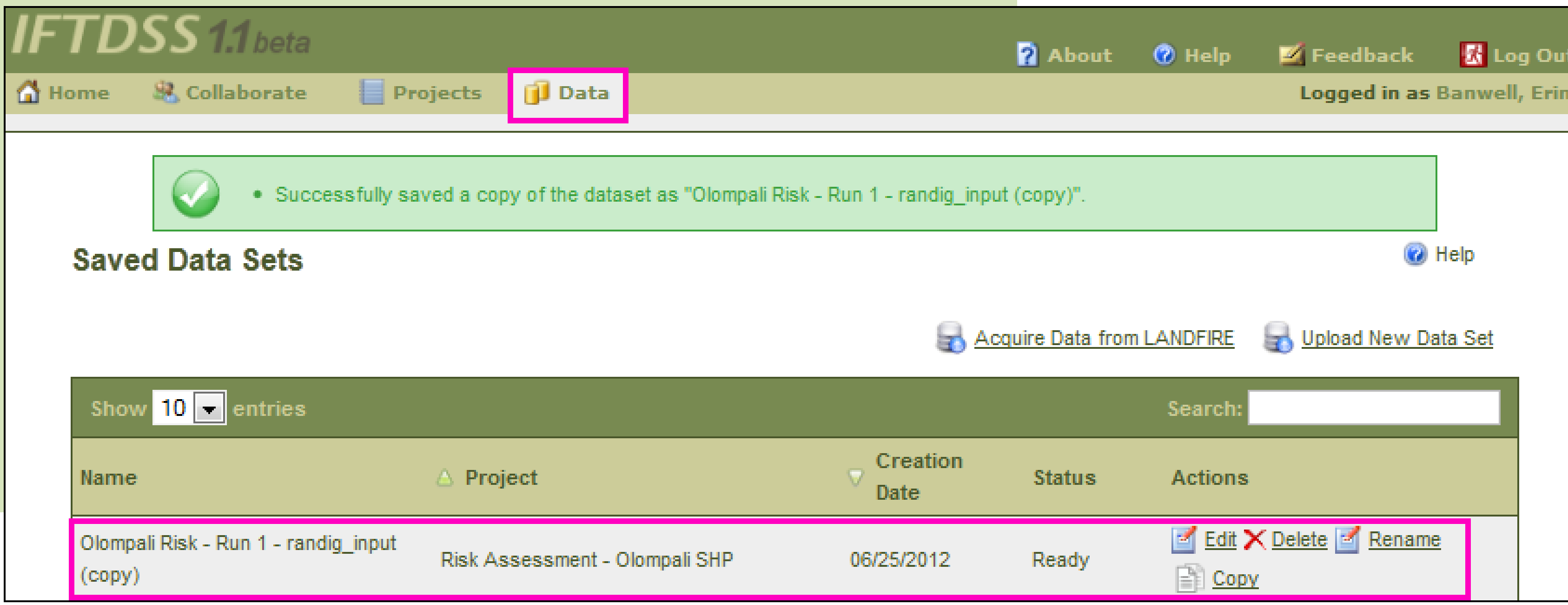
Saving Data Sets for Future Use

After entering a unique data set name, you are taken to the **Data** tab. All of your data sets are saved here. You can use the IFT-RANDIG input data set in any spatial run.

For example, if you edited the spatial landscape data during your run, the edits are saved in this data set.

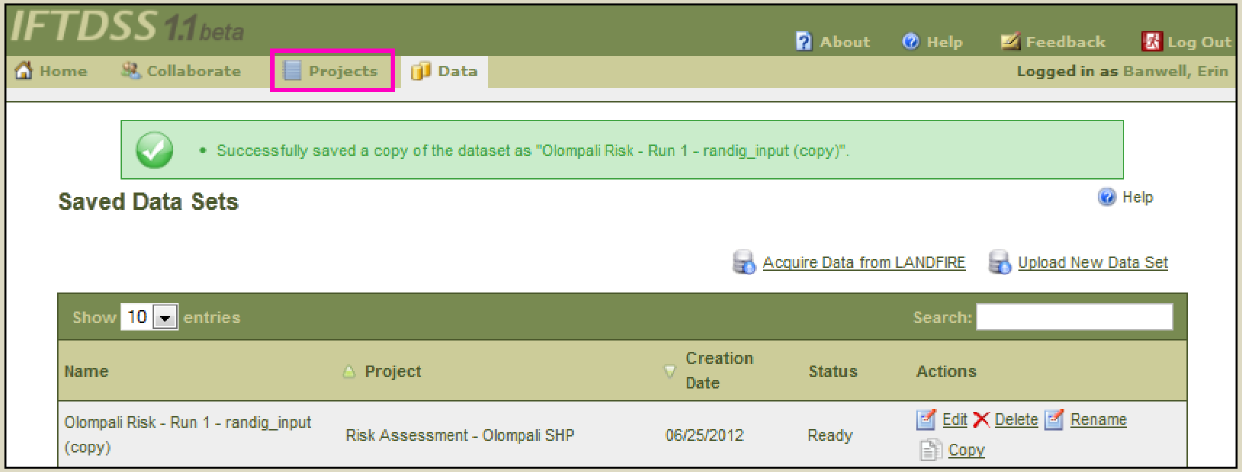
If you create a new spatial run (i.e. **Calculate fire behavior across a landscape (IFT-FlamMap)**), you can select this data set on the **Configure** step of the run.

Next, we will navigate back to the **Risk Assessment – Olompali SHP** project to learn how to copy runs for future use.

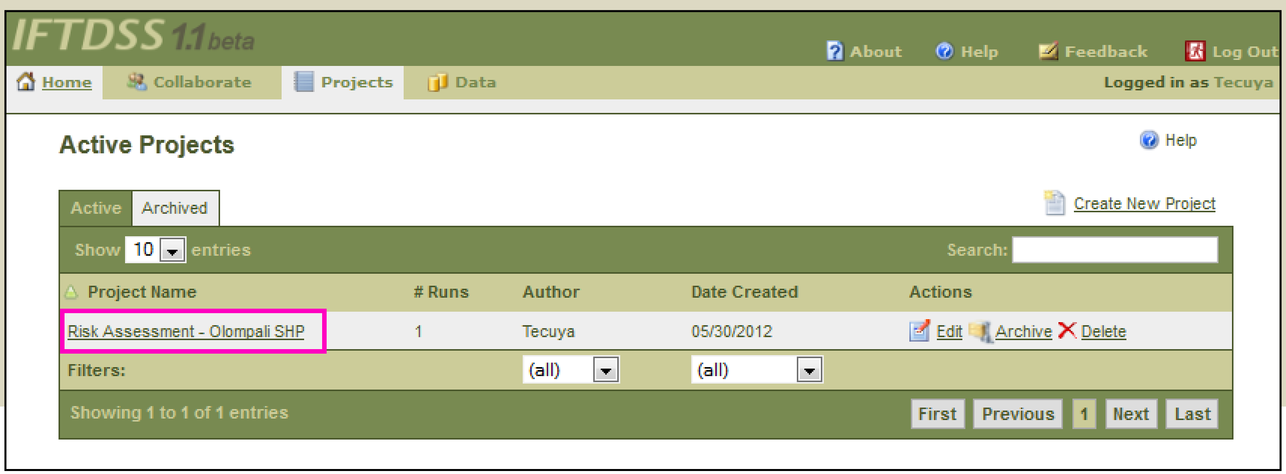


Copying Runs for Future Use

From the **Data** tab, navigate to the **Projects** tab.



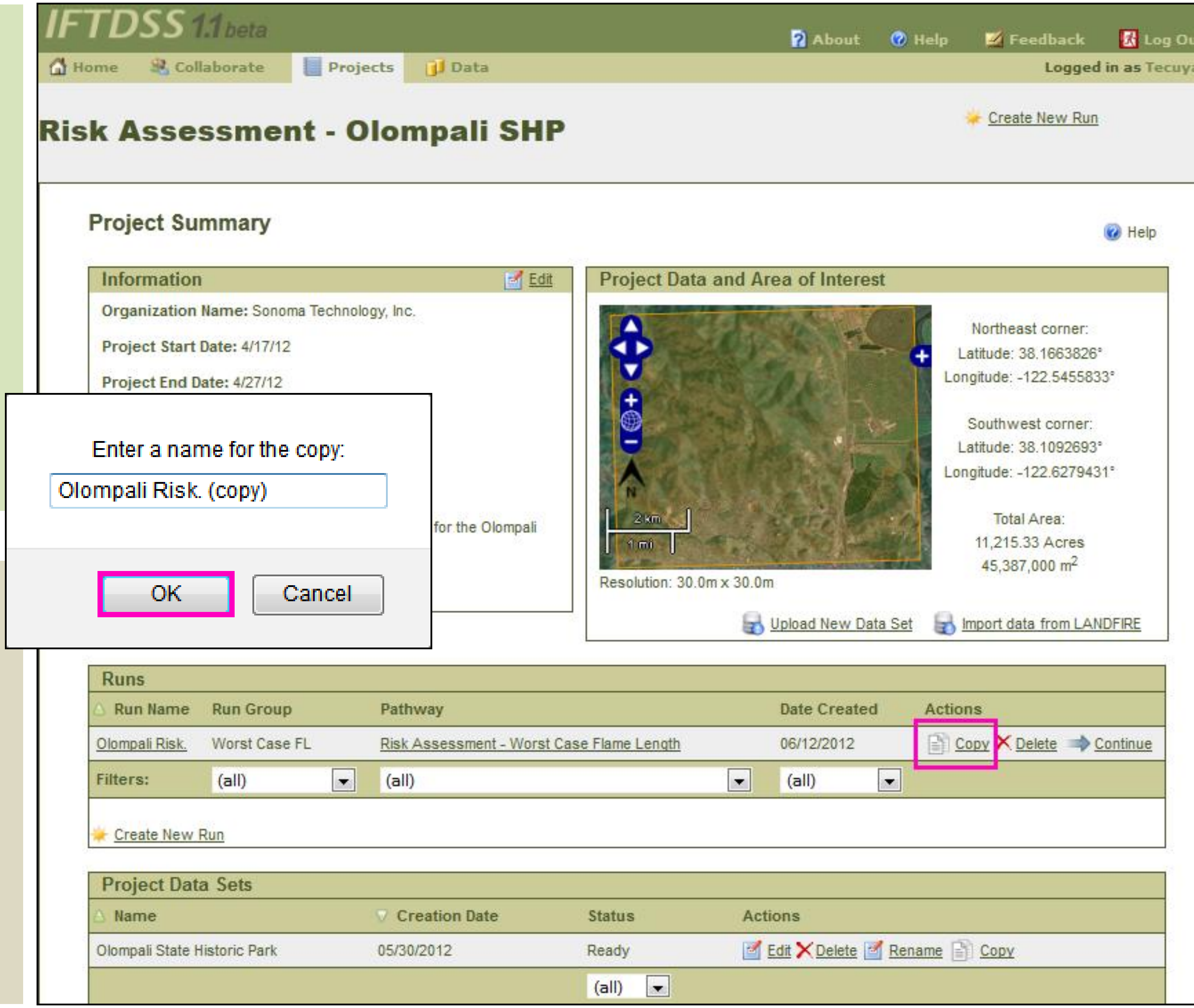
You are now on the **Active Projects** page. Here, select the **Risk Assessment – Olompali SHP** project that you created at the beginning of this tutorial.



Copying Runs for Future Use

On the **Project Summary** page, you can copy runs.

Copying runs is useful if you want to re-use the values-at-risk map. You can rerun the module using different inputs. This way, you can perform risk assessments across a variety of environmental conditions.



Select **Copy** on the "Olompali Risk" run that you made for this tutorial.

Enter a name for the copied run and choose **OK**.

After choosing **OK**, you are taken to the pathway of the copied run.

Next Steps: Assessing Further Needs

The information from this risk assessment 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 a neighborhood within a high risk area is intermixed with trees.

- Make a site visit

- Conduct additional fuels treatment analyses

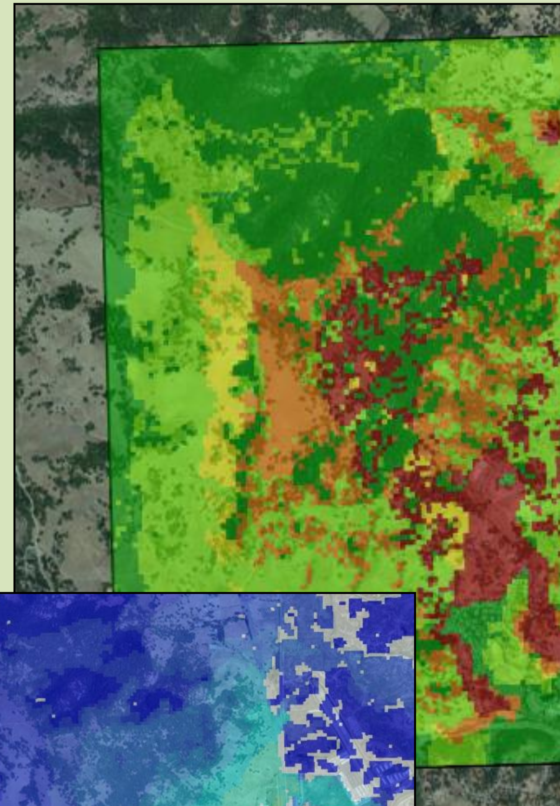
- Review the fire behavior fuel model layer

  Although 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, it is clear that the LANDFIRE data needs to be edited; return to the editing spatial landscape data step to edit your fuel models (pages 36 and 37). Then rerun the module to see differences in the fire behavior and risk outputs.

Things You Need to Know

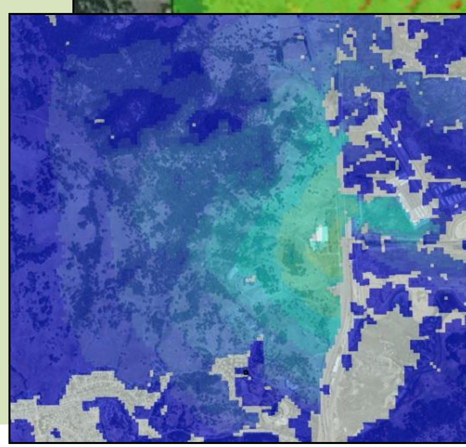
Fire behavior values are calculated pixel-by-pixel and are **simulated independently** with respect to the surrounding pixels in the landscape input file.



For the IFT-FlamMap output, fire behavior in adjacent locations, roads, or hazardous fuel types in proximity to the area under assessment **does not** affect the fire behavior potential of the pixel (or point location) being assessed.

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

The worst-case flame lengths approach assumes random ignitions across the area of interest; however, some areas have higher ignition potentials than others. This approach does not yet take this into account.



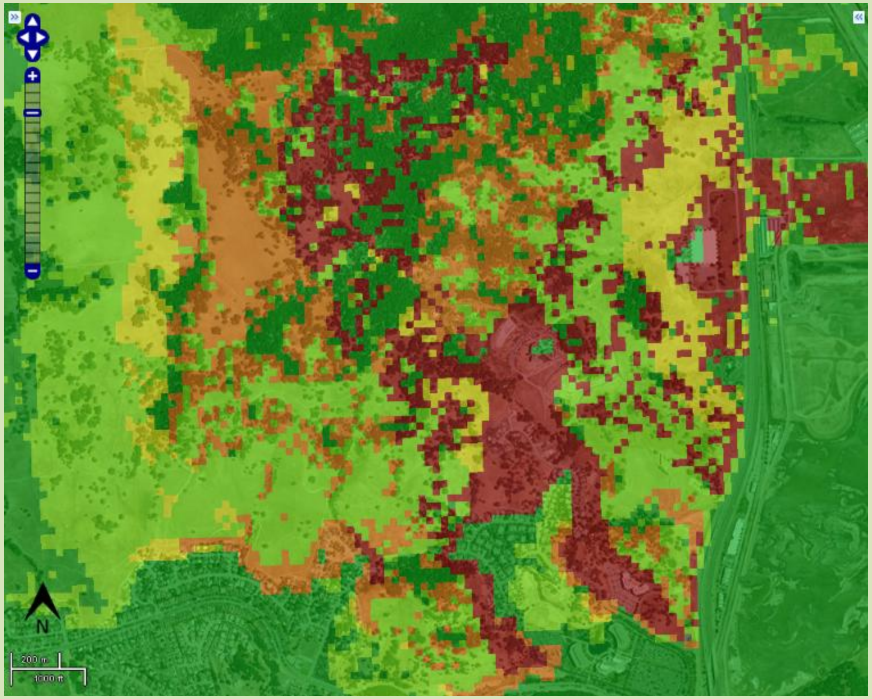
For example, human-caused ignitions often occur close to roads and natural ignitions caused by lightning occur at elevated areas.

The worst-case flame lengths risk assessment approach may overestimate the degree of damage to the value at risk in an area represented by an individual pixel.

Review

Using the risk assessment workflow in IFTDSS, we were able to

- Acquire LANDFIRE data and set up a project in IFTDSS.
- Create a run focused on fire risk across a landscape (using IFT-FlamMap and IFT-RANDIG).
  - Develop a values-at-risk map.
  - Establish environmental parameters.
  - Review/edit spatial landscape input data.
  - Analyze potential fire behavior output data.
  - Identify potential fire hazards and risks across a landscape.
  - Examine data relative to points of interest and other geographic features using Google Earth.
- Copy a run for use with different inputs.



More IFTDSS Tutorials:

- Creating a risk assessment using the flame length probabilities approach
- Performing a landscape-level hazard analysis
- Assessing fire hazard for prescribed fire planning
- Preparing a prescribed burn plan