How to Use IFTDSS to Spatially Evaluate Fuel Treatment Effectiveness

There are multiple ways that fuels treatment effectiveness can be addressed. In IFTDSS, fuels treatment polygons may be created or uploaded; 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 fire behavior parameters, and displays the percent difference to identify where positive and negative changes have occurred across the landscape from modeled fuel treatments.

In this tutorial, IFTDSS will be used 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. This process will be performed using the spatial **fuels treatment across a landscape** pathways. Specifically, treatment effectiveness will be determined by downloading and editing LANDIRE lcp data, simulating fuels treatments in manually-drawn polygons, and comparing outputs generated by IFT-FlamMap.

During this tutorial users will follow a step by step process that includes:

- Identifying key information and caveats
- Creating a project
- Acquiring LANDFIRE data in IFTDSS
- Creating a run focusing on fire behavior across a landscape using IFT-FlamMap
- Reviewing landscape data
- IFT-FlamMap Inputs
- Data review
- Identifying fuels treatment locations

A PDF version of this tutorial is available here.

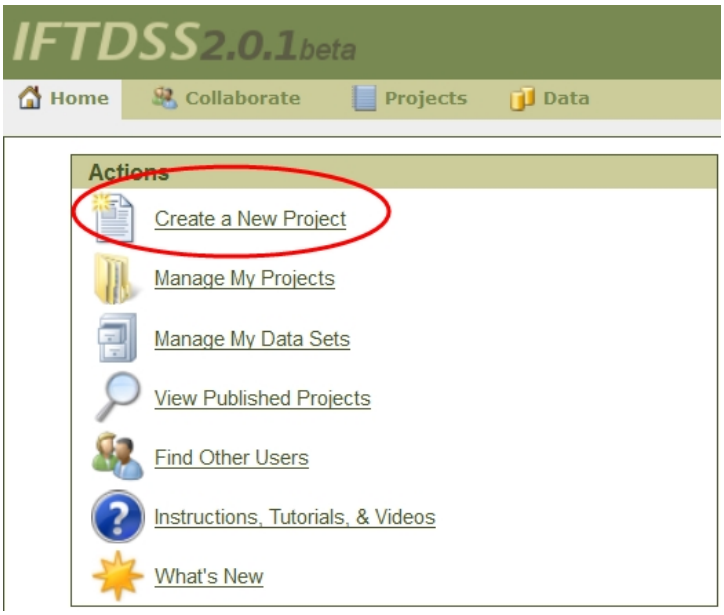
Key Information and Caveats

When running IFTDSS to evaluate the effectiveness of fuel treatments based on modeled fire behavior, it is important to note the following:

- 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.

Creating a Project

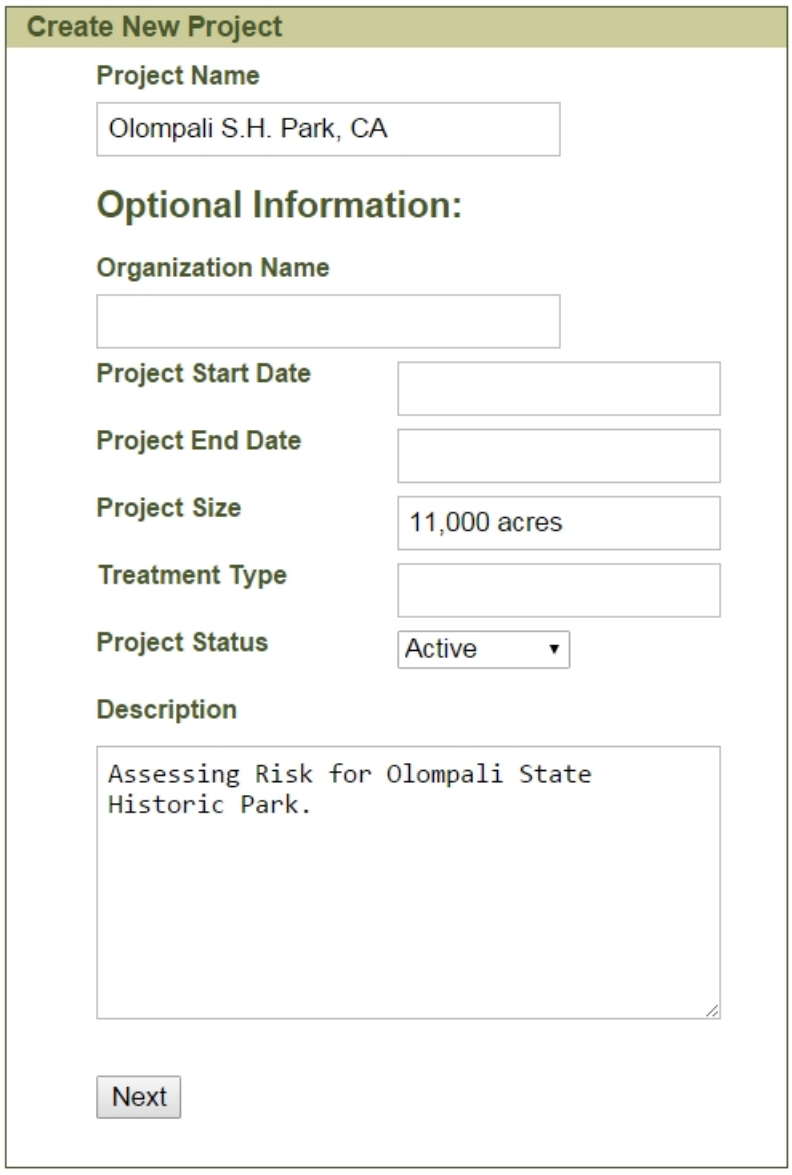
To begin, click **Create a New Project** under the Home tab.



Choose a descriptive project name.

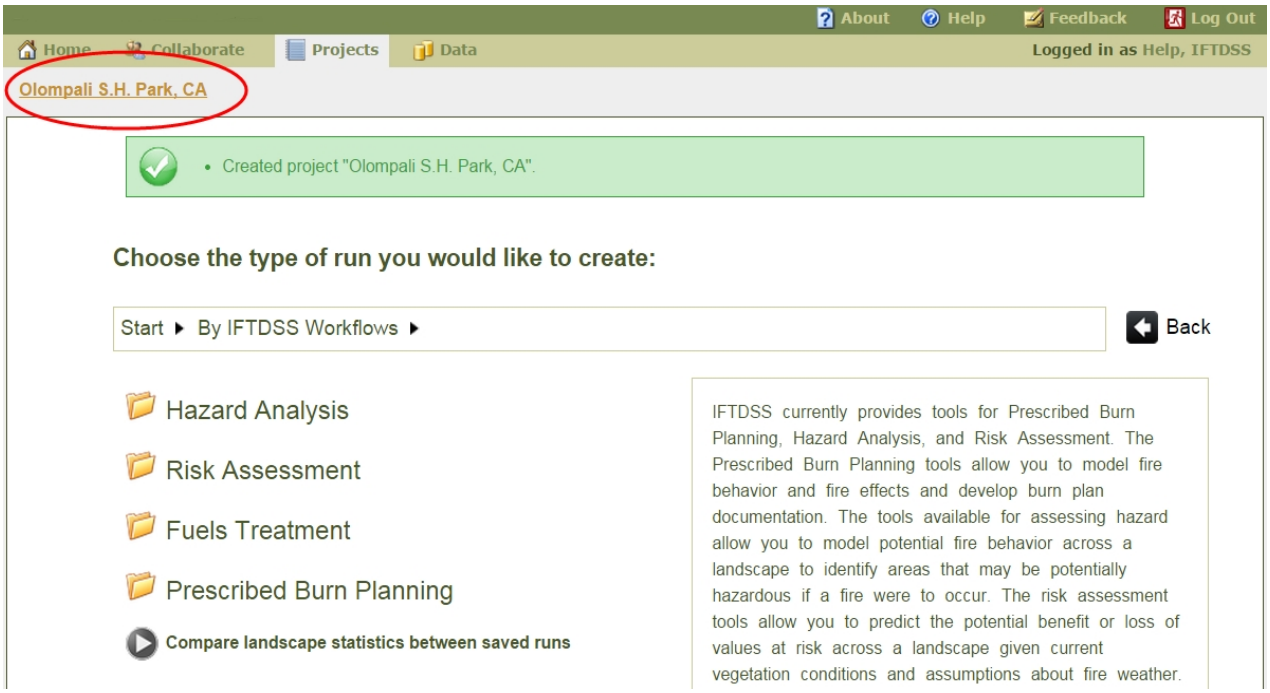
If desired, fill in the optional information.

Choose **Next**.



After creating a new project, you will see the page for **creating a new run**.

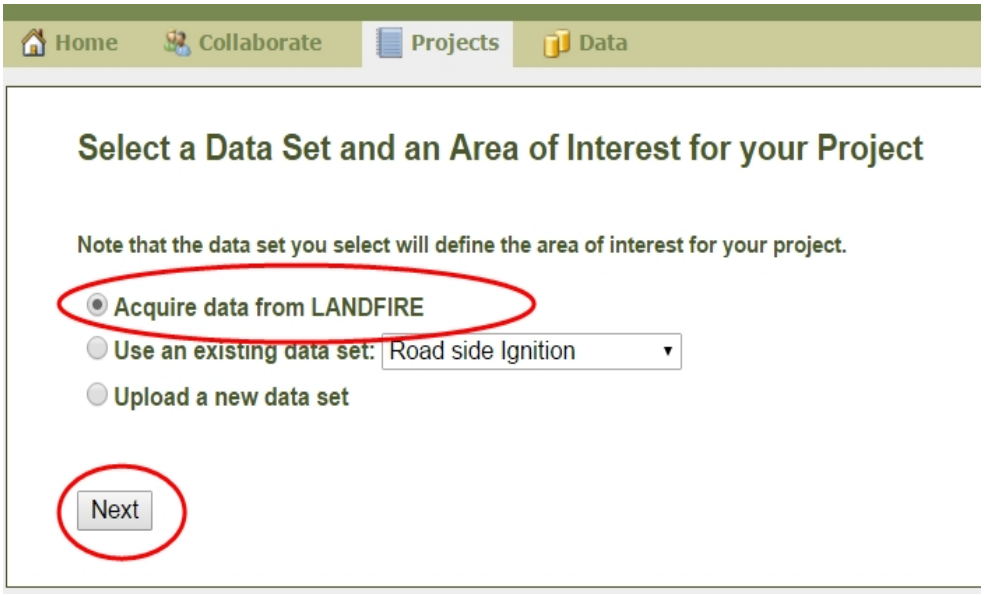
For the next steps, setting up an area of interest and acquiring LANDFIRE data, we are going to navigate to the project summary page by clicking on our project name (circled in red).


About
Help
Feedback
Log Out
Home
Collaborate
Projects
Data
Logged in as Help, IFTDSS
Olompali S.H. Park, CA
Created project "Olompali S.H. Park, CA".
Choose the type of run you would like to create:
Start ▸ By IFTDSS Workflows ▸
Back
Hazard Analysis
Risk Assessment
Fuels Treatment
Prescribed Burn Planning
Compare landscape statistics between saved runs
IFTDSS currently provides tools for Prescribed Burn Planning, Hazard Analysis, and Risk Assessment. The Prescribed Burn Planning tools allow you to model fire behavior and fire effects and develop burn plan documentation. The tools available for assessing hazard allow you to model potential fire behavior across a landscape to identify areas that may be potentially hazardous if a fire were to occur. The risk assessment tools allow you to predict the potential benefit or loss of values at risk across a landscape given current vegetation conditions and assumptions about fire weather.

Acquiring LANDFIRE Data

From the project summary page, click **Acquiring data from LANDFIRE** in the area of interest box

Make sure the **Acquire data from LANDFIRE** option is selected and click **Next**.



Navigate to your desired location using one of these methods:

- Use the navigation tools located in the top left portion of the map.
- Use the mouse. Click and drag to move; double-click to zoom in.

- **Enter coordinates**.

For this example, you may enter the following coordinates:

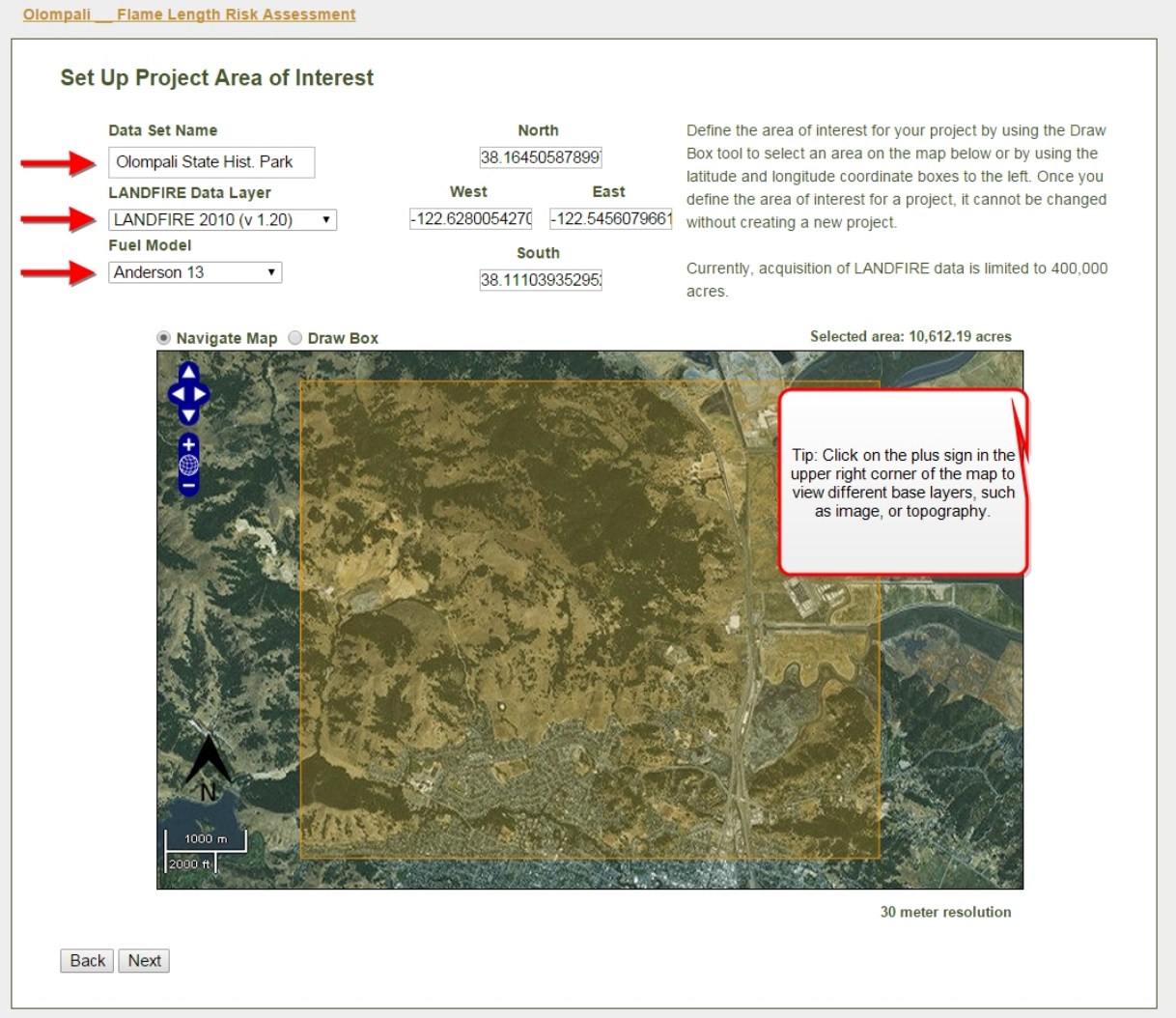
- **North:** 38.164505878997
- **East:** -122.54560796614
- **South:** 38.111039352952
- **West:** -122.62800542709

> **Note**
> To navigate to your desired location and select a project area using your mouse instead of typing coordinates, do the following: first click and drag, then double click to zoom into the approximate area of the map. Next, select the **Draw Box** radio button on the top left of the map, mouse to the edge of your intended project area, hold down the left mouse button, and drag over your area of interest, then let go of the mouse button.

Name the data set

Select a LANDFIRE data layer, in this example, we'll choose LANDFIRE 2010 (V 1.20)

Select a fuel model type (Scott and Burgan 40 or Anderson 13). In this example we use Anderson 13.



Once you select your dataset, the project area **cannot** be changed. To change a project area, you must create a new project.

Note
Currently, acquisition of LANDFIRE data is limited to 400,000 acres. The acreage of your selected area is displayed on the top right of the map.

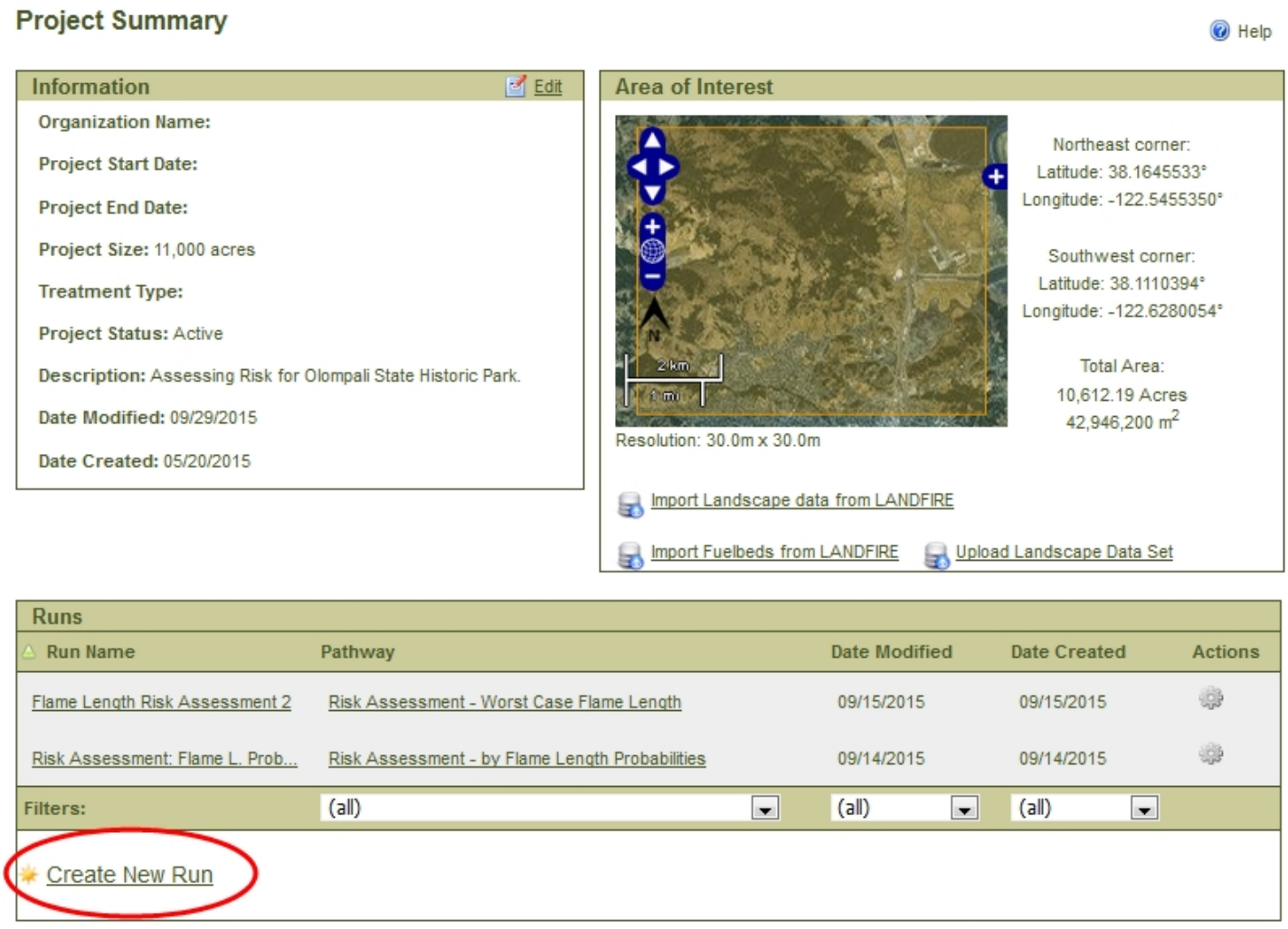
After acquiring the LANDFIRE data, you are returned to the **Project Summary** page. Stay on this page for the next section.

For use in spatial modules, you now have

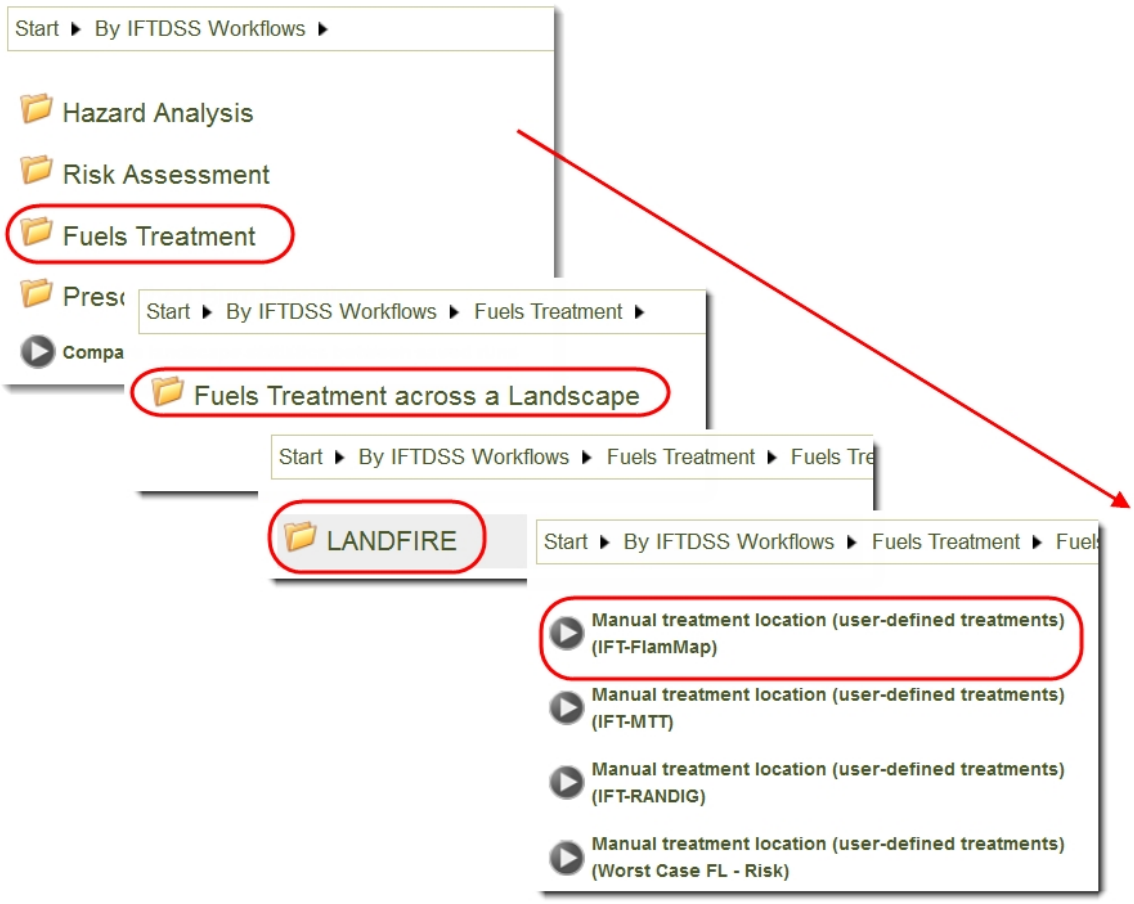
- a Project Area of Interest and
- a Project Data Set.

Creating the Run

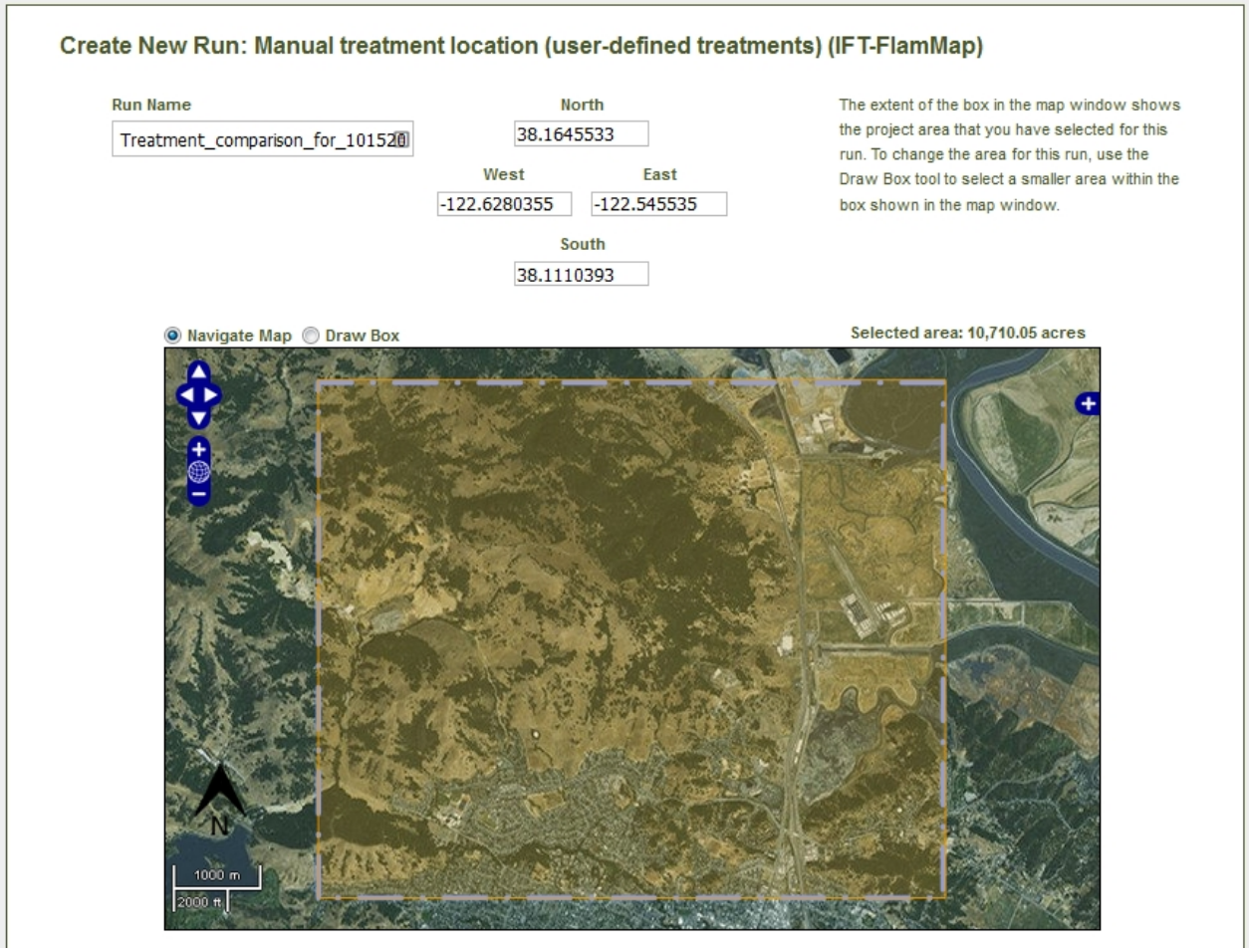
To spatially compare fuels treatments, begin a run that will compare treatments using IFT-FlamMap. From the **Project Summary page**, scroll down to the **Run** section and select **Create a New Run** (circled in red below).



From the IFTDSS **Workflows page** select **Fuels Treatment**, **Fuels treatment across a landscape**, **LANDFIRE**, and then the **manual treatment location (user-defined treatments)(IFT-FlamMap)** pathway. This will initiate a run where fuels treatments can be compared using the LANDFIRE lcp data acquired earlier, and polygons which we will created shortly, to delineate fuel treatments.

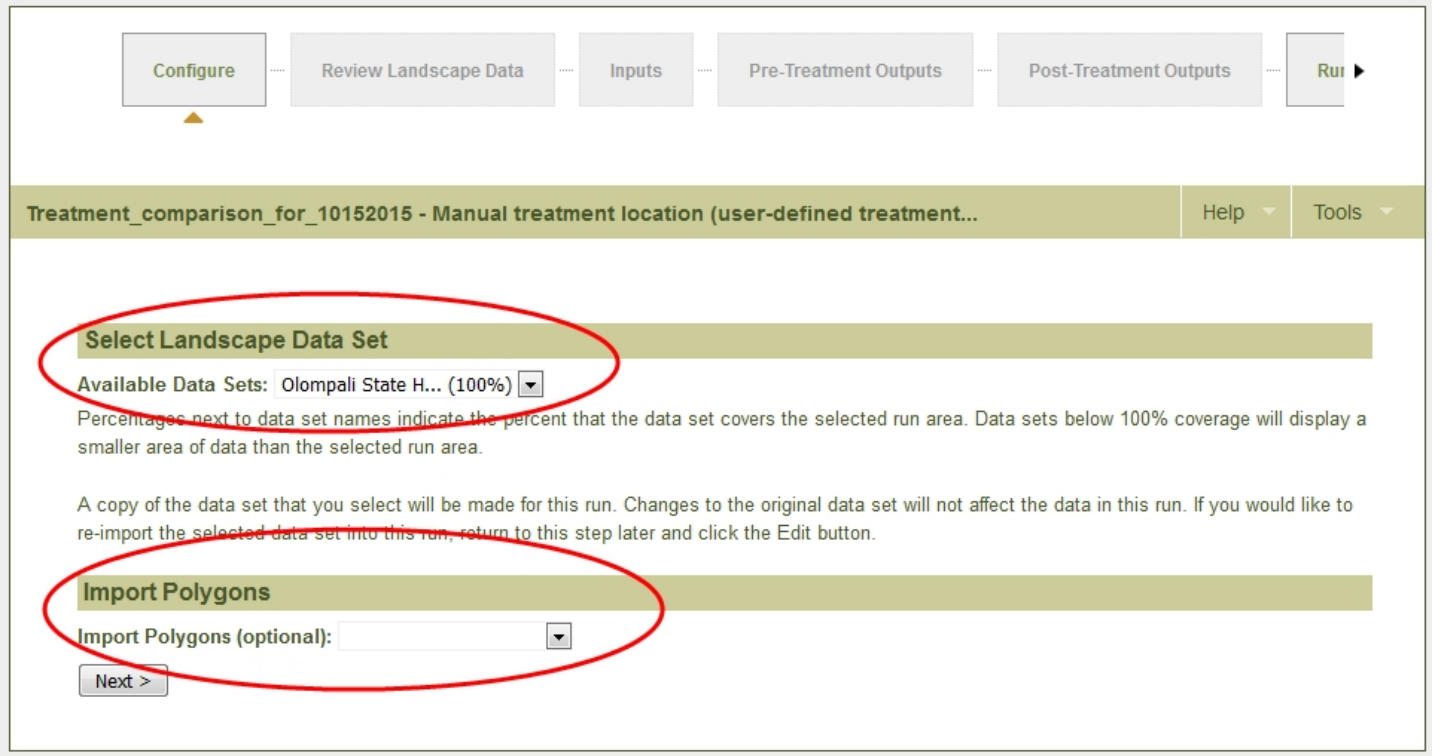


You will be prompted to name your run, and have the choice to alter the area in which the run occurs.



For this example, we will give the run a descriptive name so it can be easily found later, and we'll leave the area of interest alone.

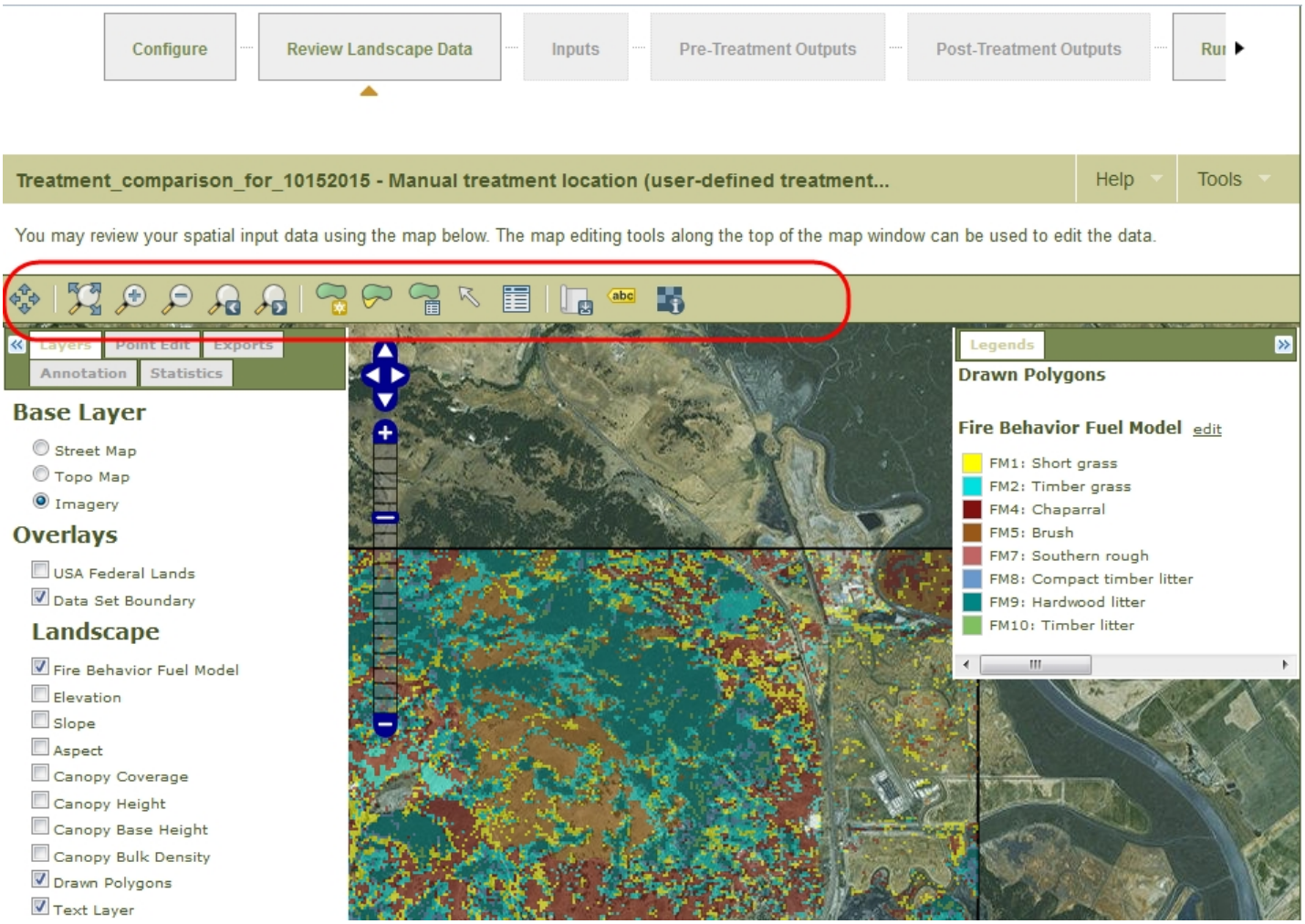
The next step will be to configure the run. Under the **Select Landscape Data Set** heading we can approve, or change the lcp data, and under the **Import Polygon** heading we can select pre-drawn polygons from other runs if we have them.



For this example we will leave our data set selection on the default, which is the LANDFIRE data we acquired earlier. Leave the **Import Polygons** option blank, we will create them later, and then click **Next**.

Review Landscape Data

In the Review Landscape Data portion of the run, you can review, or edit data that was downloaded from the LANDFIRE lcp file such as the Fire Behavior Fuel Models, canopy height, bulk density, etc, using to mapping toolbar (outlined in red).



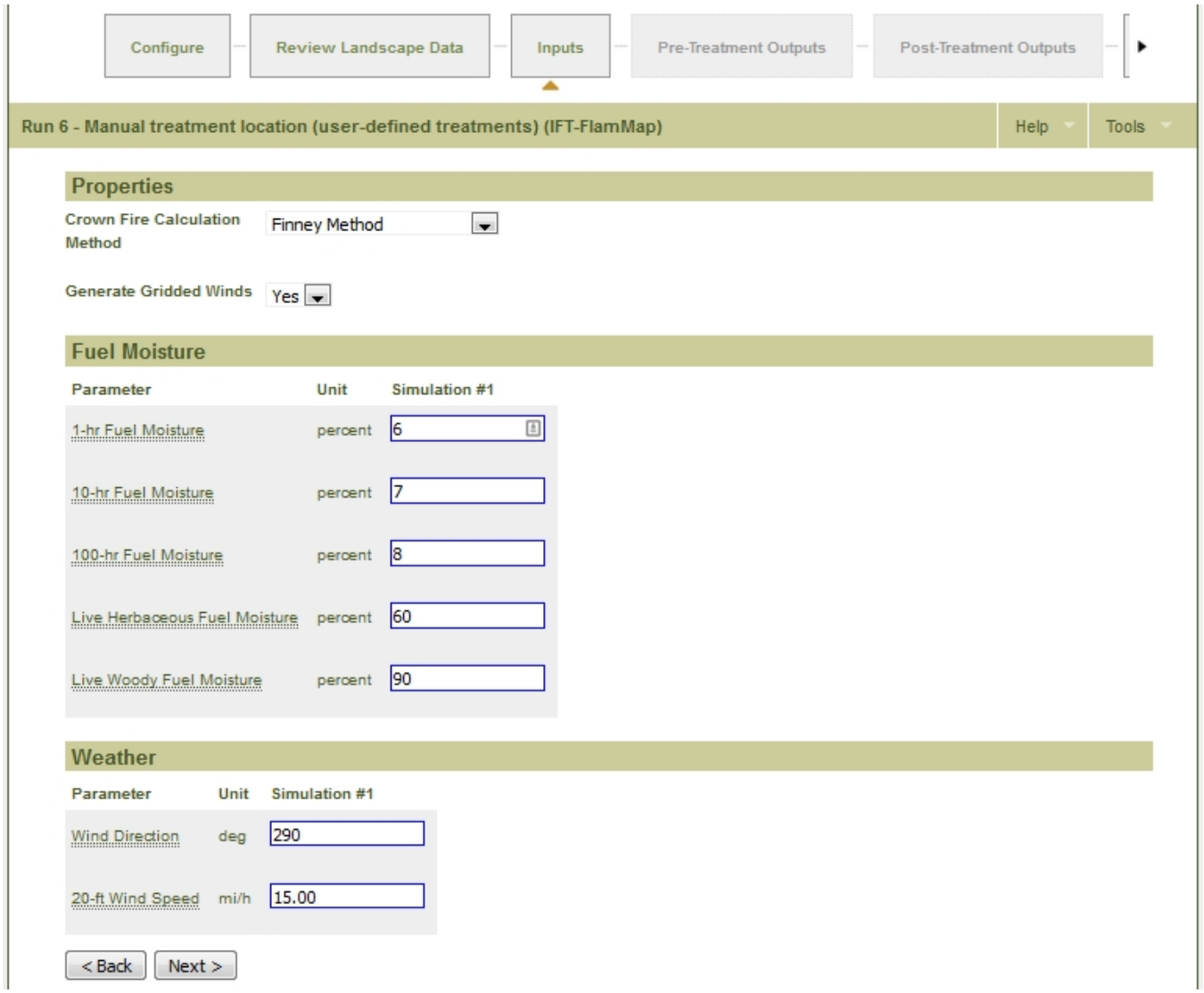
This will be our pre-treatement comparison so no edits will be made yet. Scroll to the bottom of the screen and click **Next**.

Inputs: Properties, Fuel Moisture, and Weather

The Inputs step is where all the information about fuel properties, fuel moisture, and weather needed to run IFT-FlamMap are input. The input fields are pre-populated with default values.

Inputs include:

- Crown fire calculation method
- Generate gridded winds (yes/no)
- 1-hr Fuel Moisture
- 10-hr Fuel Moisture
- 100-hr Fuel Moisture
- Live Herbaceous Fuel Moisture
- Live Woody Fuel Moisture
- Wind Direction
- 20-ft Wind Speed



Note
When you hover your mouse cursor over the underlined parameters next to each field, definitions and possible value ranges are displayed.

In the next step, we will populate these fields with custom data.

Crown Fire Calculation Method can either be set to the **Finney Method** or the **Scott-Reinhardt Method**. A detailed discussion of crown fire methods is discussed in depth elsewhere in this Help application. Essentially, differences in the way these methods are calculated can lead to the modeling of more or less crown fire occurring on your landscape based upon your inputs. 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 that landscape.

For this example we will use the **Finney Method**, and when prompted to **generate gridded winds** we will specify **No**.

> **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, high, and extreme fire behavior.

For this example we will environmental parameters that would generate high fire behavior: **1**,**10**, and **100 hour** fuel moistures will be set to **4**,**6**, and **8** respectively, **herbaceous fuel moisture** will be set t **55**, and **live woody fuel moisture** will be set to **80**%. We will set **wind direction** to **270 degrees** at a **20-ft windspeed** of **40 mph**. Check your inputs be ensure they match the image below, and then click **Next**.

at the end of this process, your inputs should match the figure below:

Properties

Crown Fire Calculation Method	Finney Method
Generate Gridded Winds	No

Fuel Moisture

Parameter	Unit	Simulation #1
1-hr Fuel Moisture	percent	4
10-hr Fuel Moisture	percent	6
100-hr Fuel Moisture	percent	8
Live Herbaceous Fuel Moisture	percent	55
Live Woody Fuel Moisture	percent	80

Weather

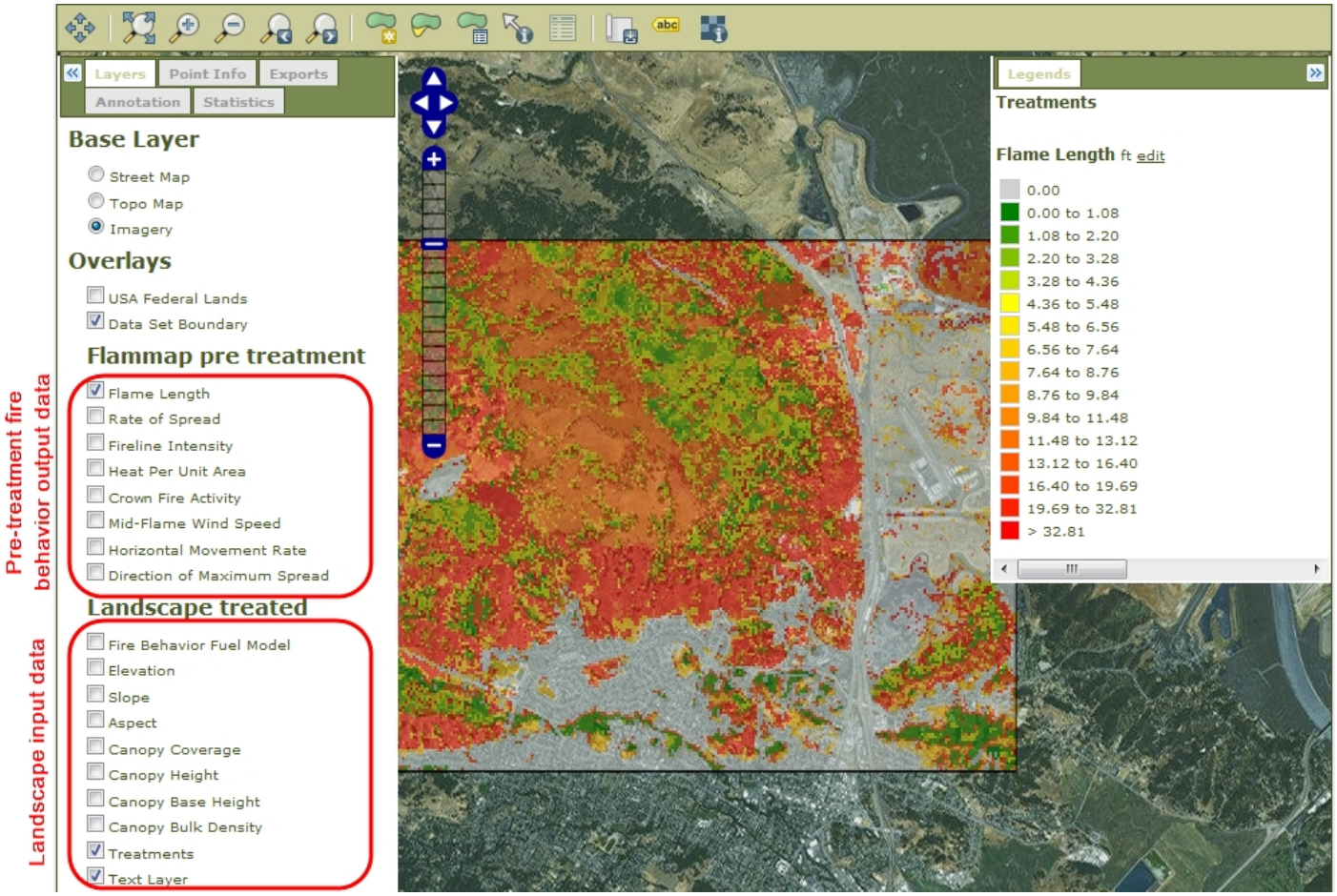
Parameter	Unit	Simulation #1
Wind Direction	deg	270
20-ft Wind Speed	mi/h	40

< Back | Next >

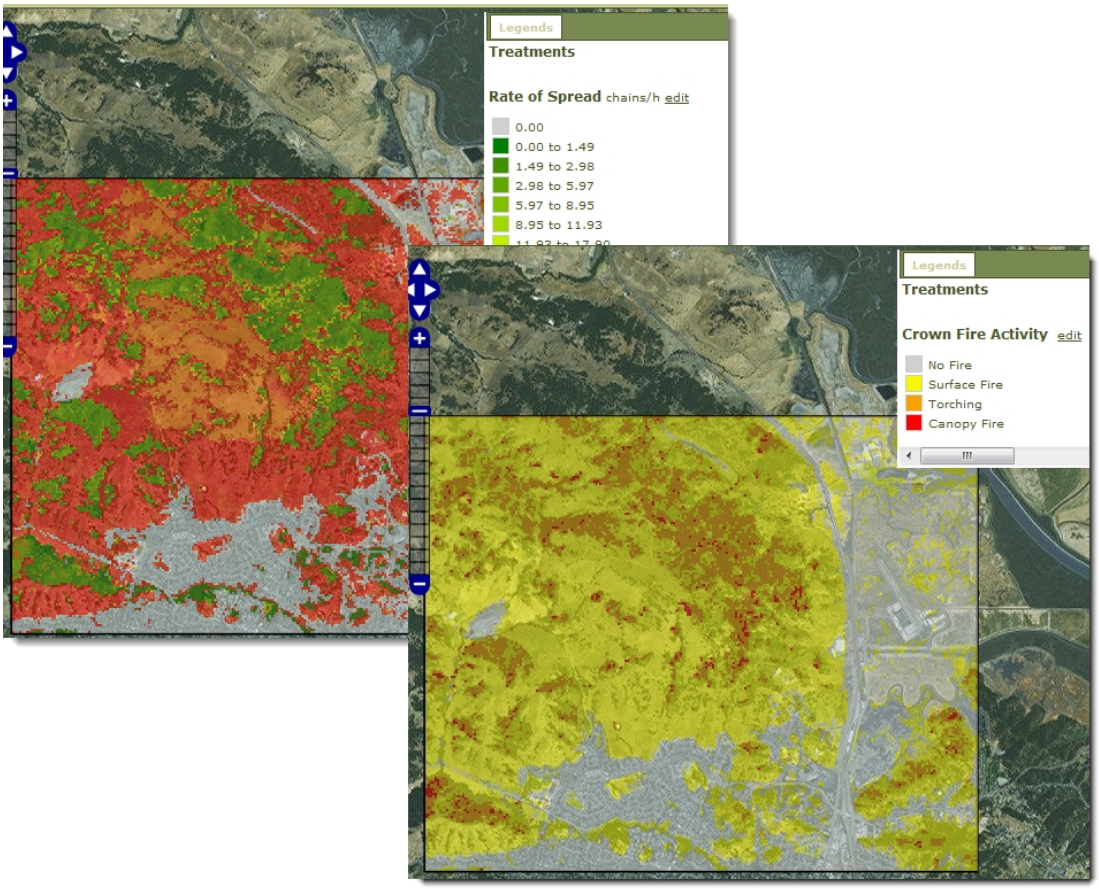
Reviewing Pre-Treatment Outputs

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



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.

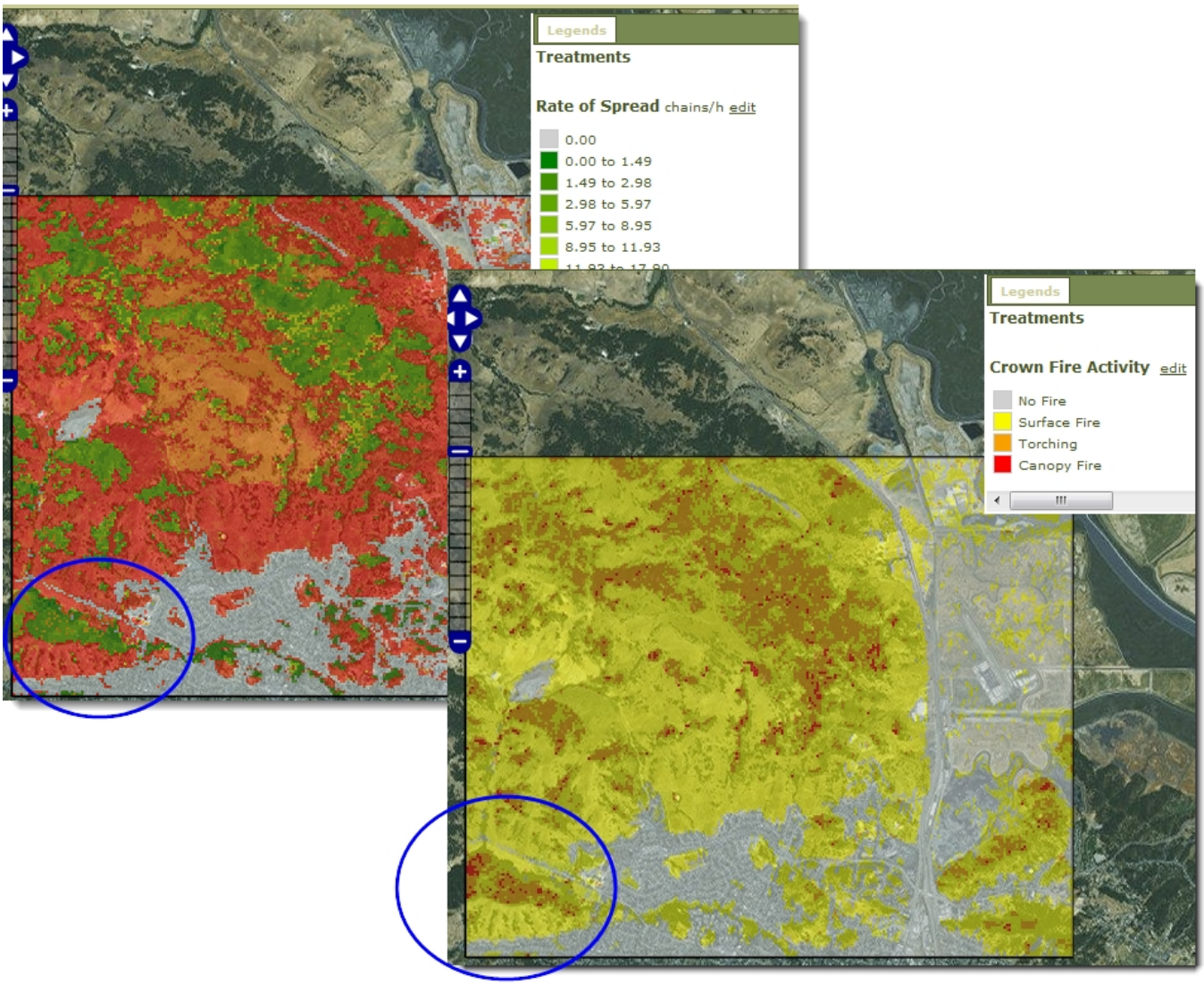


Identifying Fuels Treatment Locations

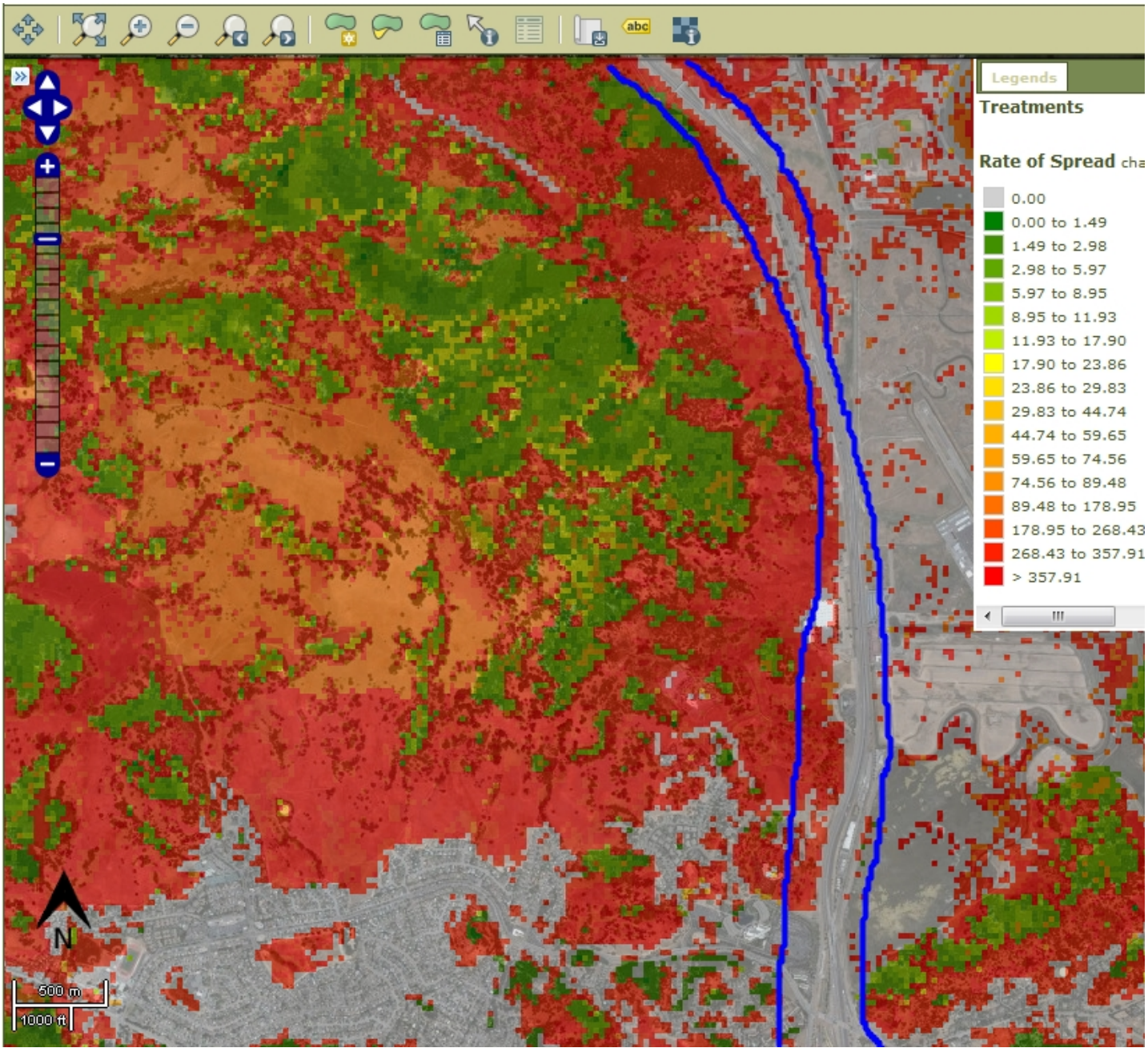
In this example, the areas with a low rate of spread (green pixels in upper left screen-shot) are at risk for canopy fires (red pixels in lower right screenshot).

We would like to reduce the risk of canopy fires near the wildland urban interface (gray 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.



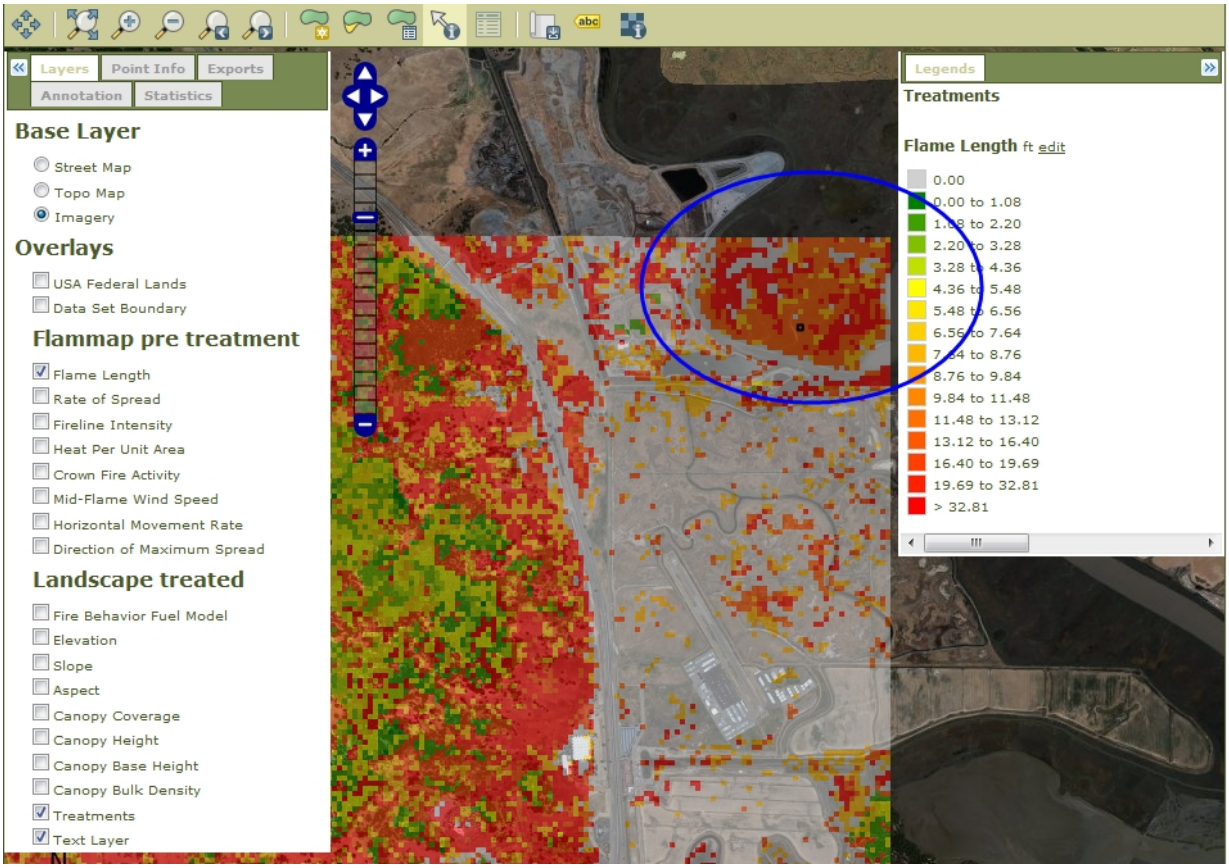
Looking to the east of the map we can see U.S. Highway 101 (outlined in light blue), this will be our next fuels treatment location. Specifically, the grassland/oak woodland buffer along the highway.



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 road-side, and to lower the risk of a wildfire jumping the highway.

Lastly, our third fuels treatment location will be Gnoss Field (the Marin County Airport). This area is classified by a mix of brush, chaparral, and short grass (Fuel models 5,4, and 1) 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.



Based on these observations, our goals will be to:

- Reduce canopy fire potential in the area surrounding the wildland urban interface.
- Reduce the potential rate of spread adjacent to Highway 101.
- Reduce the potential flame lengths near the Marin County Airport.

In the next steps we will add the fuels treatments polygons and edit the LANDFIRE fuels data within those polygons to create fuels treatments.

Creating Fuels Treatment Polygons

In the next few steps fuels treatments will be created by drawing polygons and editing the 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

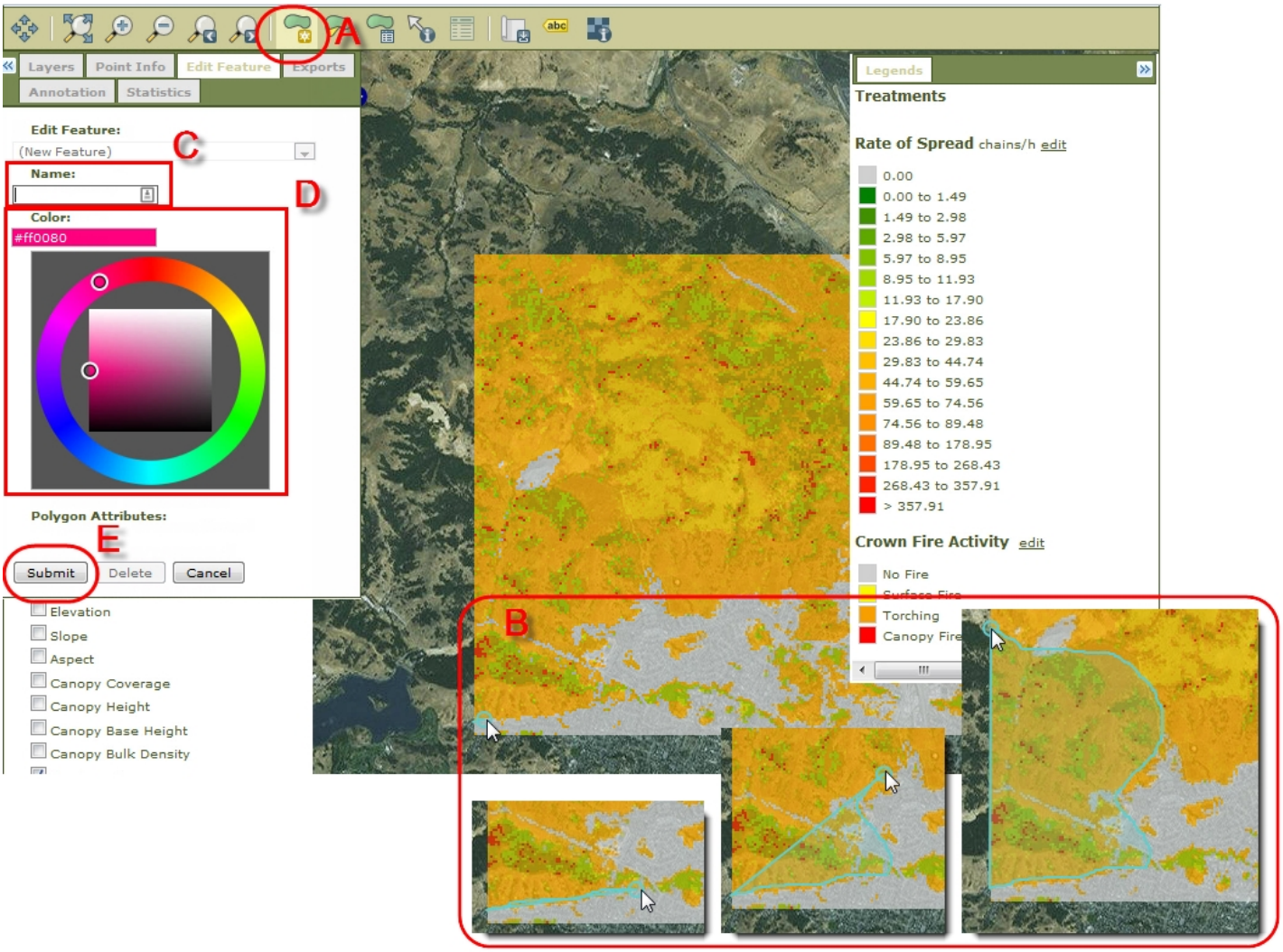
2. The Point and Click Method is useful when:

- 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

To create a polygon using the freeform method

First, we will create a treatment polygon in which to reduce crown fire potential in south western corner of the map near the wildland urban interface. This is done by:

A. Click the draw polygon tool in the map toolbar
B. Hold down the shift button, move the mouse to where you want your polygon to begin, then hold down the left mouse button to draw your perimeter. When you have encircled the area, let go of both shift and the mouse key, and an edit feature box will appear
C. Name the polygon, for this example we will name the polygon 'Thin from below' as this will be the proposed treatment method.
D. Change the color if desired by clicking on the color wheel
E. When your ready, click submit

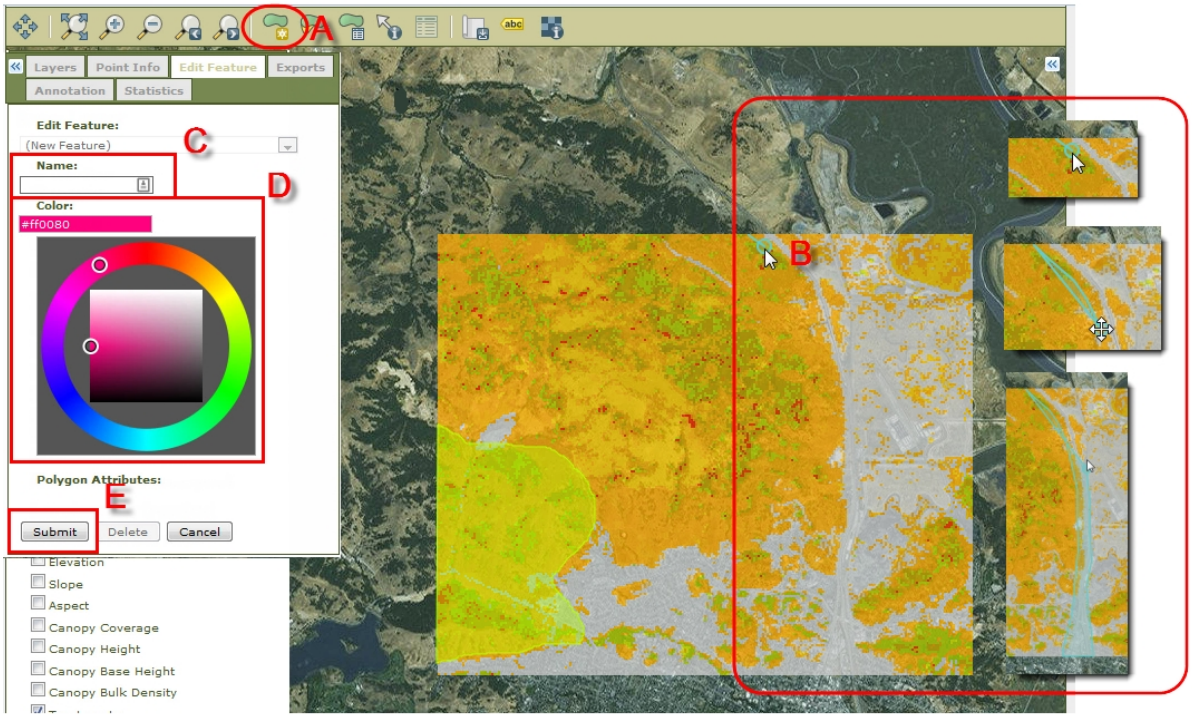


To create a polygon using the point and click method

For this example we will create a treatment polygon in which to reduce rates of spread along Highway 101. To create this polygon:

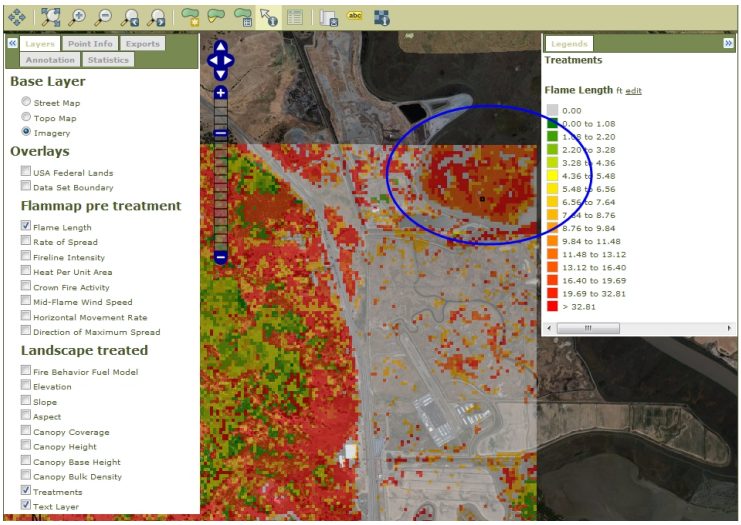
A. Click the draw polygon tool in the map toolbar
B. Move the mouse to where you want your polygon to begin, then left click to place your first anchor point. Scroll to the next point, click, and continue to dray your polygon. When you have closed your polygon, double click and mouse, and an edit feature box will appear
C. Name the polygon, for this example we will name the polygon 'Mowing' as this will be the proposed treatment method.

D. Change the color if desired by clicking on the color wheel
E. When your ready, click submit

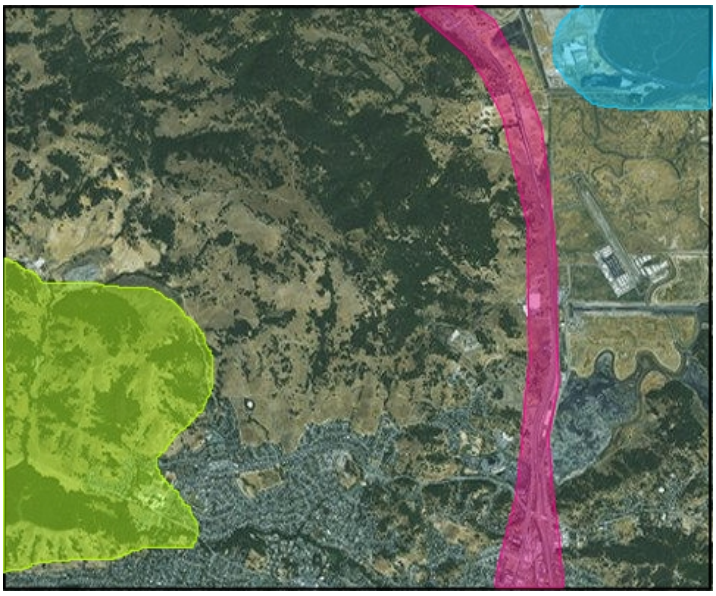


Prescribed fire treatment polygon

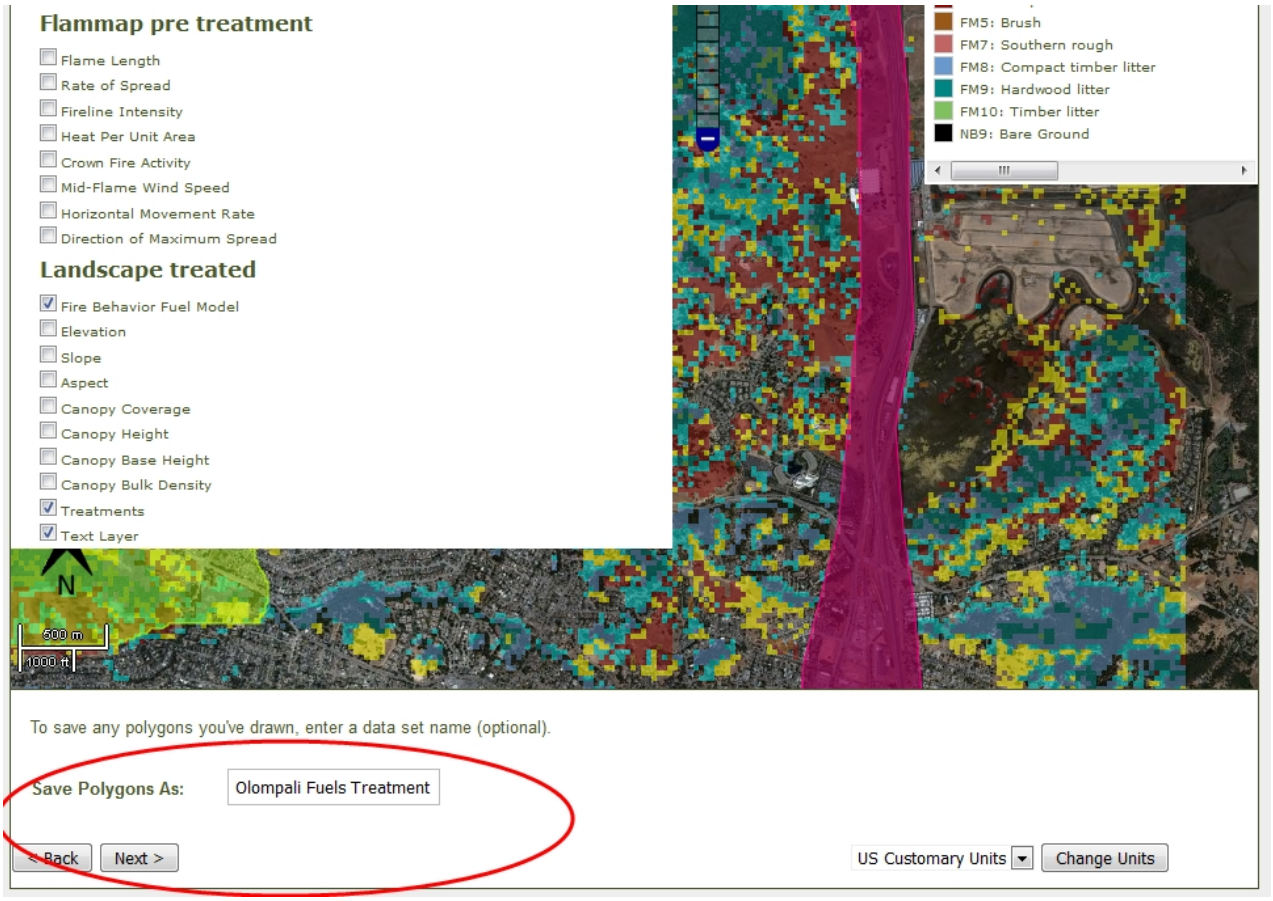
Use either of the above methods to create a treatment area in the north east corner of the map (circled in blue). This goal for this area will be to reduce flame lengths by treating the area with prescribed fire. Name the polygon 'Prescribed fire'.



When you are completed, your polygons will look similar to the image below:



When all three treatment areas are represented by polygons, name this collection of polygons (in this example we will name the 'Olompali fuel treatments' and click submit (circled in red).


Flammap pre treatment
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
Landscape treated
Fire Behavior Fuel Model
Elevation
Slope
Aspect
Canopy Coverage
Canopy Height
Canopy Base Height
Canopy Bulk Density
Treatments
Text Layer
FM5: Brush
FM7: Southern rough
FM8: Compact timber litter
FM9: Hardwood litter
FM10: Timber litter
NB9: Bare Ground
N
500 m
1000 ft
To save any polygons you've drawn, enter a data set name (optional).
Save Polygons As:
Olompali Fuels Treatment
< Back
Next >
US Customary Units
Change Units

Editing LANDFIRE Data to Create Fuels Treatments

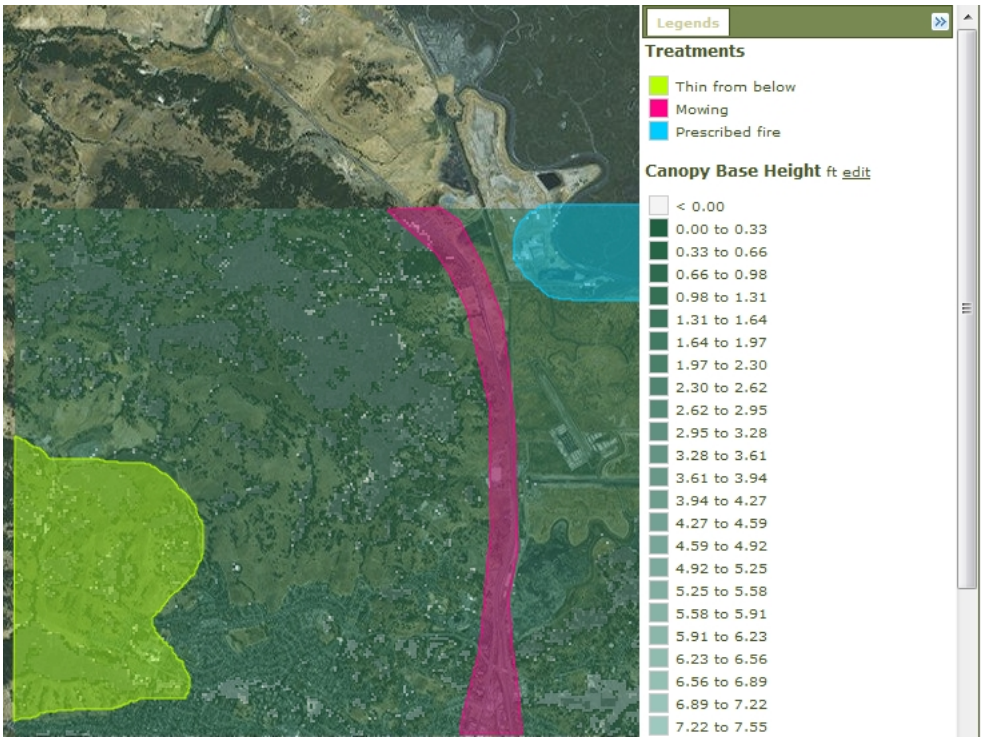
Once fuels treatment polygons are created, the next step is to manually edit the LANDFIRE data within these polygons to reflect fuels treatments.

The **Polygon Advanced Edit Tool** (indicated above in red) allows for specific changes to be made to the fuel attributes within any given polygon. In this example the polygon advanced edit tool will be used to represent:

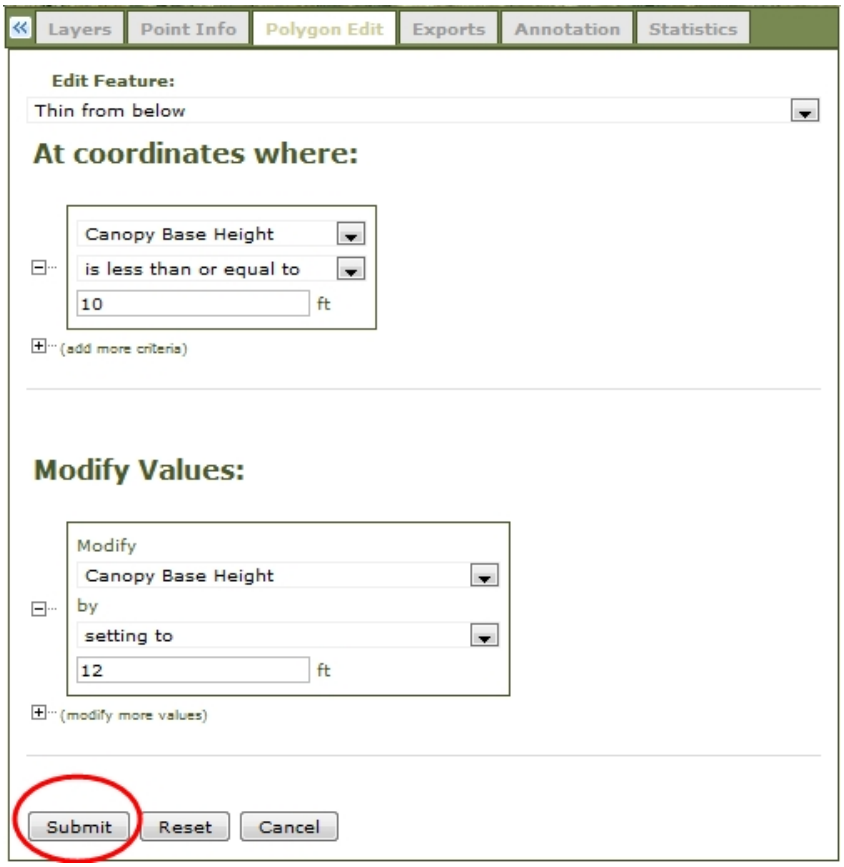
- Thinning from below by changing the canopy base height to 12 feet for all pixels where the canopy base height is currently 10 feet or less
- Mowing by changing the Fire behavior fuel models to 'Bare ground'
- Post-presecribed fire vegetation by changing the Fire behavior fuel models to 'Bare ground'

Using the Advance Edit Tool to represent thinning from below

To begin editing, click the **Polygon Advanced Edit Tool** and then select the polygon of interest by clicking on it. In this case we'll click on the Thin From Below polygon in the southwestern corner of the map.



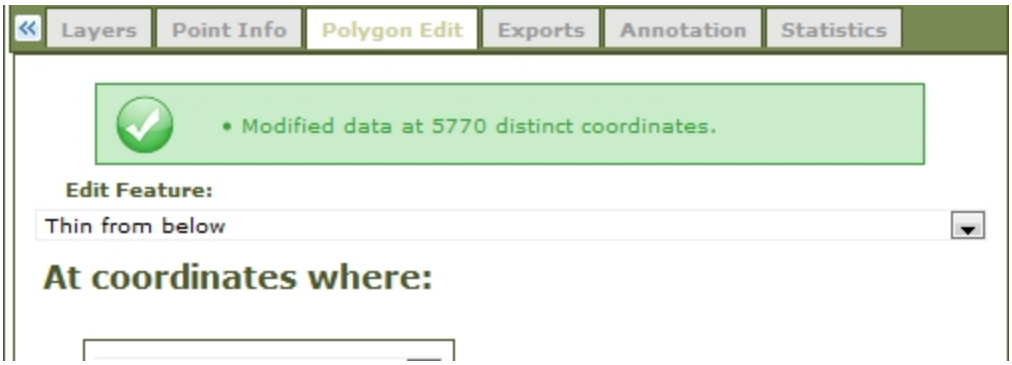
Once the polygon has been selected, the **Polygon Edit** box will appear on the left side of the map.



The first field in the **Polygon Edit** box is the **Edit Feature** field, which allows us to verify that we have indeed selected the Thin from below polygon. Now to set all pixels with a canopy base height of 10 feet or less to a canopy base height of 12 feet. Under the **At coordinates where:** field, select **canopy base height** from the list of data layers, select **is less than or equal to**, then enter **10** as the value to modify. In the **Modify Values** fields, set **Canopy Base Height** as the field to modify, select **setting to**, and enter **12** as the value to use. When this is complete and your box matched the one pictured above, click **submit** (circled in red) to make the changes.

Note

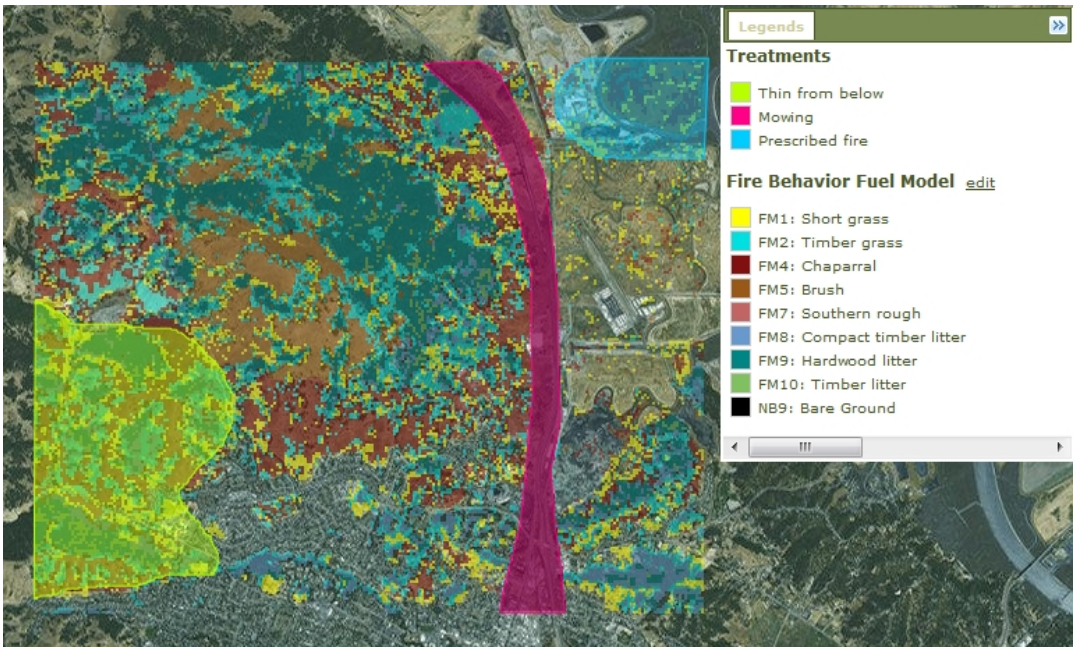
At the end of the Add Coordinates Where" fields there is an option to add more criteria and at the end of the "Modify Values" there is an option to modify more values. Clicking on these options will open more fields in which you may enter additional criteria and modifications to be made within your polygon. This enables very selective criteria and very specific modifications to be made, if needed.



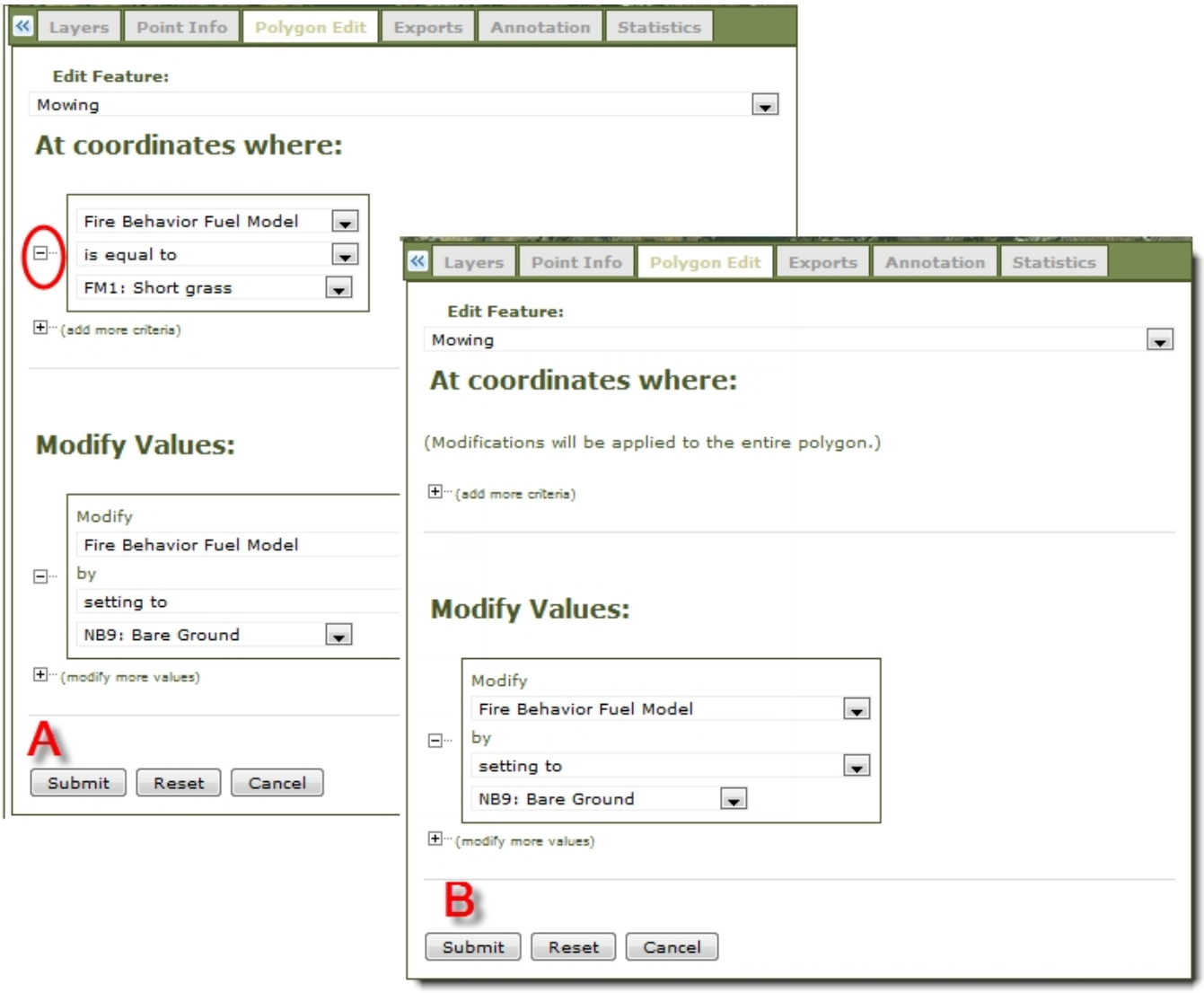
Once the process has completed a green box will appear at the top of the **Polygon Edit** box listing the number of pixels changed. You may notice the box will remain open even after you have clicked submit. This is normal, and as long as you have clicked 'submit and this green confirmation box appears, your polygon changes have been incorporated into the run.

Using the Advanced Edit Tool to represent Mowing & Prescribed Fire

Next we will modify the Mowing polygon. To begin editing, click the **Polygon Advanced Edit Tool** and then select the polygon of interest by clicking on it.



Once the polygon has been selected, the **Polygon Edit** box will appear on the left side of the map.



First we will refer to the **Edit Features** field to ensure the Mowing polygon is the one we selected. For this example, we will change all the fire behavior fuel model types within the polygon to fuel model NB9, bare ground. To change all the pixels within a polygon, click on the minus sign (circled in red in part A of the above image) to the left of the **At coordinates where** box. Once this is done, those fields will disappear, as seen in part B of the image above. In the **Modify values** fields select **Fire Behavior Fuel Model** as the layer to modify, by **setting to**the fire behavior fuel model **NB9: Bare Ground**.

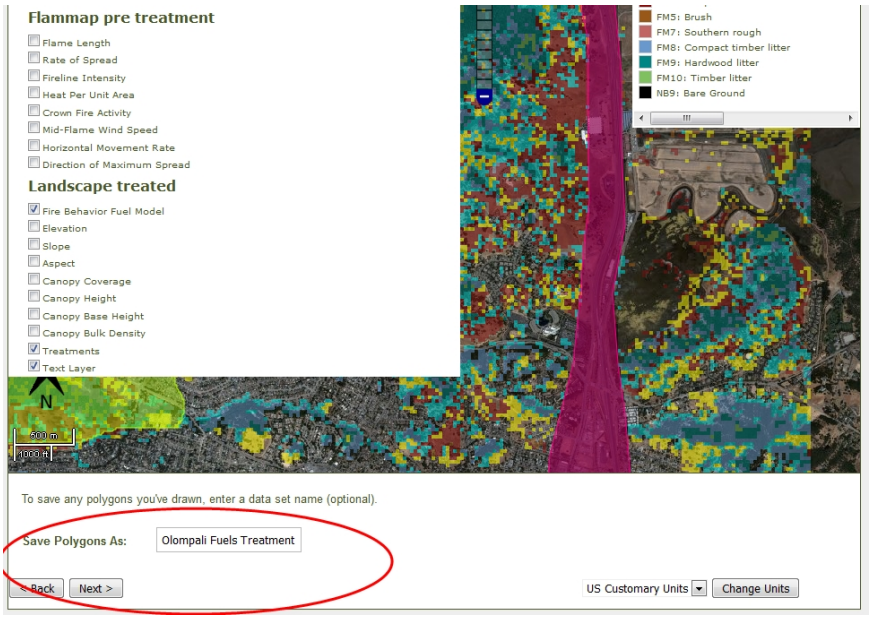
click **Submit** at the bottom left of the box to make the changes.

Once the process has completed a green box will appear at the top of the **Polygon Edit** box listing the number of pixels changed. You may notice the box will remain open even after you have clicked submit. This is normal, and as long as you have clicked 'submit and this green confirmation box appears, your polygon changes have been incorporated into the run.

For this example, use the same procedure to change the Fire Behavior Fuel Models throughout the **Prescribed Fire Polygon** to **NB9 Bare Ground**.

Note
For this example we have made a very simple change to the pixels within the prescribed fire polygon. However, at the end of the Add Coordinates Where" fields there is an option to add more criteria and at the end of the "Modify Values" there is an option to modify more values. Clicking on these options will open more fields in which you may enter additional criteria and modifications to be made within your polygon. This enables very selective criteria and very specific modifications to be made across multiple fuel layers within the polygon.

Once all the polygons have been changed, scroll to the bottom of the page, give this collection of polygons a name, and click **Next**. This will re-run IFT-FlamMap with the changes that you have just made.


Flammap pre treatment
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
Landscape treated
Fire Behavior Fuel Model
Elevation
Slope
Aspect
Canopy Coverage
Canopy Height
Canopy Base Height
Canopy Bulk Density
Treatments
Text Layer
FM5: Brush
FM7: Southern rough
FM8: Compact timber litter
FM9: Hardwood litter
FM10: Timber litter
NB9: Bare Ground
N
400 m
1000 ft
To save any polygons you've drawn, enter a data set name (optional).
Save Polygons As:
Olompali Fuels Treatment
< Back
Next >
US Customary Units
Change Units

Evaluating Fuel Treatment Effectiveness

Now you are on the Post-Treatment Outputs step. This is the part of the run in which we can compare the pre-treatment fire behavior, with the post-treatment fire behavior.

On the **Layers** box on the left side of map, you will notice in addition to our inputs, we now have fire behavior attributes for:

- Flammap post treatment
- Flammap pre treatment
- Differences (this display the change between the two Flammap layers).

We'll review the treatment goals, use these outputs to evaluate the effectiveness for each treatment polygon below

Thinning Effectiveness

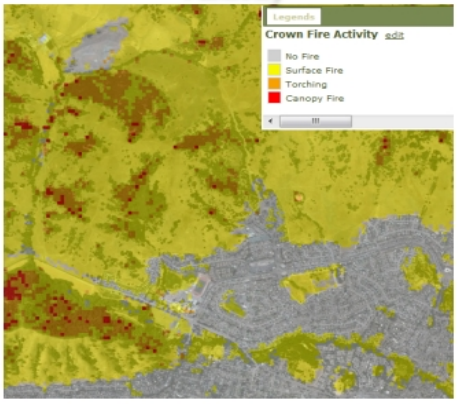
The goal for the **Thin from below** treatment area was to reduce canopy fire potential in theh area surrounding the wildland urban interface

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

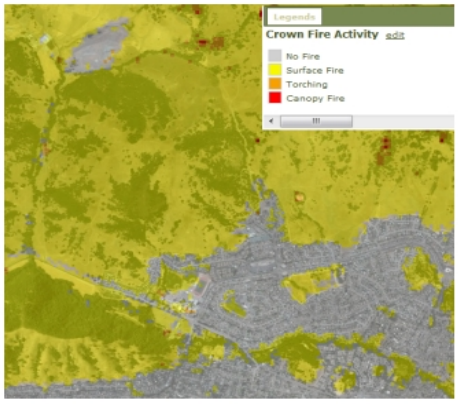
A majority of the canopy fire (red) and torching (orange) pixels were reduced to surface fire (yellow) following the fuels treatment.

Thin from Below Fuels Treatment Unit

Pre-Treatment Crown Fire Activity



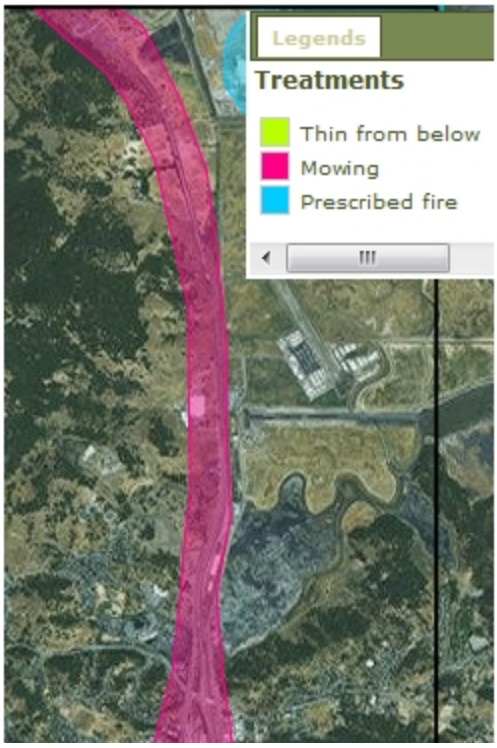
Post-Treatment Crown Fire Activity



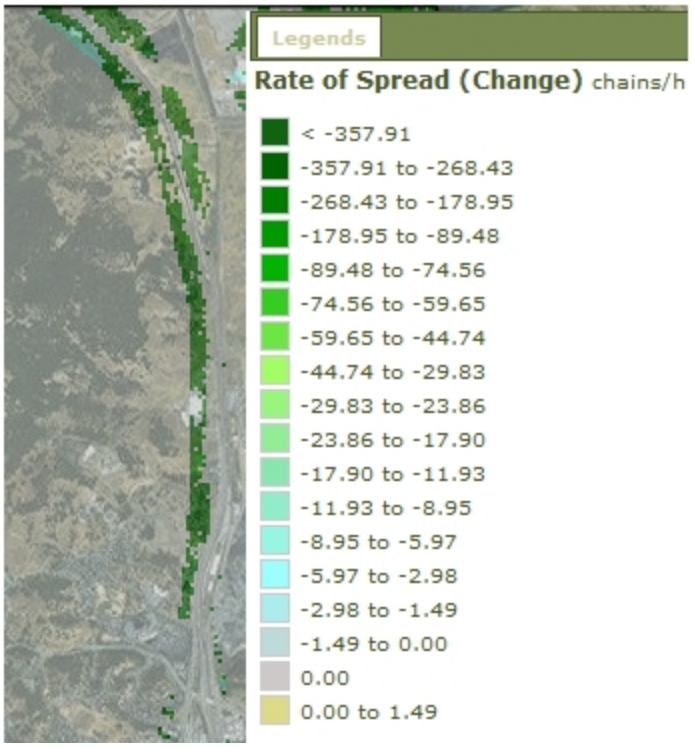
Mowing Effectiveness

The goal for the Mowing treatment was to reduce the potential rate of spread adjacent to Highway 101. Evaluating the **Differences Rate of Spread** layer, 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 Treatment Unit



Rate of Spread Change

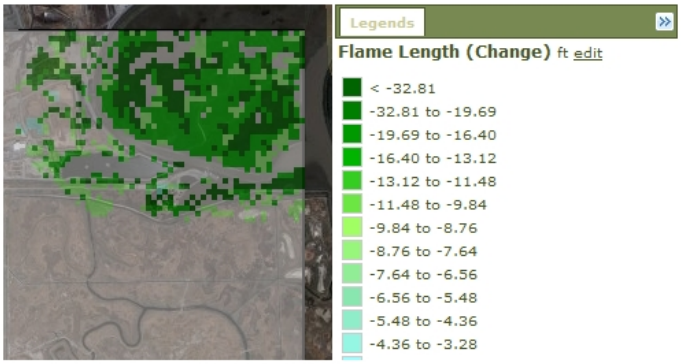


Prescribed Fire Effectiveness

The goal for the Prescribed Fire treatment was to reduce the potential flame lengths near the Marin County Airport. 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.

Rx Treatment Unit

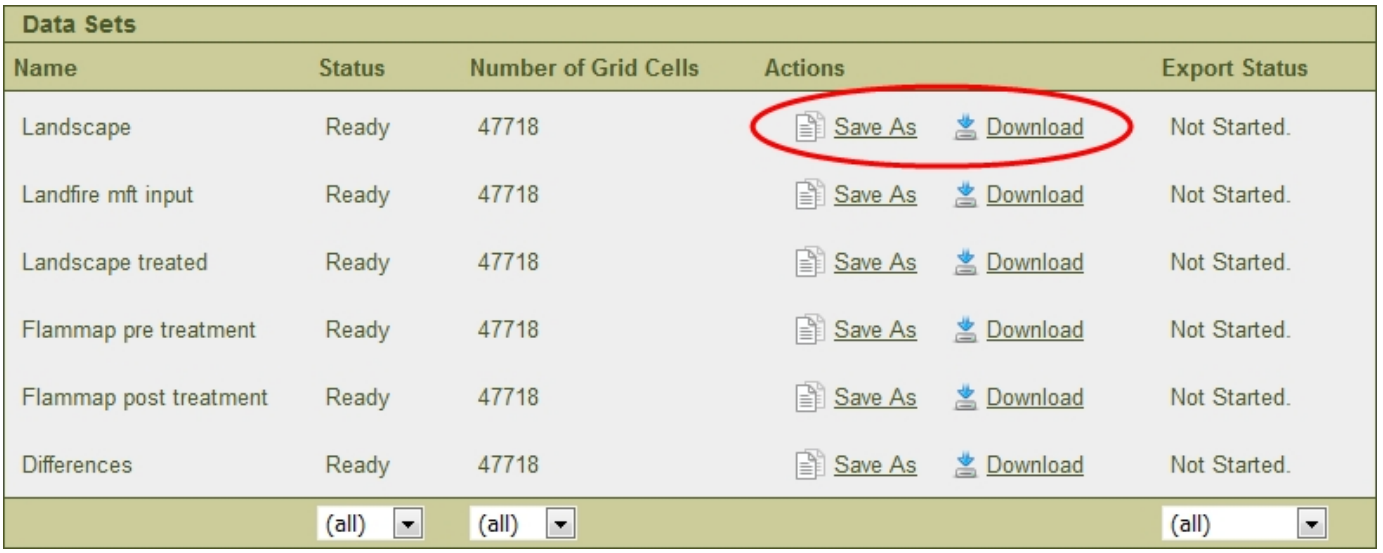
Rx Flame Length Change



To proceed to the **Run Summary** page, scroll down to the bottom of the page and click **Finish**

Next Steps

From the **Run Summary** page, you may scroll down to the Data Sets section, and have the option of either saving the run outputs in IFTDSS, or download them as shape files, raster files, or lcp files.



Data Sets

Name	Status	Number of Grid Cells	Actions	Export Status
Landscape	Ready	47718	Save As Download	Not Started.
Landfire mft input	Ready	47718	Save As Download	Not Started.
Landscape treated	Ready	47718	Save As Download	Not Started.
Flammap pre treatment	Ready	47718	Save As Download	Not Started.
Flammap post treatment	Ready	47718	Save As Download	Not Started.
Differences	Ready	47718	Save As Download	Not Started.
	(all)	(all)		(all)

Landscape Planning

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 may include:

- 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

- Manual treatment location (user-defined treatments) (IFT-FlamMap)
- Manual treatment location (user-defined treatments) (IFT-MTT)
- Manual treatment location (user-defined treatments) (IFT-RANDIG)
- Manual treatment location (user-defined treatments) (Worst Case FL - Risk)

Review & Wrap-up

In this tutorial we compared fire behavior outputs from pre and post fuel treatments. Topics covered included:

- Identifying key information and caveats
- Creating a project
- Acquiring LANDFIRE data in IFTDSS
- Creating a run focusing on fire behavior across a landscape using IFT-FlamMap
- Reviewing landscape data
- IFT-FlamMap Inputs
- Data review
- Identifying fuels treatment locations
- Creating fuels treatment polygons
- Edit fuel attributes within fuels treatment polygons
- Evaluating fuels treatment effectiveness
- Next steps

Additional Help

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

- Click the **Help** button.
- 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, prescribed burn planning, fuels treatment, spatial analysis across a landscape, and many more.