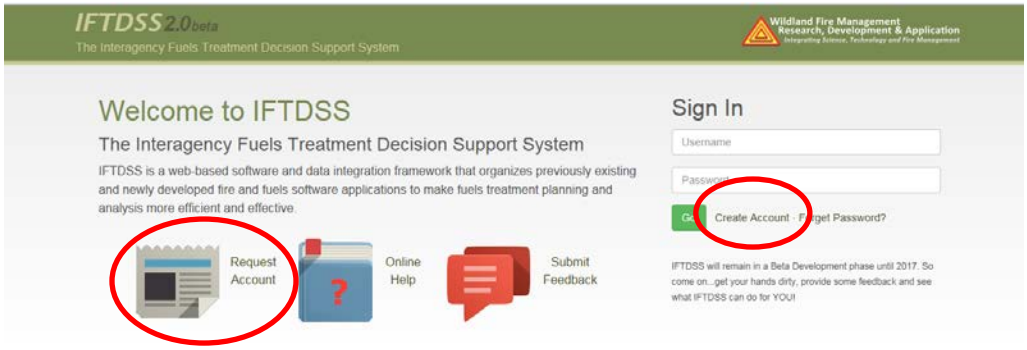
Objectives

Learn how to navigate the basic components of the IFTDSS user interface and get an account established for running project analyses.

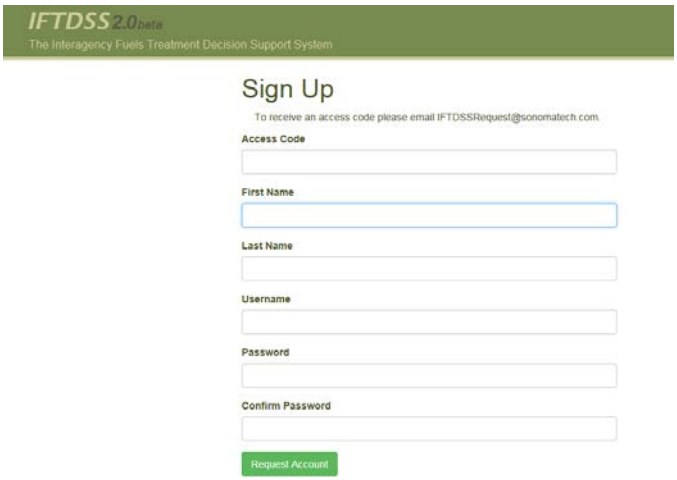
Overview

This is an instructor led tutorial that will walk you through creating an account, logging in, creating a user profile, creating a new project, establishing a project area, and acquiring and reviewing landscape data. These are basic steps required for all spatial modules within IFTDSS.

1. Navigate to http://iftdss.sonomatech.com/ and click on **Request Account** or **Create Account** on the main page.



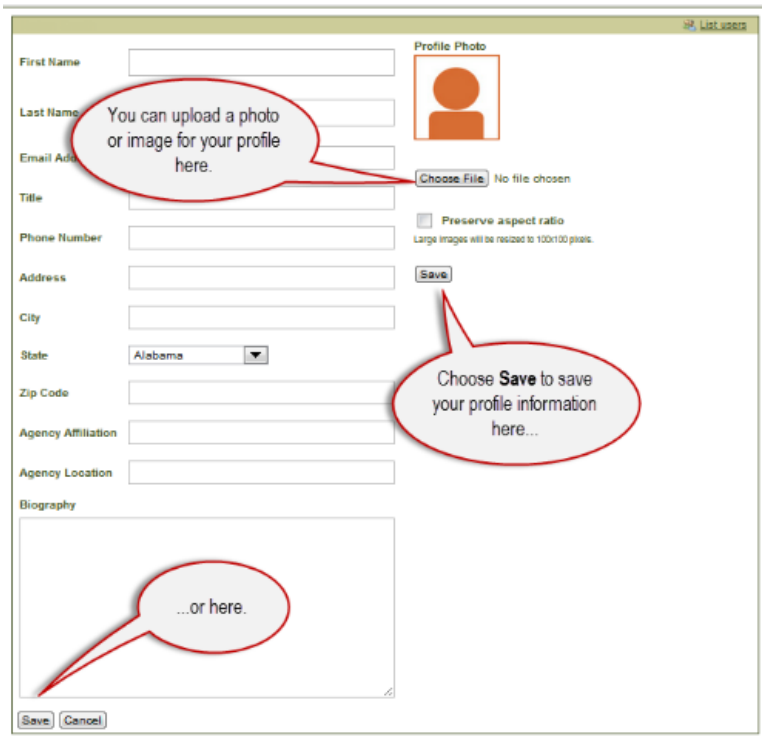
2. You are taken to the **Sign Up** page where you are to email IFTDSSRequest@sonomatech.com to request an access code. Once you receive an access code, enter a user name, password, and the access code. Click **Request Account.** You should now be able to log in to IFTDSS.



3. Now that you have created an account, navigate back to the IFTDSS home page, http://iftdss.sonomatech.com/ and sign in with your username and password. Click **GO**.

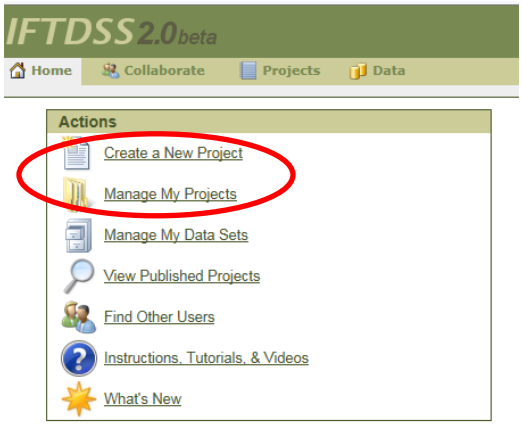
4. If this is your first time logging in to IFTDSS, you will have the option to **Create Your Profile** on the **Home** page**.** You can edit your profile information at any time using the **Edit** button on the **Home** page in the **My Profile** box.

Creating a profile allows others to identify you within the system and provides a mechanism for you to receive periodic IFTDSS related updates.



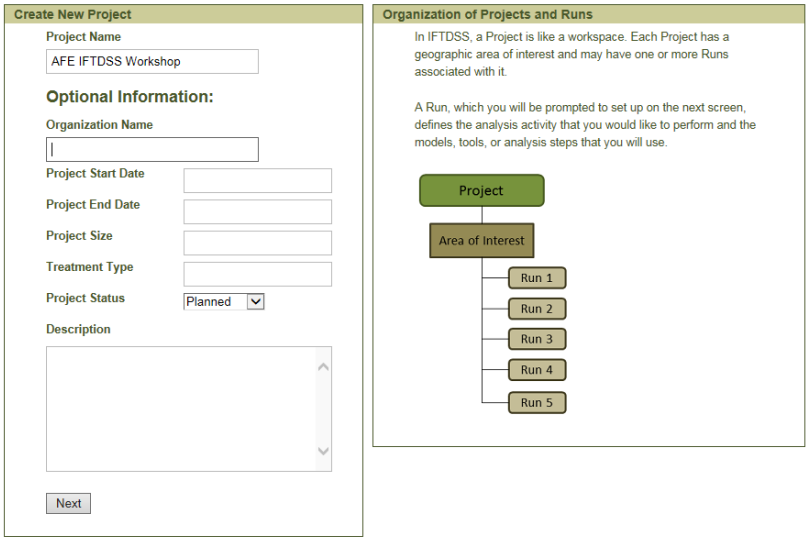
CHECK IN: At this point you should be on your Home page after having created an account, logged in, and created a user profile.

5. On the **Home** page, a menu of options is displayed on the left side of the screen and in the navigation tabs along the top. To begin, select **Create a New Project** in the **Actions** box.



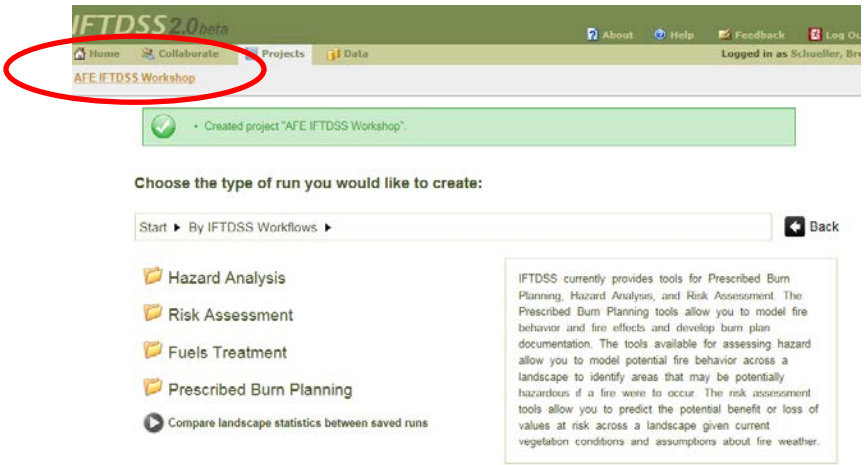
The tabs along the top provide access to general areas in IFTDSS and appear on every page.

6. On the **Create New Project** page, enter project details, including a descriptive project name. The project name is the only required field. You can use this project as the host for runs you will work through in the tutorials. Click **Next**, which saves the Project**.**



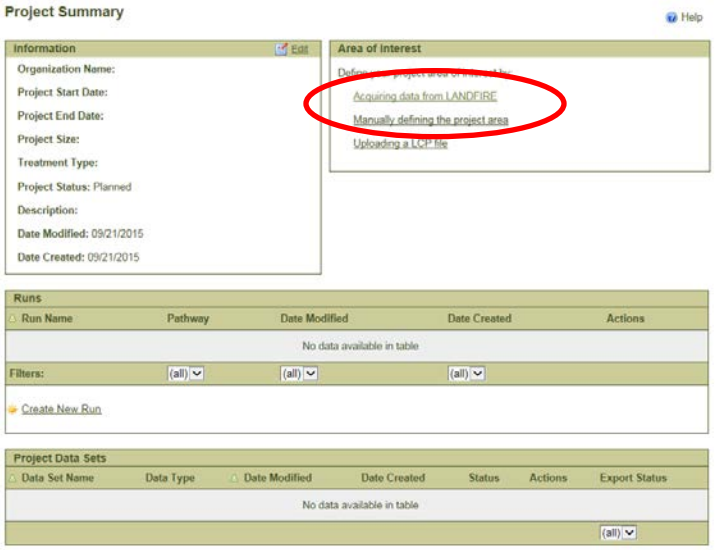
Think of your projects like workspaces. Each has a defined geographic area of interest and may have one or more runs associated with it.

7. When you clicked **Next**, your project was saved and you are taken to the **Choose the type of run you want to create** page. This is where you can choose an analysis activity for your project, BUT do not select anything now. Analyses will be covered in other tutorials. Instead, navigate to the **Project Summary** page to acquire and edit data by clicking on your project name in the upper left hand corner.

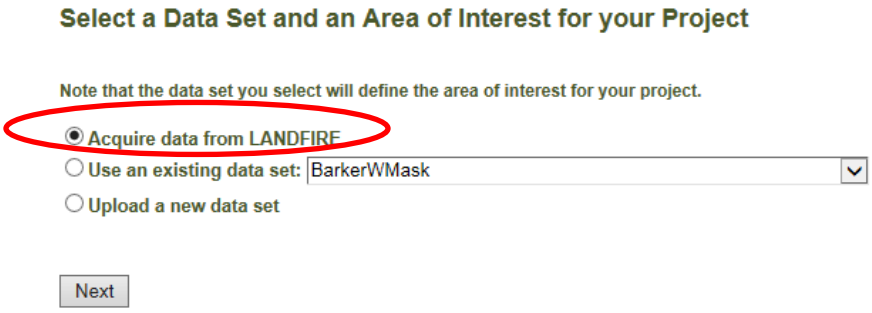


8. You are at the **Project Summary** page. This page displays information you entered when you created your project in the **Information** box, it lists runs associated with your project in the **Runs** box, and hosts data sets contained within your project in the **Project Data Sets** box. The **Area of Interest** box shows only links because we haven't defined an Area of Interest.

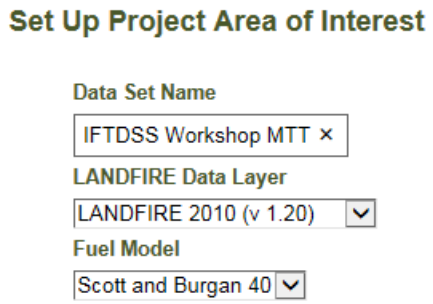
   Click on **Acquiring data from LANDFIRE** to begin the process of defining the Area of Interest and acquiring data for the project analysis.



9. The **Select a Data Set and an Area of Interest for your Project** page will appear. You can choose to acquire data from LANDFIRE, use and existing data set, or upload a new data set. For this exercise we will **Acquire data from LANDFIRE**. Click **Next**.



10. You will be at the **Set up Project Area of Interest** page. Name the data set in the **Data Set Name** box, select a LANDFIRE data layer in the **LANDFIRE Data Layer** box, and select a fuel model type in the **Fuel Model** box. For this example we will use LANDFIRE 2010 (v 1.20) and Scott and Burgan 40 for the fuel model type.

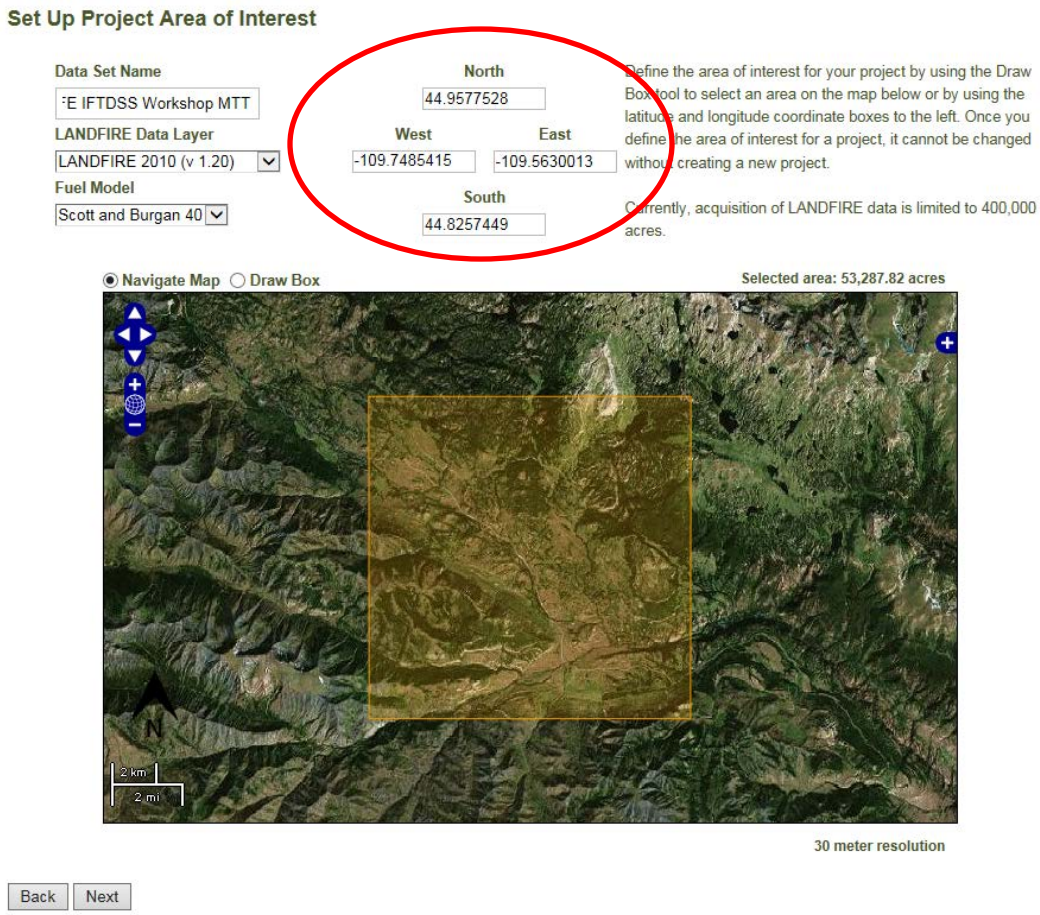


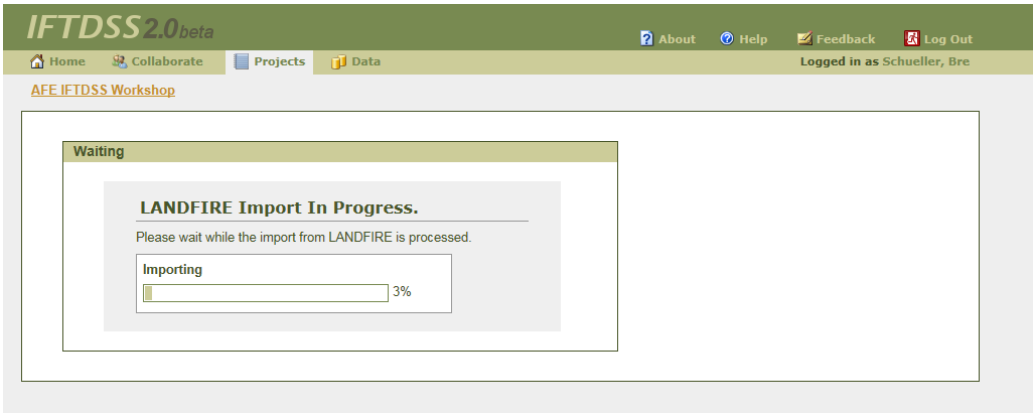
You can define the area of interest for your project by using the **Draw Box** to select an area on the map or by using the latitude and longitude coordinate boxes. Explore the **Navigate Map** (activates map tools) and **Draw Box** radio buttons. Practice drawing your Area of Interest using the **Draw Box** radio button. Place the cursor at the top left hand corner of the desired area, click and hold the left mouse button, and drag the box to the lower right hand corner of the desired area and release. If a mistake is made, reposition the cursor and repeat.

NOTE:

- **Acquisition of LANDFIRE data is limited to 400,000 acres within IFTDSS. Check the acreage of your desired area of interest by looking at the "Selected area" acres located above the upper right hand corner of the map view.**
- **The Area of Interest is final and cannot be changed once the "Next" button is clicked or if you "enter" the fourth coordinate when using lat/long values. To change it, you must create a new Project.**

When you feel comfortable with the map navigation and draw box functions, enter the latitude and longitude values shown below, which can be used if you plan on working through the IFT-MTT tutorial later or define your own Area of Interest. Click **Next**; you will see the LANDFIRE import box.

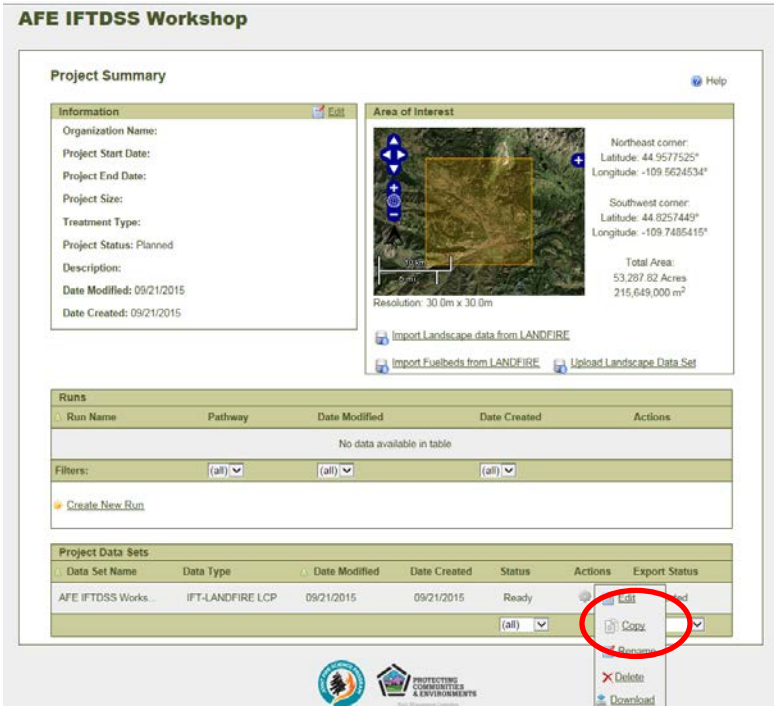




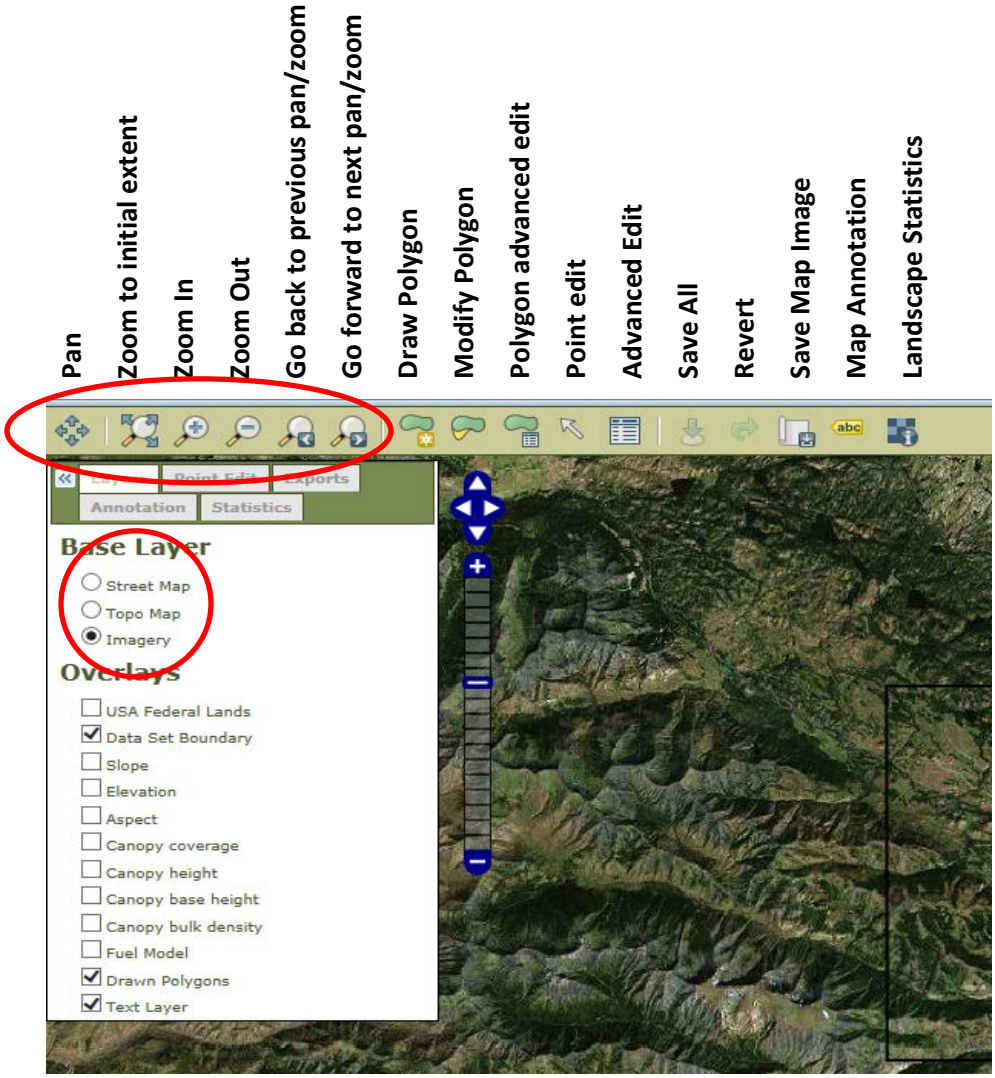
11. Once LANDFIRE data is acquired and the Area of Interest is defined, you are returned to the **Project Summary** page where you can **Edit, Copy, Rename, Delete**, or **Download** the LANDFIRE Data Set. You could also Create a New Run from here, but that will be covered in analysis tutorials.

CHECK IN: At this point you should be looking at the Data Studio view after creating a new project, defining an area of interest, acquiring LANDFIRE data, and started editing your LANDFIRE dataset.

We will edit the LANDFIRE Data Set and get familiar with the IFTDSS mapping interface and tools. Click on the cog under **Actions** in the **Project Data Sets** box and select **Edit**.



12. You can review and edit your spatial landscape data using the **Data Studio** map view. Here is a snapshot of the tools available for manipulating the map and editing spatial data.



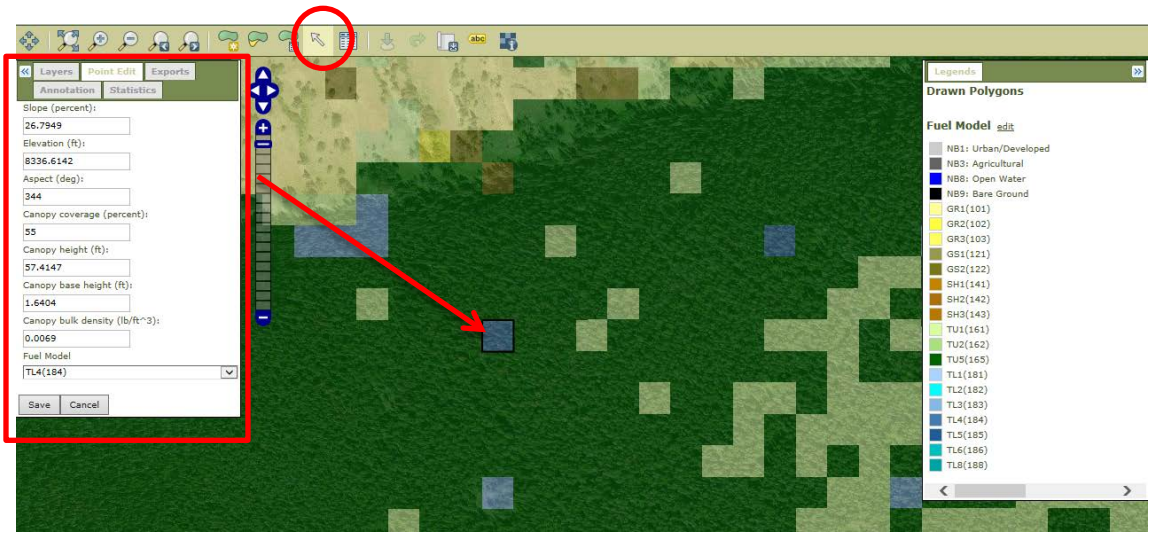
Explore using the **Pan** and **Zoom** tools as well as toggling through the **Base Layer** options of **Street Map, Topo Map**, and **Imagery**.

Toggle through the **Overlays** options to view the data layers acquired from LANDFIRE. Below you can see the area of interest with Fuel Model data displayed.

Legend items will auto populate as Overlays are checked on and off.

13. You may need to edit the acquired spatial data if vegetation was modified since the date of the LANDFIRE dataset. Use the **Point Edit** tool and edit one grid cell at a time or the **Advanced Edit** tool to edit multiple cells at once.

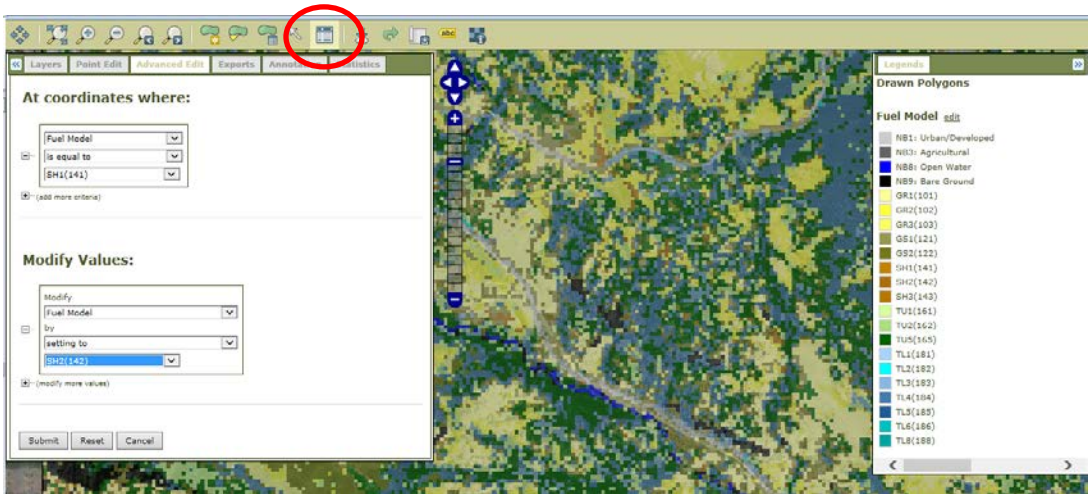
    Turn on your **Fuel Model** layer in your **Overlays** list. Zoom into an area close enough that you can see individual grid cells. To edit one cell at a time, click on the **Point Edit** tool on the toolbar and click on the grid cell you would like to edit. The grid cell should be highlighted in black and the **Point Edit** panel appears. Edit the grid cell by using the Fuel Model drop down box to change to a different fuel model and click **Save**.



To edit multiple cells at once choose 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

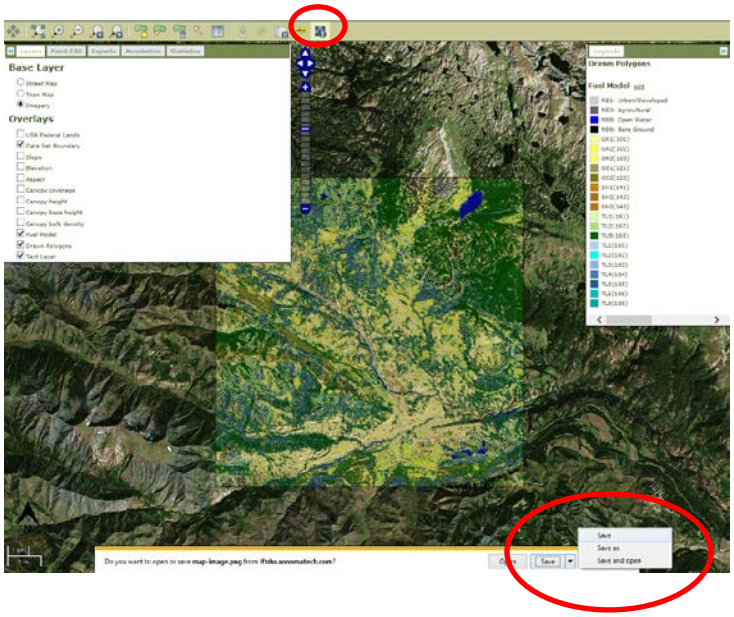
multiple cells can be changed at once. For this landscape we will change all SH1 (141) to SH2 (142). Under **At coordinates where**, set Fuel Model equal to SH1 (141) and under **Modify Values**, set Fuel Model to SH2 (142). Click **Submit**. This will change all SH1 to SH2 across the area of interest.

Advanced editing can occur exclusively within a user created or uploaded polygon using the **Polygon-based Advanced Edit** tool.



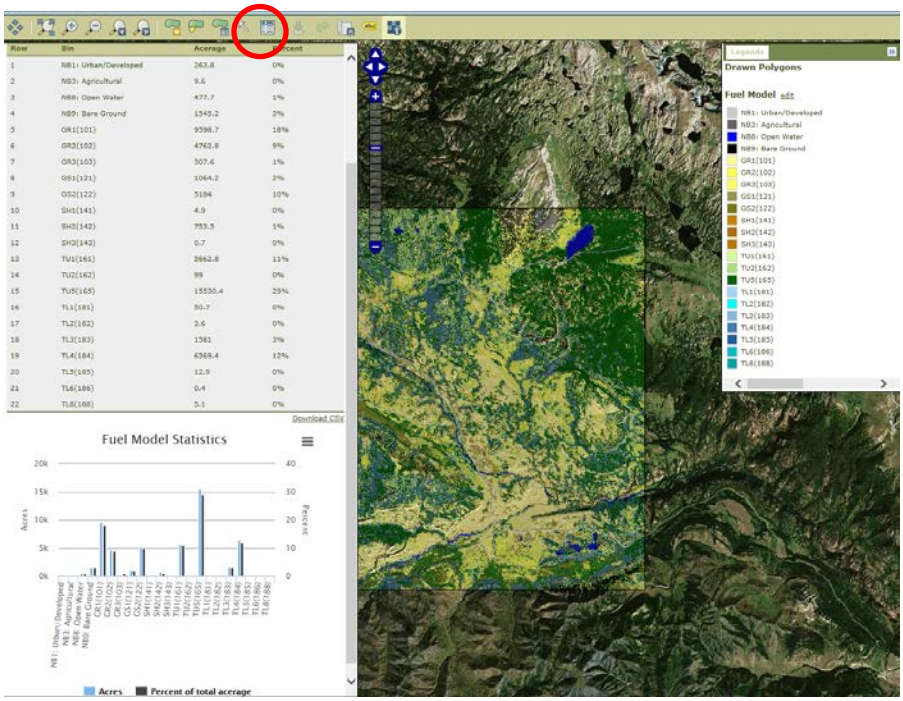
HINT: Always take time to review your landscape after editing to ensure your modifications were made as intended.

14. You can save an image of your map and legend as a PNG file by clicking the **Save Map Image** icon (this is not just a screen capture).



15. Evaluate landscape statistics for your acquired dataset by choosing the **Landscape Statistics** tool. The **Statistics** tab activates when you click on the **Landscape Statistics** tool. Choose Fuel Model in the **Select Parameters** box and select **Go**.

Landscape Statistics can be calculated exclusively for a polygon* created or uploaded by the user using the **Select Polygon** drop down in the **Statistics** tab.



The **Polygon and **Annotation** tools are covered in other self-led tutorials*

Review landscape statistics in tabular and graphic formats. Statistics can be downloaded for further analysis by clicking Download CSV in the upper right corner of the Statistics Chart. Exit the pop-up by clicking the X in the upper right corner. If you didn't save edits, you are prompted to do so.

CHECK IN: At this point you should be comfortable using pan and zoom tools on the map view, and explored the different base layers offered in the IFTDSS map interface. Additionally, you practiced editing spatial data acquired from LANDFIRE using the point edit and advanced editing tools. Lastly, you learned how to create a snapshot image of the map view for additional reporting and calculated landscape statistics for the area of interest.

<u>In this tutorial you:</u>

1) Created an IFTDSS account
2) Logged in to IFTDSS
3) Created a user profile
4) Created a new project
5) Established a project area of interest
6) Acquired LANDFIRE data
7) Reviewed and edited landscape data
8) Calculated landscape statistics

Objectives

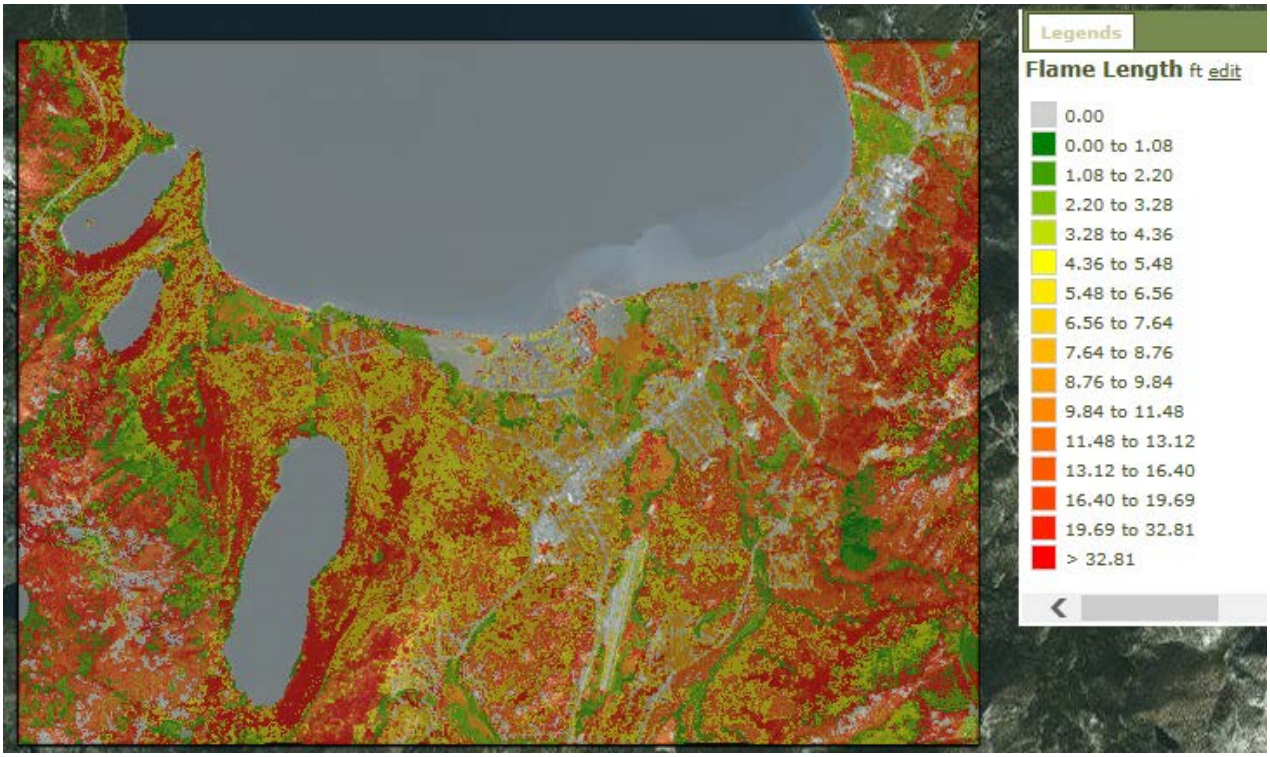
FlamMap calculates fire behavior outputs over an entire landscape using constant wind and fuel moisture. There is no contagion or "spread" among pixels; fire behavior is calculated independently on each one to produce a grid of potential fire behavior. In this tutorial, users will develop basic skills to perform a landscape-scale hazard analysis using IFT-FlamMap to identify high potential fire hazard across a landscape.

Overview

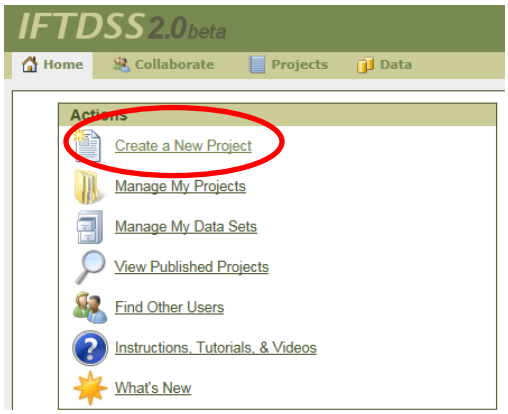
- Set up a project and acquire LANDFIRE data
- Create a run focused on fire behavior across a landscape
- Establish environmental parameters for IFT-FlamMap
- Review and edit LANDFIRE spatial data and assess fire behavior outputs
- Evaluate results and identify potential fire hazards across a landscape

Module Output Summary

Basic Fire Behavior: Flame length, rate of spread**,** fireline intensity**,** and crown fire activity outputs are similar to the outputs from other fire behavior models and are useful for assessing the type of fire behavior that can be expected at a particular point or area on the landscape.

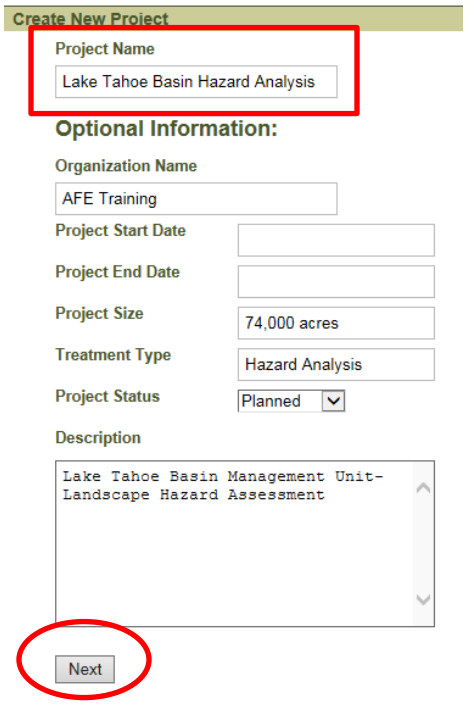


1. Navigate to http://iftdss.sonomatech.com/ and log in to IFTDSS. Choose **Create a New Project**.



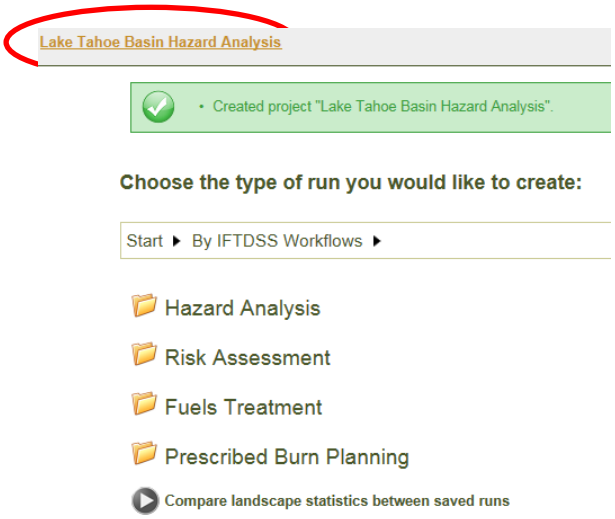
The tabs along the top provide access to general areas within IFTDSS and appear on every page within the interface.

2. On the **Create New Project** page, name your project in the **Project Name** box and populate **Optional Information** if desired. Choose **Next**.



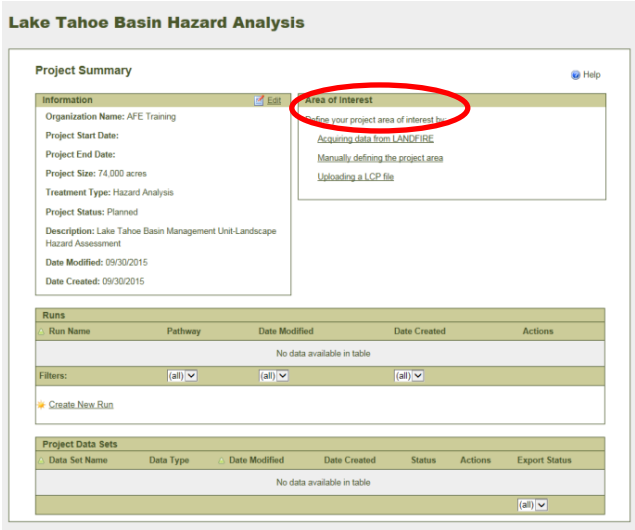
NOTE: You can think of your projects like workspaces. Each will have a defined geographic area of interest and may have one or more runs associated with it.

3. When you clicked **Next**, your project was saved and you are taken to the **Choose the type of run you want to create** page. This is where you can choose an analysis activity for your project, BUT do not select anything now. Analyses will be covered in other tutorials. Instead, navigate to the **Project Summary** page to acquire and edit data by clicking on your project name in the upper left hand corner.

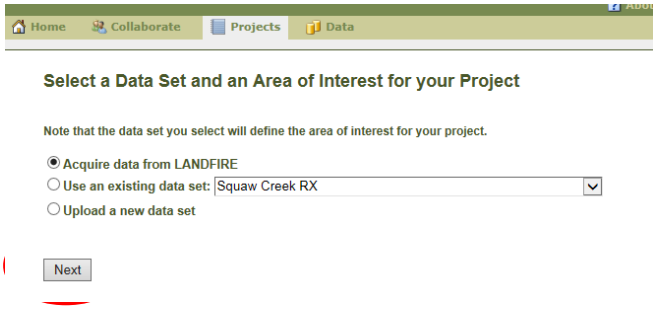


4. You are at the **Project Summary** page. This page displays information you entered when you created your project in the **Information** box, it lists runs associated with your project in the **Runs** box, and hosts data sets contained within your project in the **Project Data Sets** box. The **Area of Interest** box shows only links because we haven't defined an Area of Interest.

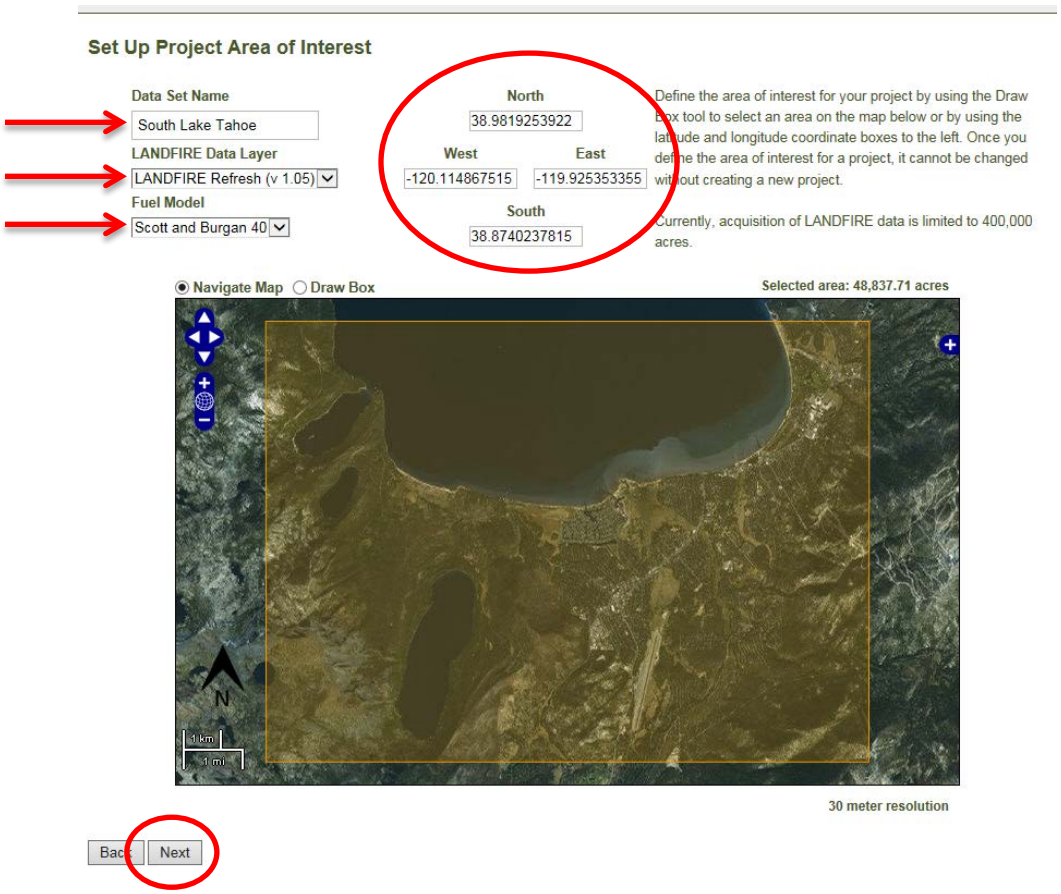
   Click on **Acquiring data from LANDFIRE** to begin the process of defining the Area of Interest and acquiring data for the project analysis.



5. The **Select a Data Set and an Area of Interest for your Project** page will appear. You can choose to acquire data from LANDFIRE, use and existing data set, or upload a new data set. For this exercise we will **Acquire data from LANDFIRE**. Click **Next**.



6. You will be at the **Set up Project Area of Interest** page. Name the data set in the **Data Set Name** box, select a LANDFIRE data layer in the **LANDFIRE Data Layer** box, and select a fuel model type in the **Fuel Model** box. For this example we will use LANDFIRE Refresh (v 1.05) and Scott and Burgan 40 for the fuel model type.



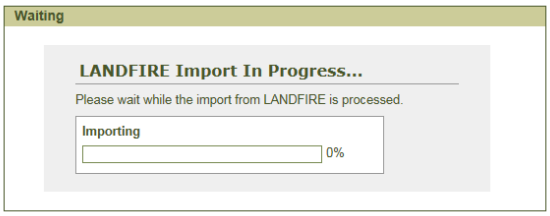
NOTE:

- **Acquisition of LANDFIRE data is limited to 400,000 acres within IFTDSS. Check the acreage of your desired area of interest by looking at the "Selected area" acres located above the upper right hand corner of the map view.**
- **The Area of Interest is final and cannot be changed once the "Next" button is clicked or if you "enter" the fourth coordinate when using lat/long values. To change it, you must create a new Project.**

You can define the area of interest by using the **Draw Box** to select an area on the map or by using the latitude and longitude boxes. For this exercise we will enter the coordinates that define the Area of Interest:

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

The **Waiting** page will appear as your LANDFIRE data is being acquired.



CHECK IN: At this point you have created a new project, defined your project area of interest, acquired LANDFIRE data, and are on the Project Summary page ready to Create a New Run.

7. Once your LANDFIRE data is acquired and your Area of Interest defined, you are returned to the **Project Summary** page where you can either **Create a New Run** or you can **Edit, Copy, Rename, Delete**, or **Download** your new LANDFIRE Data Set. Choose **Create New Run**.

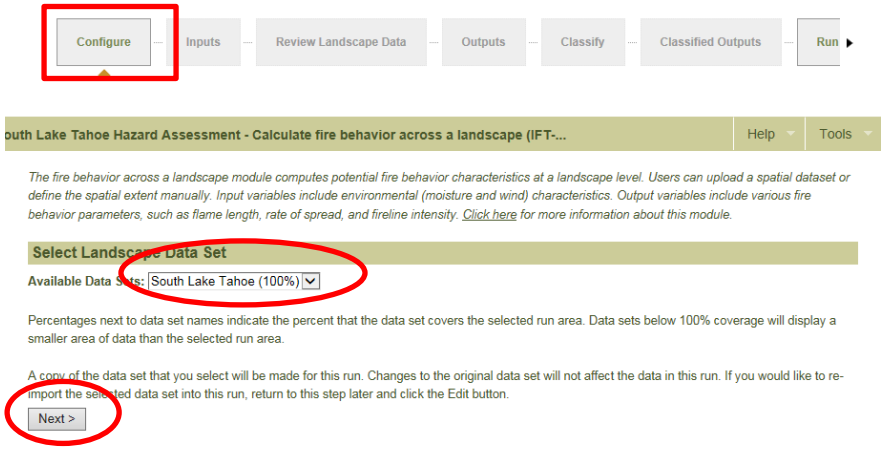
8. You are now back on the **Choose the type of run you would like to create** page. Select the **Hazard Analysis** Workflow> **Fire Behavior** tools> **Calculate fire behavior across a landscape (IFT-FlamMap)**.

9. Name your Run Area on the **Create New Run** page using a unique name in the **Run Name** box. For this example, use the entire project area as your run area. Click **Next**.

HINT: A run defines the activity you would like to perform and the modules or workflows you will use as part of a run. Selecting the entire project area boundary for your run area is useful if you want to model fire behavior across a landscape.

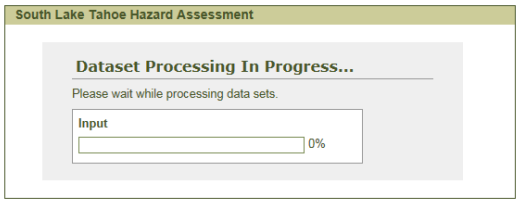
10. You should see the **Calculate fire behavior across a landscape (IFT-FlamMap)** workflow. Along the top of the page you will see workflow boxes which will help you walk through the module in a sequential manner. The first step in this workflow is to **Configure** your run.

    The **Select Landscape Data Set** drop down allows you to select the existing project LANDFIRE data set you created when you defined your project area of interest (see below) or you may be able to select subsets of that dataset created when the run area was defined. We did not define a unique run area for this project, so use the **Available Data Sets** drop down to ensure your project area dataset (100%) is selected and click **Next**.



Workflow boxes at the top of the page help you understand where you are within the module, and allow easy navigation back to previous steps.

The **Dataset Processing** box will appear.



11. At the **Inputs** step in the workflow, fields are pre-populated with default values.

    Select the appropriate crown fire method under **Properties** in the **Crown Fire Calculation Method** box. For this exercise choose the **Finney** Crown Fire Method. Finney is the recommended crown fire calculation method when using LANDFIRE 2008 (v1.10) or LANDFIRE Refresh (v1.05).

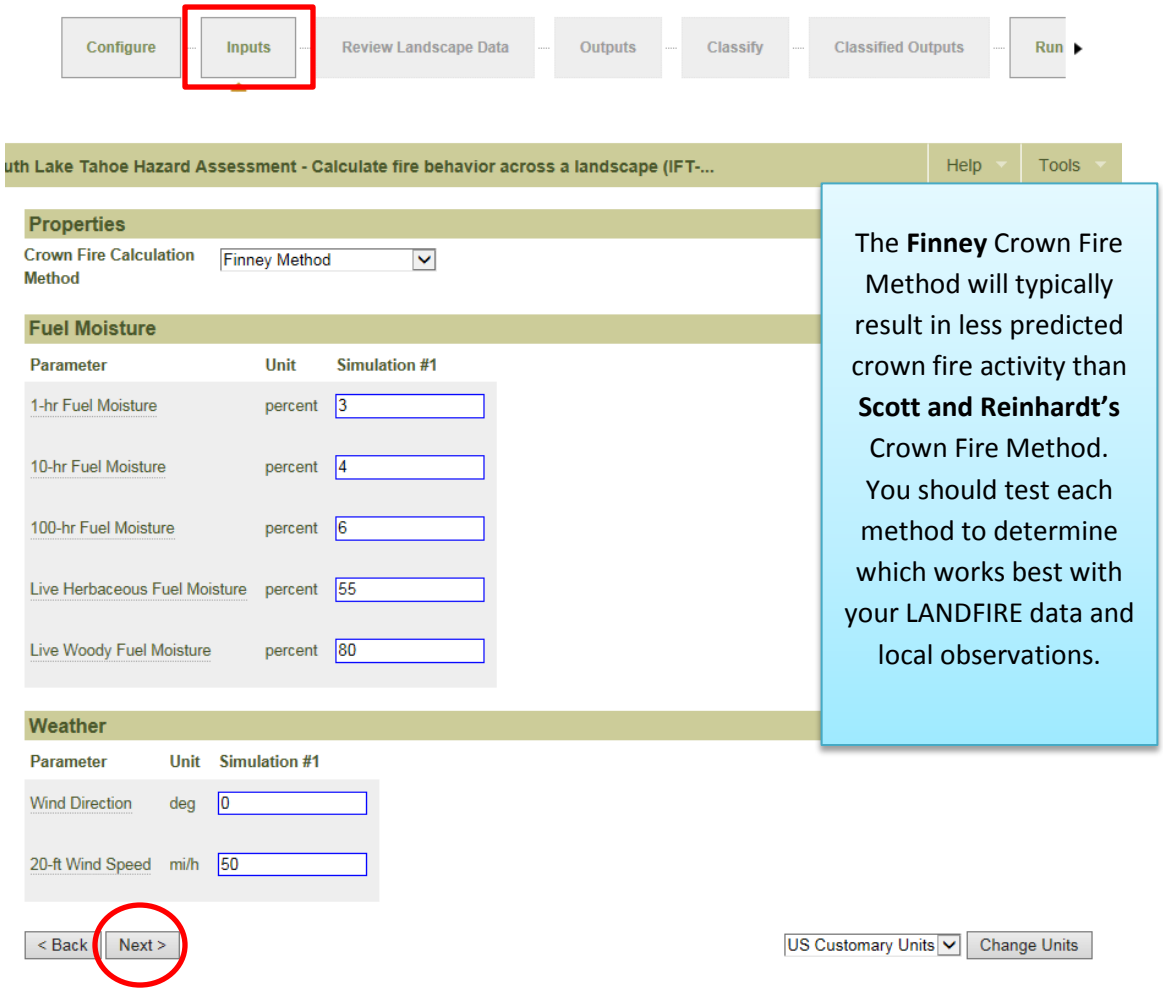
    Enter custom fuel moistures and weather to represent red flag conditions that occur in this region. Red flag warning conditions often include low fuel moisture and relative humidity, high/erratic winds, and lightning activity.

NOTE:

- **The conditions you establish for your wildfire can be determined in a number of ways. You can use Fire Family Plus to determine percentile weather or you may choose to use red-flag conditions for your area. It will all depend on the purpose of your analysis.**

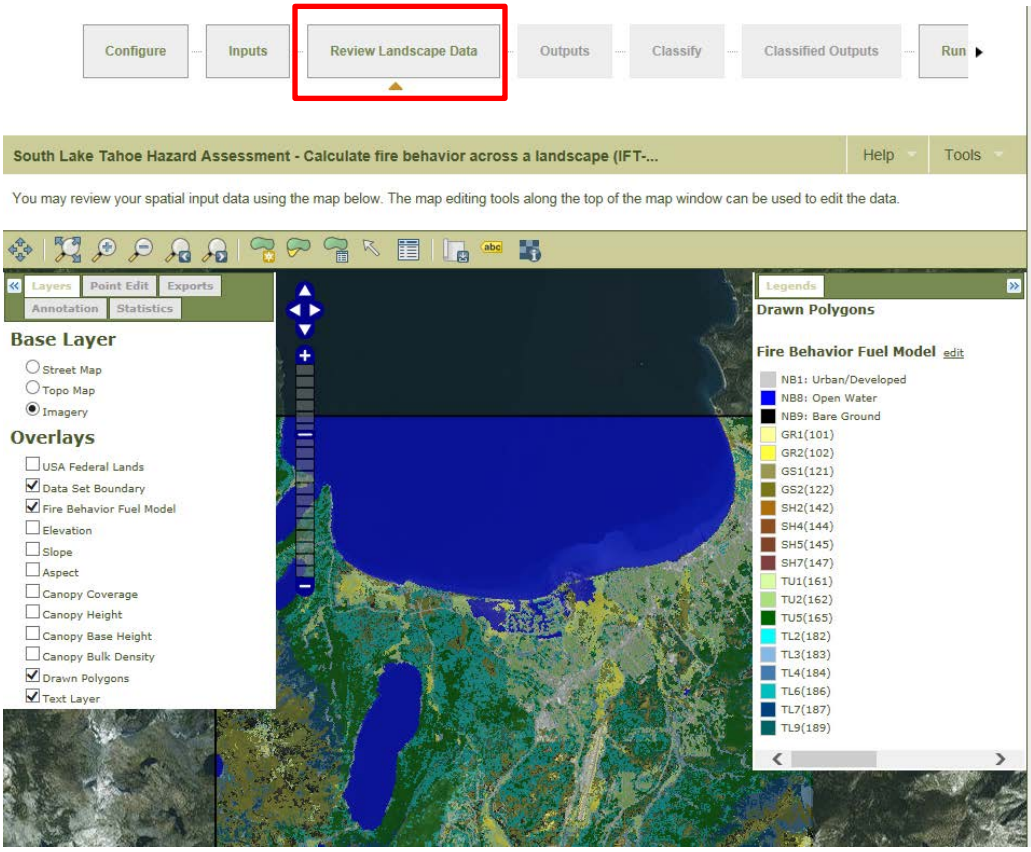
TIPS on IFT-FlamMap Inputs:

- **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, high, and extreme fire behaviors. The results will help you understand how the inputs are affecting your specific area of interest.**

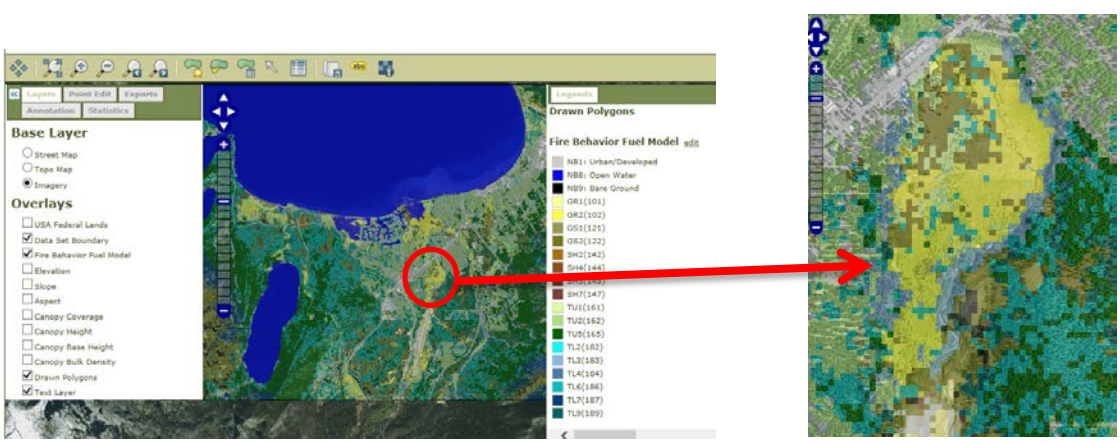


Click **Next** to review your acquired landscape data.

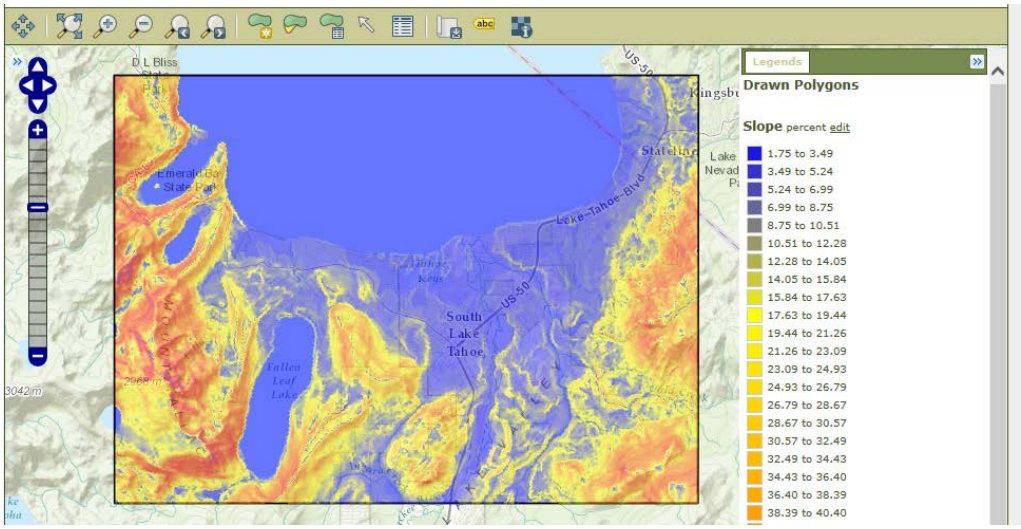
12. You can review and edit your acquired landscape data on the **Review Landscape Data** step in the workflow (see below). Assess the different LANDFIRE data layers within your area of interest. Set different base layers (imagery, topography, or street maps) as the background to help you determine potential modifications to the landscape data.

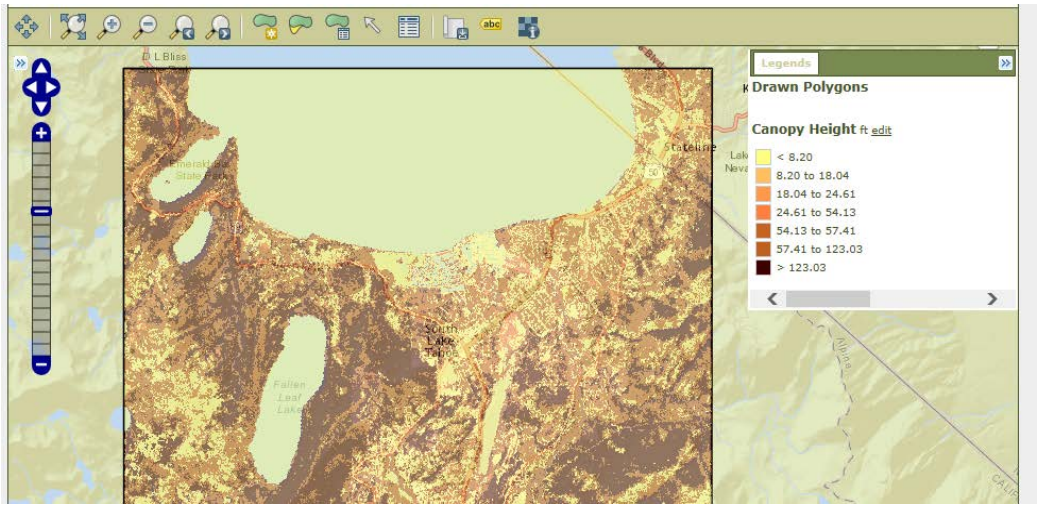


The area shown below is dominated by three different fuel models: GR2(102) Low load/dry climate grass, TU5(165) Very high load, dry climate timber-shrub, and NB1 Urban/Developed.



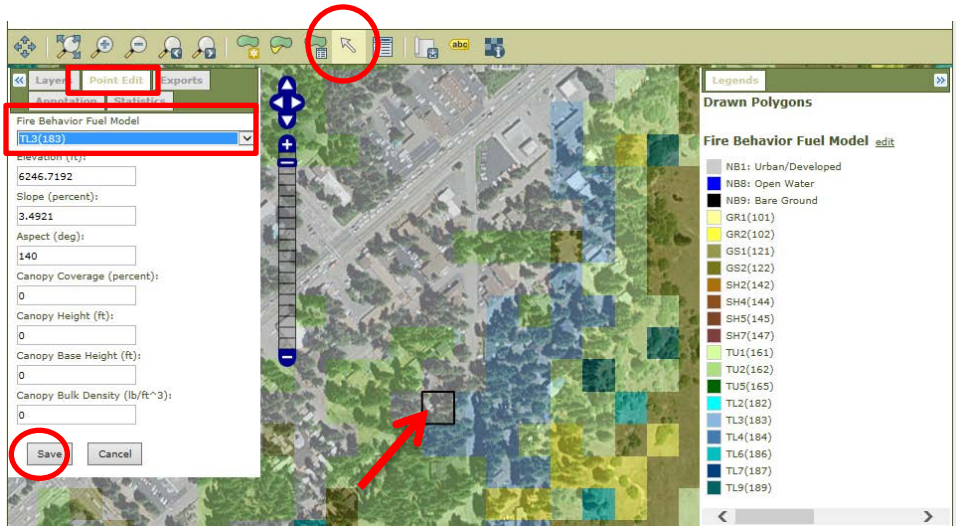
These images demonstrate viewing the slope dataset over the topography base layer and the canopy height dataset over the street view. Exploring data this way helps determine if LANDFIRE represents the area of interest as expected.



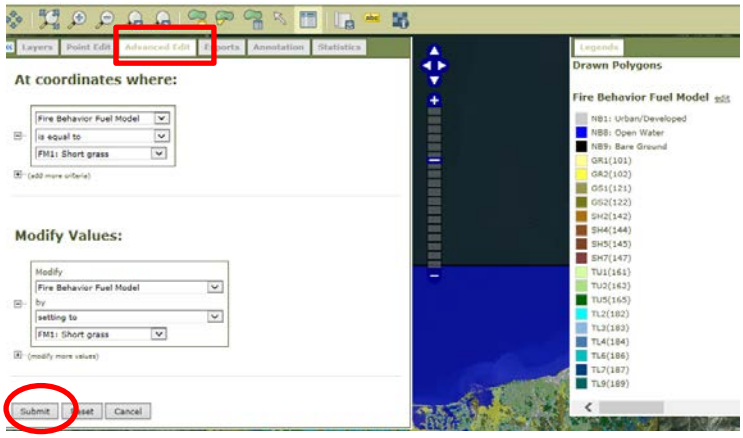


13. You should have gathered enough information from your review to begin editing the landscape data. You will use the **Point Edit** and **Advanced Edit** tools to make modifications to your landscape data.

    Zoom in to the GR2, TU5, NB area that we looked at in Step 12. Turn on the **Fire Behavior Fuel Model** layer. You will see that there are a few pixels set to NB1 that should be represented by a burnable fuel model. Use the **Point Edit** tool to highlight these pixels and set them to FM TL3 as demonstrated below in the Point Edit panel. Use the **Fire Behavior Fuel Model** drop down to select the new fuel model and click **Save**. Practice using the **Point Edit** tool to modify a few more pixels.



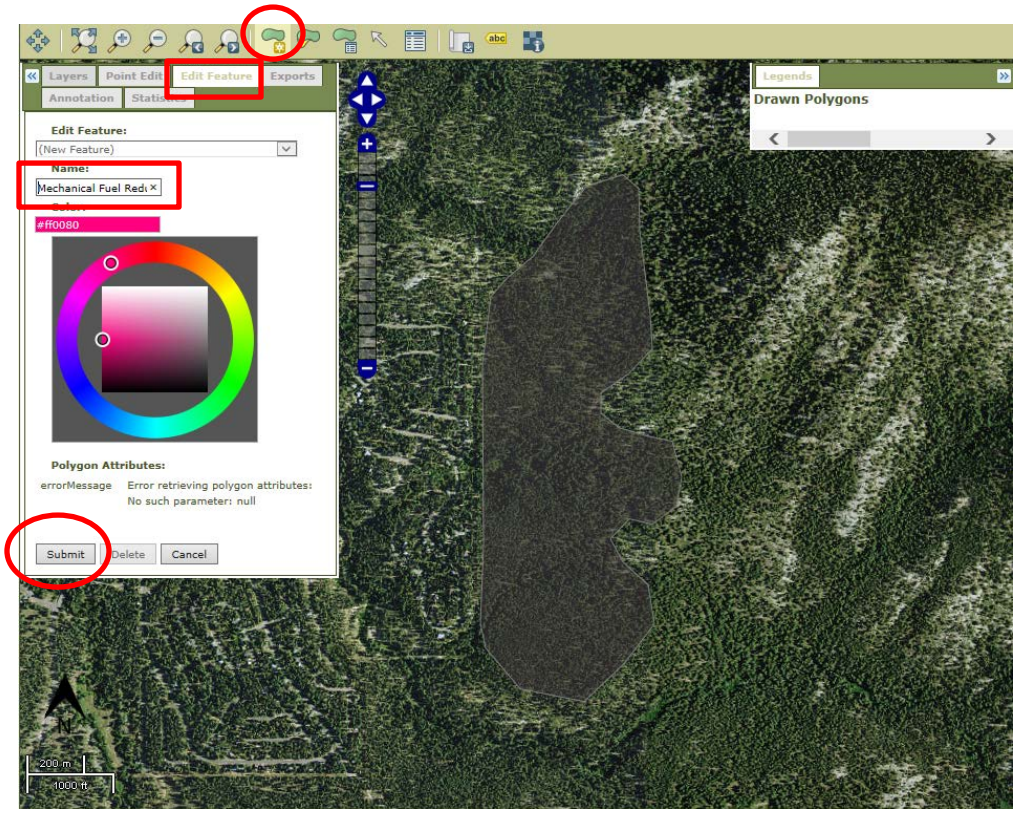
Practice landscape editing using the **Advanced Edit** tool to edit multiple cells at once. Make any advanced edits of your choosing. Select the **Advanced Edit** tool and use the **Advanced Edit Panel** to modify spatial data in query form to change multiple cells at once. Choose **Submit** when finished.



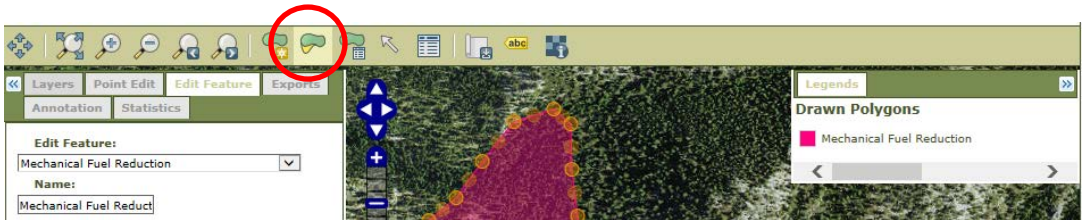
You can use the **Polygon Based Advanced Edit** tool to edit features within an imported or drawn polygon. Create a polygon (since we have not imported pre-existing polygon) by selecting the **Draw Polygon** tool. Zoom in to an area of your choosing to create a polygon that will represent a recently completed mechanical fuel reduction unit.

To draw a polygon using the point-and-click method, select the **Draw Polygon** tool. Click on the map and release the map button. Move the mouse to a new point and click and release again to add another point. Continue this process until you have completed drawing your polygon. Double click to create the polygon and open the **Edit Feature** panel on the left.

Name your fuel treatment in the **Name** box, adjust the color , and click **Submit**.

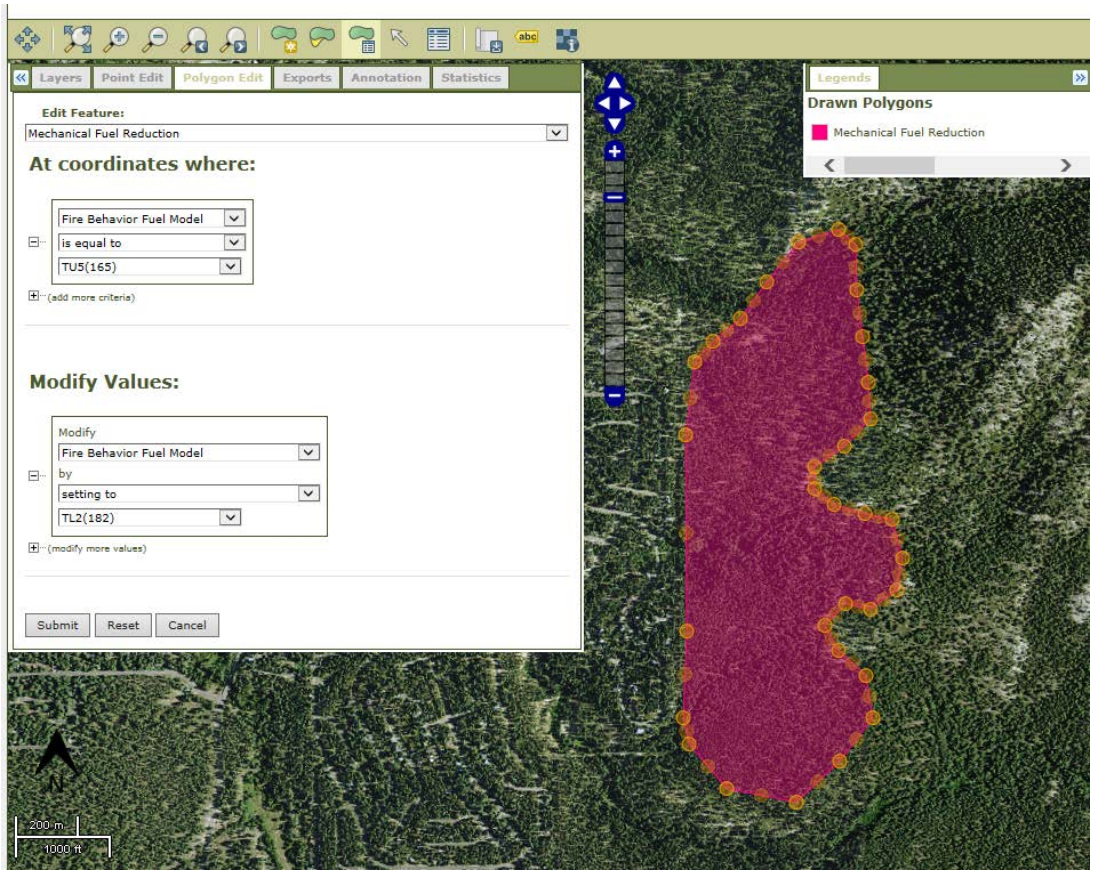


You can edit or delete your polygon with the **Modify Polygon** tool.

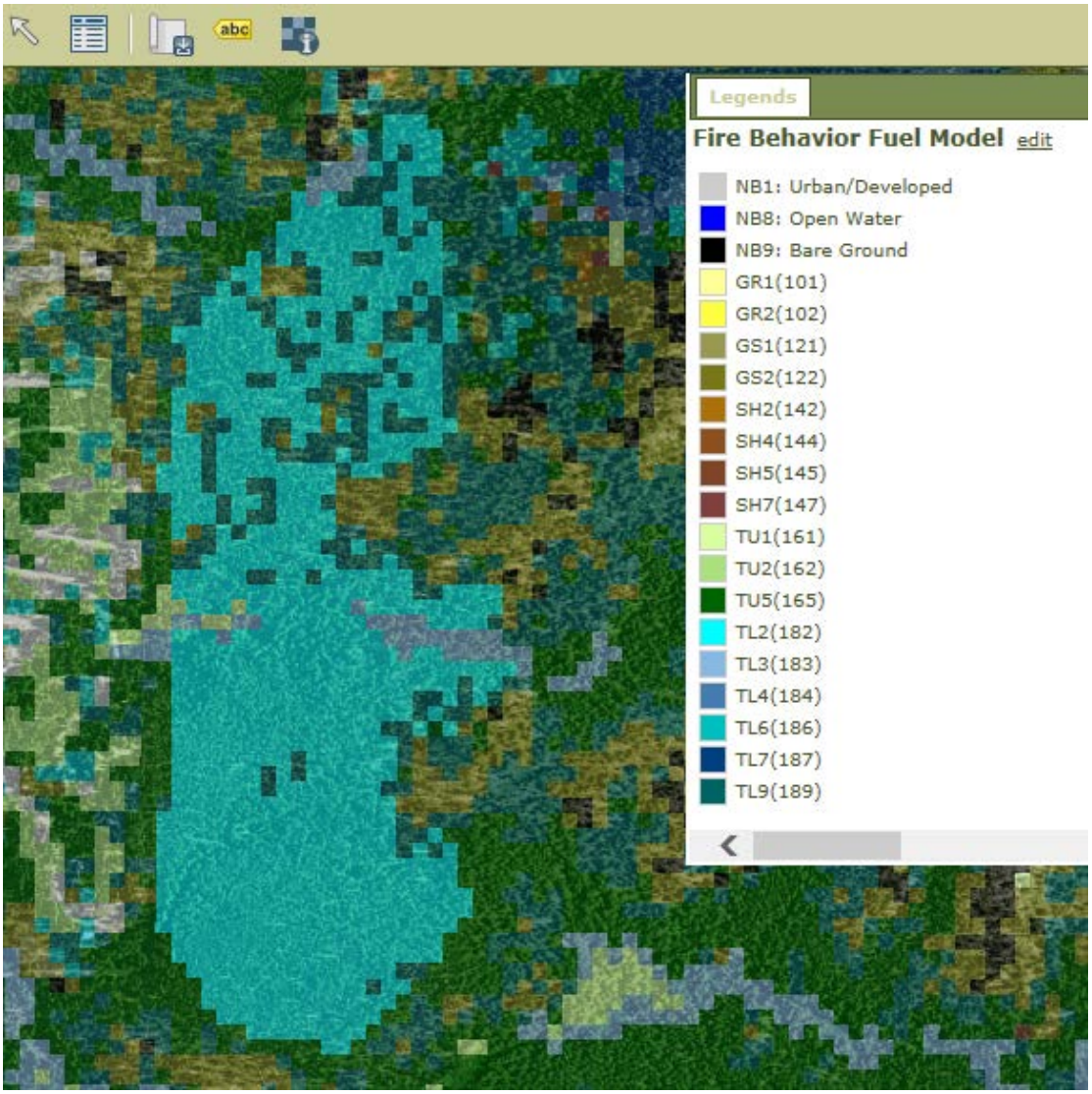


Manually edit the landscape (LANDFIRE) data in the polygon to reflect treated fuels to represent a mechanical fuel reduction treatment. Be sure that "Drawn Polygons" is turned on in the list of **Layers**> **Overlays**. Select the **Polygon Advanced Edit** tool and click on the treatment polygon you just created to open the **Edit Feature** panel in the **Polygon Edit** tab.

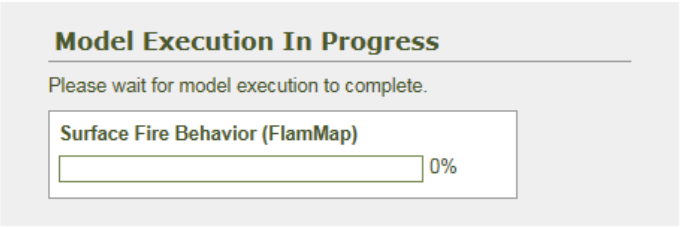
Be sure that your polygon name is showing in the **Edit Features** box and change your landscape features appropriately for the area you chose.



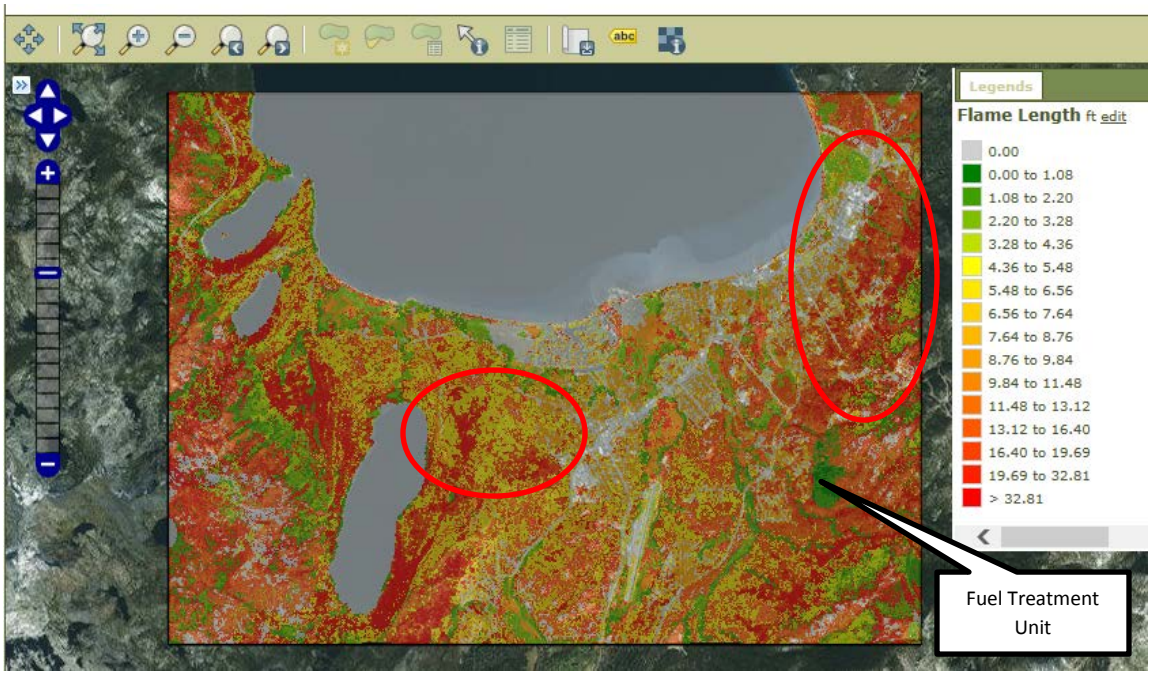
In this example, all pixels represented by fuel model TU5(165), very high load, dry climate timber-shrub, were modified to TL2(182), low load litter, to represent a post mechanical fuel reduction treatment where the most of the ladder and fine surface fuels were removed. When landscape modifications are completed, click **Submit**.



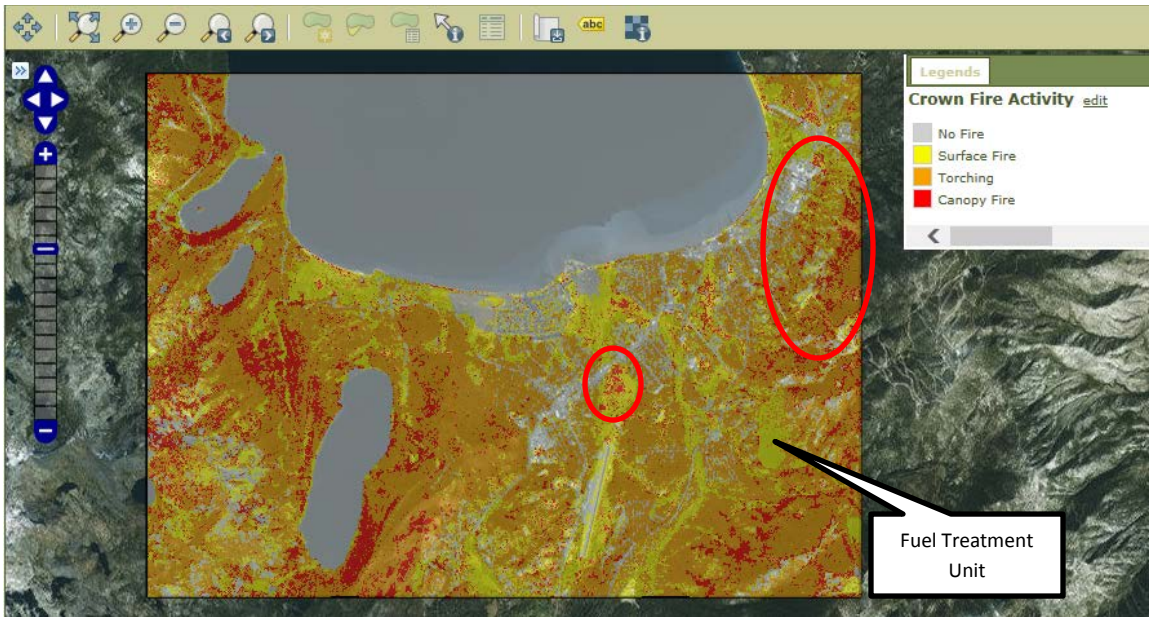
Always take time to review your landscape to ensure landscape edits were made correctly and display as you intended. When this is complete, choose **Next** and wait while IFT-FlamMap runs.



14. Review your outputs on the **Outputs** step within the workflow. Toggle fire behavior outputs on/off to assess flame length, rate of spread, and crown fire.



High fire hazard areas can be identified across a landscape using the modeled fire behavior outputs. In this analysis, we are primarily interested in fire hazards within the wildland urban interface as identified on the map above (Flame Lengths) and below (Crown Fire Activity).



- Fire behavior values are calculated independently for each pixel with respect to the surrounding pixels in the landscape output file—fire does not "spread" between them.
- Fire behavior in adjacent locations, roads, or hazardous fuel types in proximity to the area under assessment do not affect the fire behavior of other pixels, or point location, being assessed.

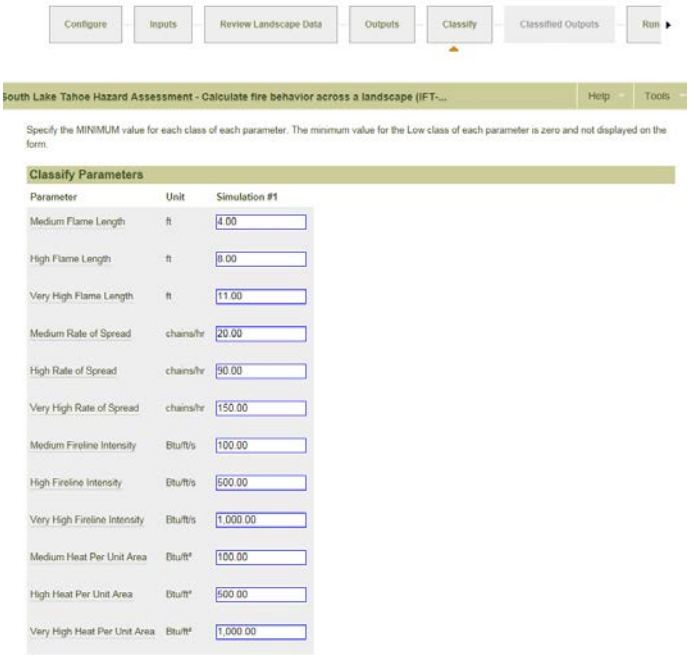
Review the fire behavior outputs and identify high fire hazard areas on the map. Find your fuel treatment area. Was fire behavior modified in the treatment?

Note: After reviewing the landscape and outputs, you may determine that additional LANDFIRE editing is required. You can make a copy of your run, edit the landscape data and rerun the module to assess differences.

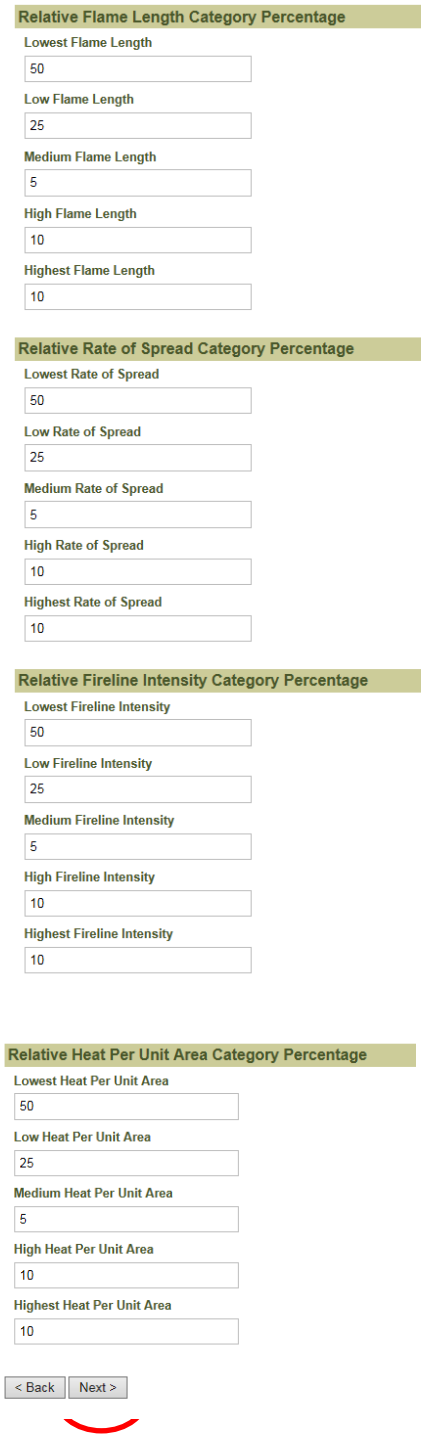
When you are finished with your review, click **Next**.

15. On the **Classify** page, group, or classify, outputs into more meaningful bins for analysis and display. Default flame length bins use the Fire Characteristics Chart breakpoints (commonly referred to as the Hauling Chart), which classifies fire behavior parameters by potential fire suppression tactics. You can elect to modify these. Accept defaults on all other fire behavior outputs.

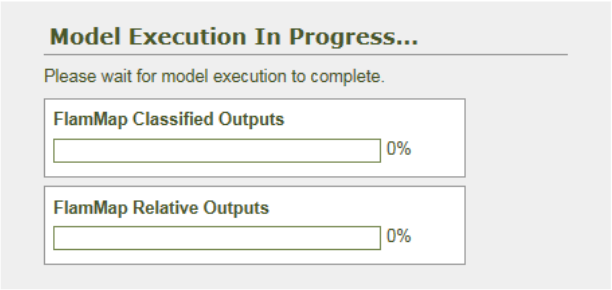
Flame Length Class	Flame Length	Fire Suppression Interpretations
Low	< 4 feet	Fires can generally be attacked at the head or flanks by persons using hand tools. Handline should hold fire.
Medium	4 to 8 feet	Fires are too intense for direct attack on the head by persons using hand tools. Handline cannot 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.



Default classification thresholds can be changed by entering minimum values for each parameter class. The "Low" class for each parameter is not directly editable. It is determined by the value you enter for the "Medium" class.

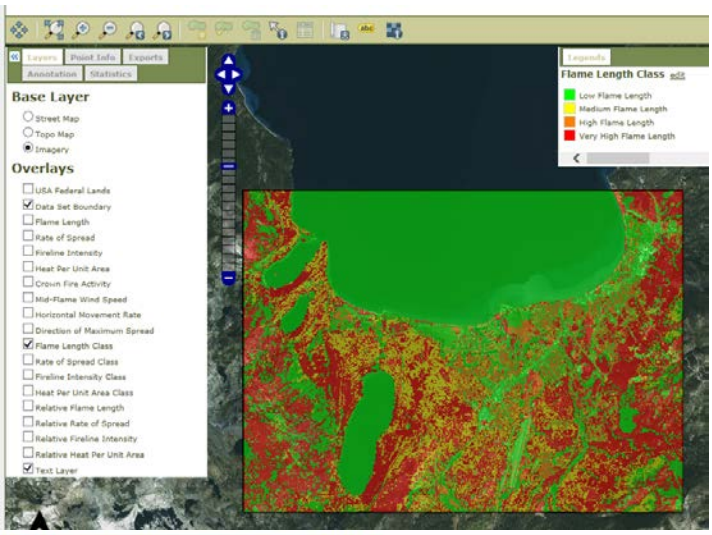


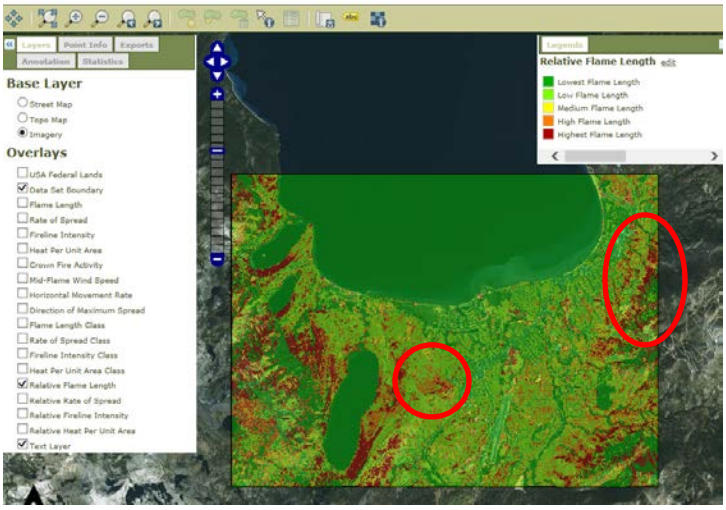
In the **Classify** step, you can also group fire behavior outputs into five classes based on relative percentages. This will narrow your search to areas with the greatest potential fire hazard. For this exercise, narrow your search of high hazard areas to areas with the highest flame length, rate of spread, fireline intensity, and heat per unit area by entering a low number in the "Highest" boxes. One example is shown below. Click **Next**. The **Model Execution** box will appear.



Note that the sum of all five weights must equal 100%

Now you can see how your customized bins turned out compared to the default values. Toggle between the two to assess how well your custom bins focused attention on the highest hazard areas. Find the areas across your landscape that are predicted to have the highest fire hazard based on relative outputs.

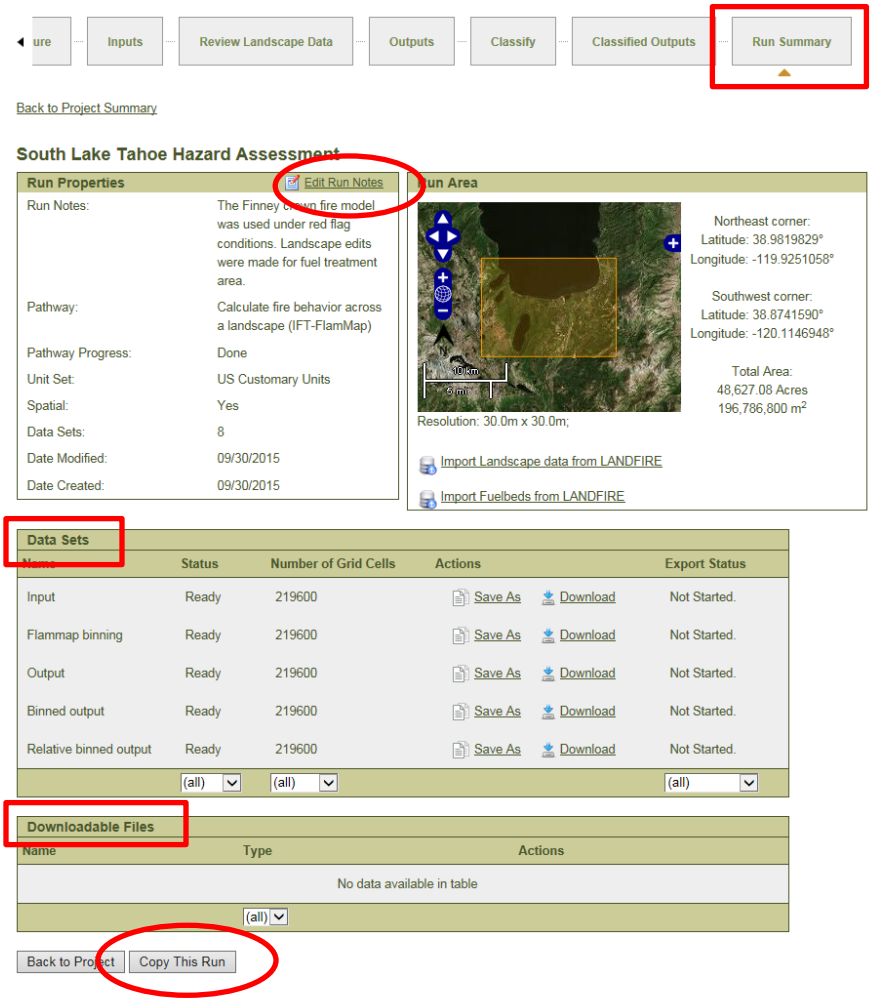




If you have Google Earth installed on your computer you can take some time to further assess your landscape data and outputs by downloading KML files from the Exports tab.

Select **Finish** when you have completed a review of the outputs.

16. The final step is to review the **Run Summary** page. Use the **Edit Run Notes** to document decisions and results of your run.



You may copy or download any of the data sets created during the run sequence. Downloads may be extracted as a shapefile or raster data set. Downloaded files can be used in ArcGIS. You can **Copy This Run** to use the same run with new input values to look at effects of different variables such as wind direction or speed, landscape edits, or perhaps compare the 97th percentile to the 90th percentile weather.

CONGRATULATIONS!!! You have completed your first IFT-FLAMMAP run!!!

<u>In this tutorial you:</u>

1. Set up a project and acquired LANDFIRE data
2. Created a run focused on fire behavior across a landscape
3. Established environmental parameters for IFT-FlamMap
4. Reviewed and edited LANDFIRE spatial data and assessed fire behavior outputs
5. Evaluate results and identify potential fire hazards across a landscape

Objectives

Minimum Travel Time (MTT) is an algorithm that simulates two-dimensional fire growth (Finney 2002). The objective for this tutorial is for the student to develop basic skills to run the IFT-MTT module and understand basic output values from the module.

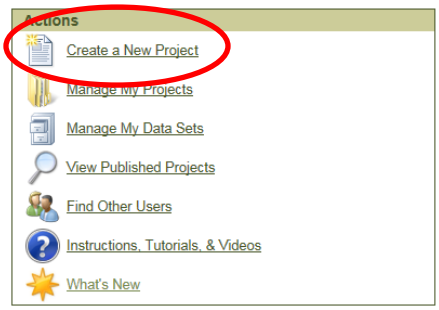
Overview

- Set up a project, acquire LANDFIRE data, and configure an IFT-MTT run
- Create ignition, barrier, and fuel treatment polygon features
- Review pretreatment spatial fire behavior outputs
- Edit LANDFIRE spatial data to reflect changes in vegetation based on fuel treatments
- Review pre- and post- treatment fire behavior to evaluate fuel treatment effectiveness

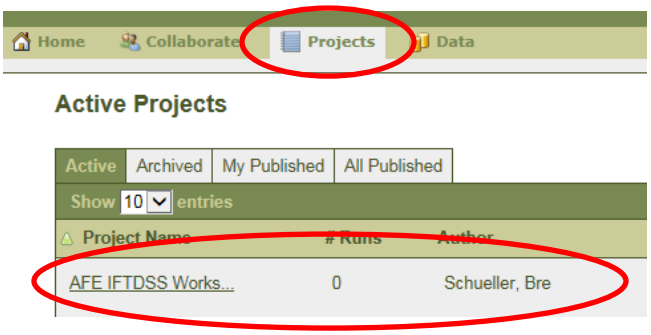
Module Output Summary

Arrival Time: A representation of time (fraction of an hour) it takes the fire to reach a location on the landscape from an ignition source. You may think of this as time step perimeters.
Major Flow Paths: Displays the minimum time pathways as the fire moves across the landscape. Just as water flows in a path of least resistance, major flow paths displays the path across the landscape that fire would spread most rapidly.
All Flow Paths: This displays the minimum time pathways between all nodes on the analysis area.
Rate of Spread (MTT): This displays the rate of spread as a function of the MTT flow paths.
Basic Fire Behavior: Raster grids of flame length, rate of spread**,** fireline intensity**,** and crown fire activity outputs are similar to the outputs from other fire behavior models and are useful for assessing the type of fire behavior that can be expected at a particular point or area on the landscape.

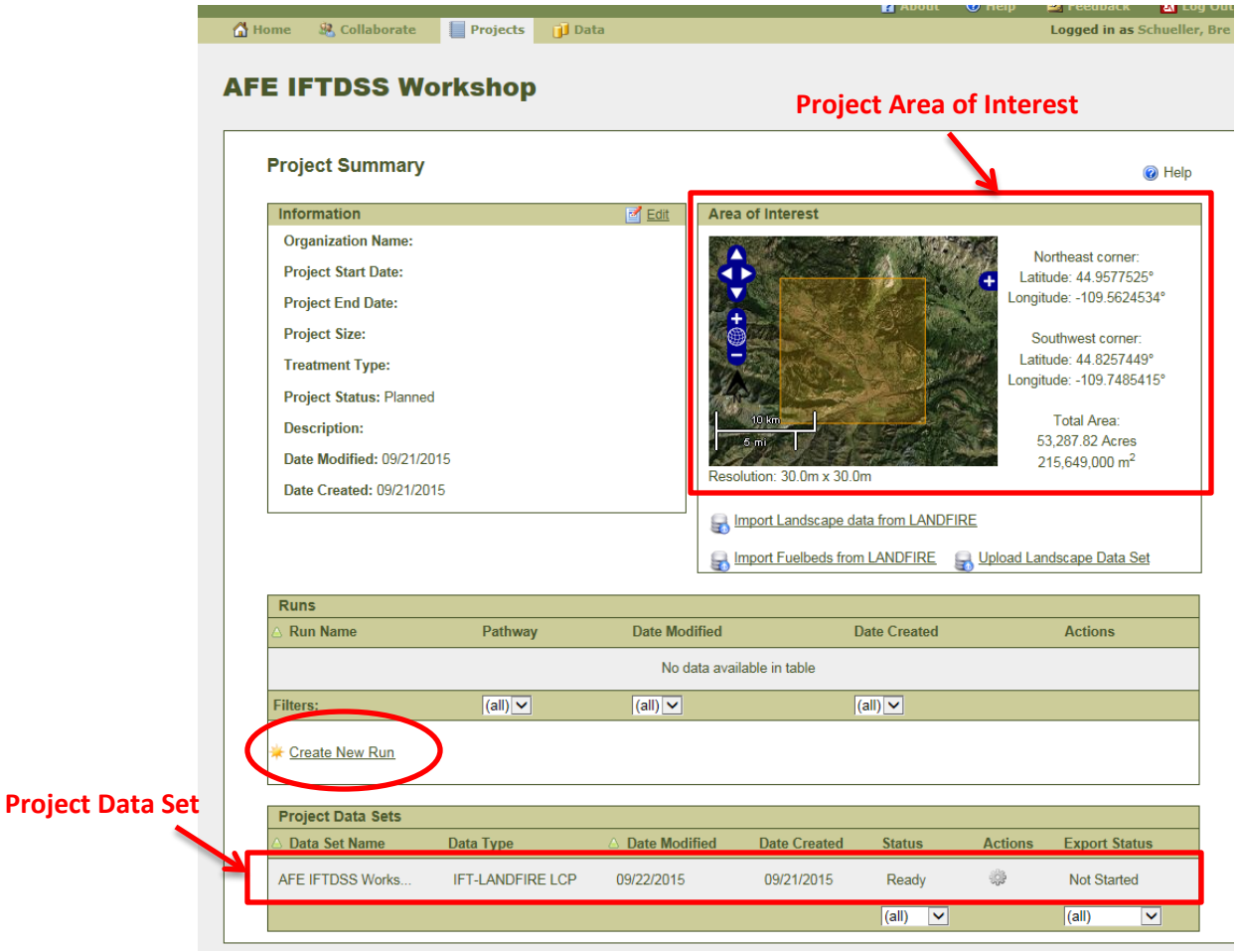
1. Navigate to http://iftdss.sonomatech.com/ and log into IFTDSS. Choose **Create a New Project** or navigate to the **Project Summary** page through the **Projects** tab and select the project you created in the Getting Started tutorial. If you are creating a new project, refer back to the Getting Started tutorial handout and walk through steps 5 through 10.



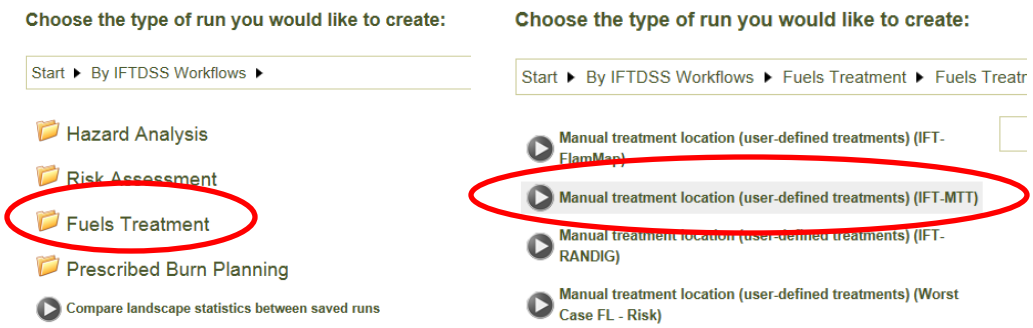
OR



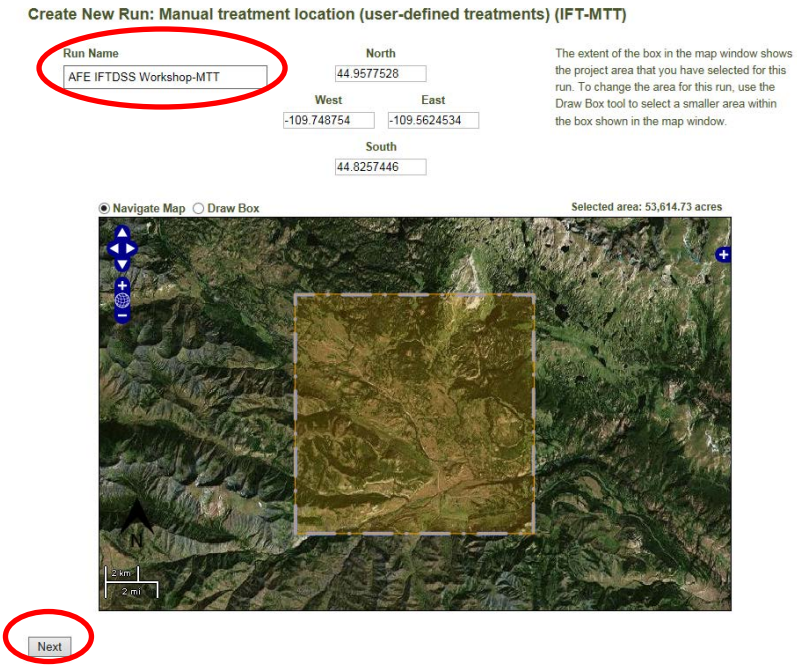
2. Select **Create New Run** in the **Runs>Filters** box towards the bottom of the page.



3. You are now at the **Choose the type of run you would like to create** page**.** Navigate through the folders to find the **Manual treatment location (user-defined treatments) IFT-MTT** module and select it.



4. On the **Create New Run** page, give your run a unique name in the **Run Name** box. You can define a smaller run area within the area of interest, but it isn't required. You do not need to select a new run area in this exercise. Click **Next**.

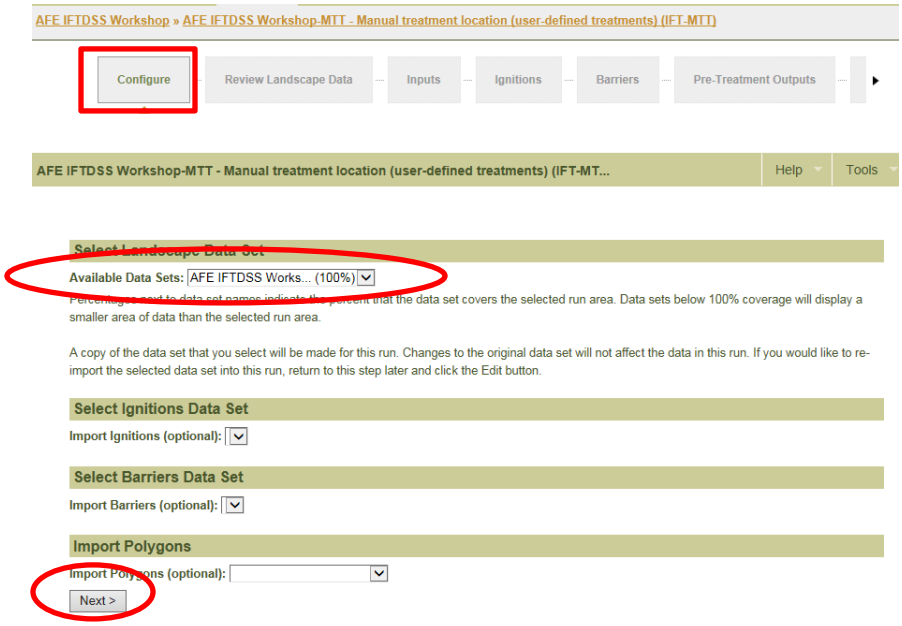


NOTE: A run defines the activity you want to perform and the modules or workflows you will use as part of a run. Selecting the entire project area boundary for your run area is useful if you want to model fire behavior across a landscape.

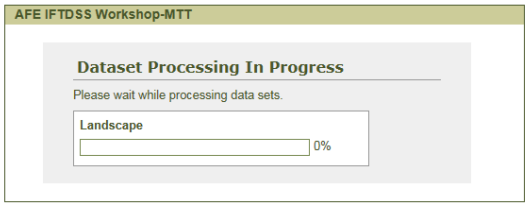
5. You are at the **Manual treatment location (user-defined treatments)(IFT-MTT)** workflow. Along the top of the page are workflow boxes that help you walk through the module in a sequential manner. The first step in this workflow is to **Configure** your run.

   The **Select Landscape Data Set** drop down allows you to select the existing project LANDFIRE data set you created when you defined your project area of interest in the Getting Started tutorial or you can select subsets of that data set that you created when you defined your run area. If you remember, you were not required to define a unique run area for this project so the only available dataset should be the project data set.

   Options exist to select imported ignition, barrier, or polygon files. You have not imported any of these files for this project as you will be creating them in coming steps. So, you can leave them blank and click **Next**.

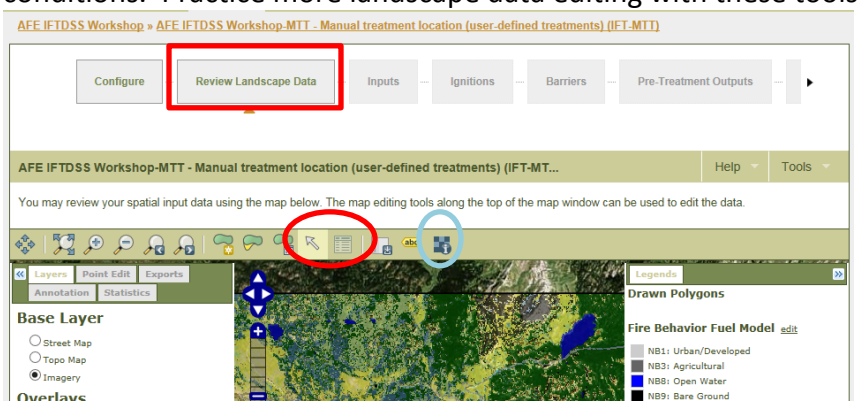


   The **Dataset Processing** box will appear.



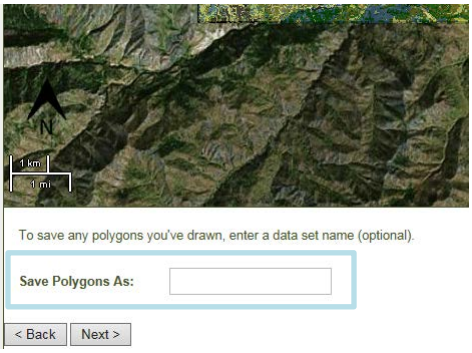
The workflow boxes at the top of the page help you understand where you are within the chosen module, and allow you to easily navigate back to previous steps in the workflow if necessary.

6. You now have the oppurtunity to review and edit your landscape and the imported LANDFIRE dataset in the **Review Landscape Data** step within the workflow. Utilize the **Point Edit** and/or the **Advanced Edit** tool to modify LANDFIRE data to suit local conditions. Practice more landscape data editing with these tools.



Use the **Landscape Statistics** tool to assess landscape features prior to editing.

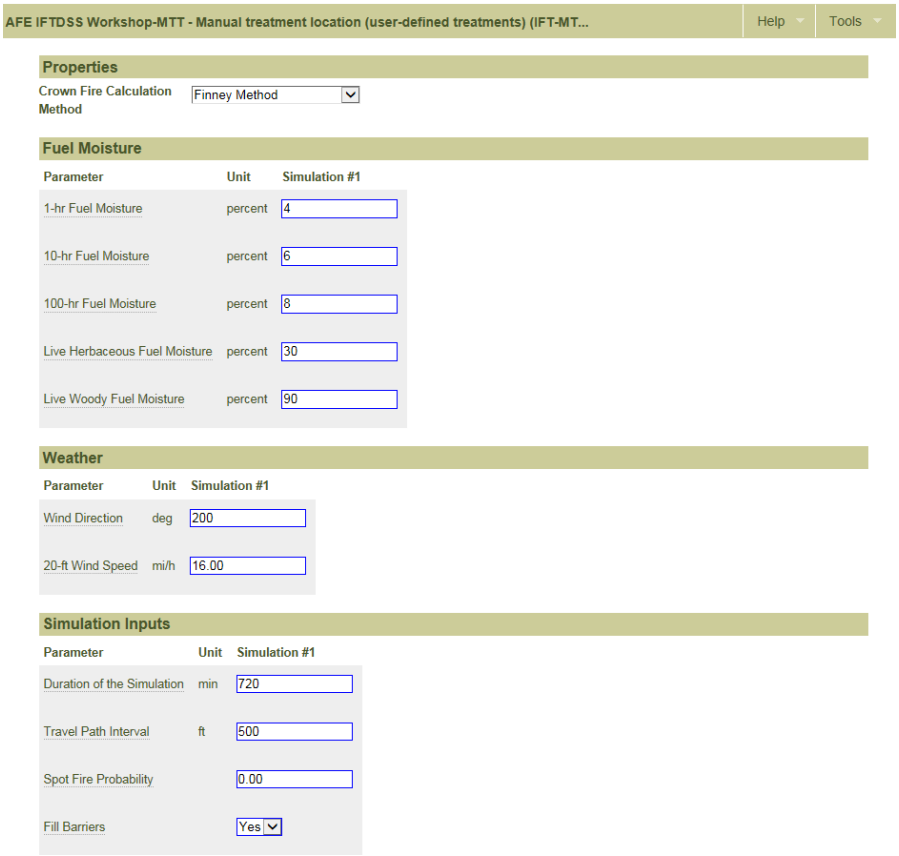
Polygons can be created at the **Review Landscape Data** step using the **Draw Polygon** tool. Drawn polygons can be used as landscape masks or fuel treatment units. Use the **Polygon based Advanced Edit** tool to edit the landscape based on your polygon feature. The polygons can be saved for use in future runs using the **Save Polygon As** box at the bottom left hand corner of the page.



When you are ready to move on to the **Inputs** step in the workflow, click **Next**. The **Dataset Processing** box will appear.

7. At the **Inputs** step in the workflow, select Finney for **Crown Fire Method**. Set **1 hour fuels** to 4%, **10 hour fuels** to 6%, **100 hours fuels** to 8%, **Live Herbaceous** to 30%, and **Live Woody** to 90%. **Wind Direction** will be constant from the southwest at 16 mph (20 foot). **Duration of the Simulation** will be 720 minutes, or 12 hours, to represent two 6-hour burn periods. **Travel Path Intervals** will be displayed at 500 ft intervals and **Spot Fire Probability** will remain at 0%. Any added barriers will be filled with this run. Click **Next**.

The **Finney** Crown Fire Method may result in less predicted crown fire compared to **Scott and Reinhardt's** Crown Fire Method. You should test each method to determine which predicts expected fire behavior given the LANDFIRE data and weather.

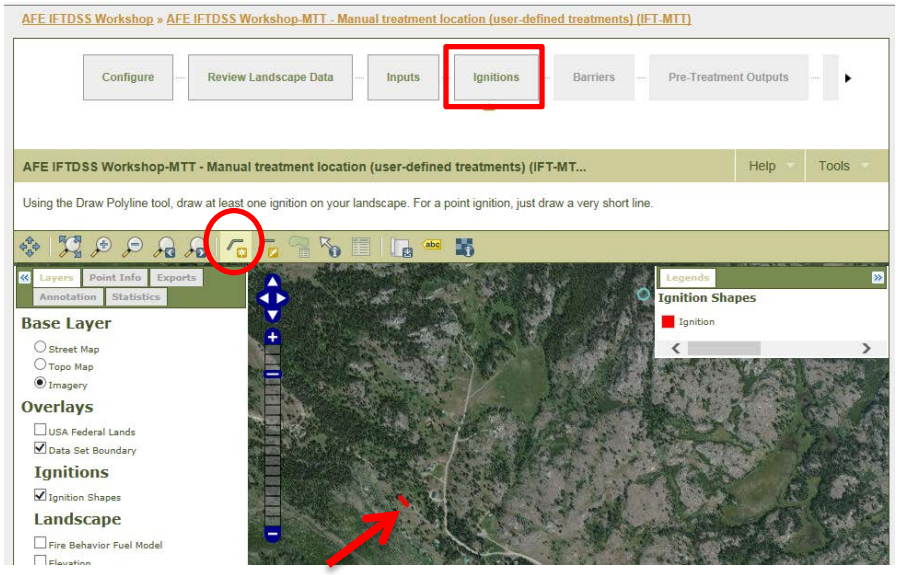


NOTE:

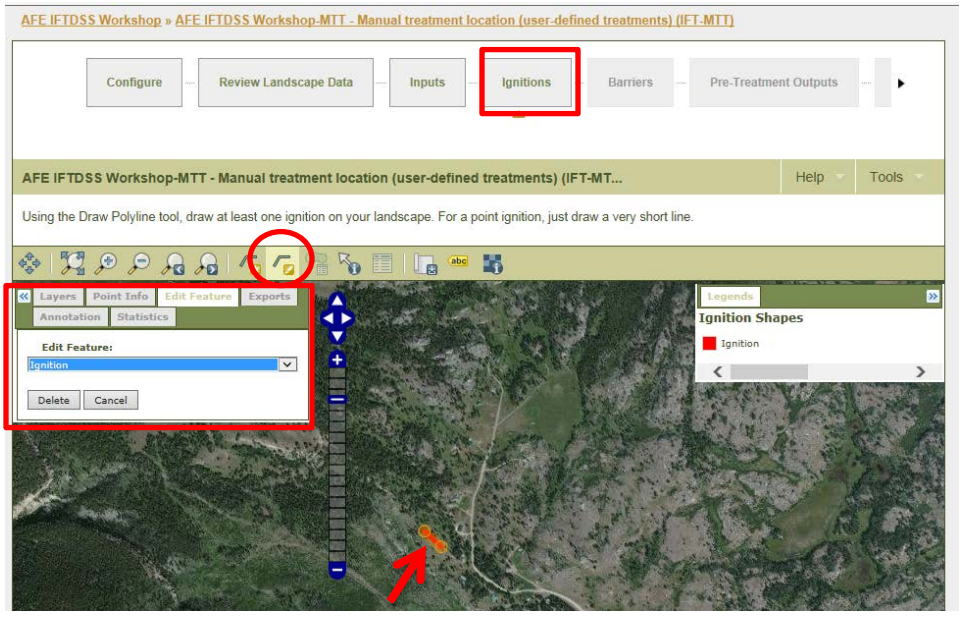
- **The conditions you establish for your wildfire can be determined in a number of ways. You can use Fire Family Plus to determine percentile weather or use red-flag conditions. It depends on the purpose of your analysis.**
- **When assessing fire hazard and fuel treatment placement across large landscapes, 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.**

8. In the **Ignitions** step, draw the ignition file(s). Select the **Draw Polyline** tool, click on the map once to start the igntion, move to a different point, and click again. Continue clicking until you are satisfied with your ignition file. Double-click to finish your shape. For this exercise, zoom into the area shown below and draw a very short polyline, or point ignition, in the same location.

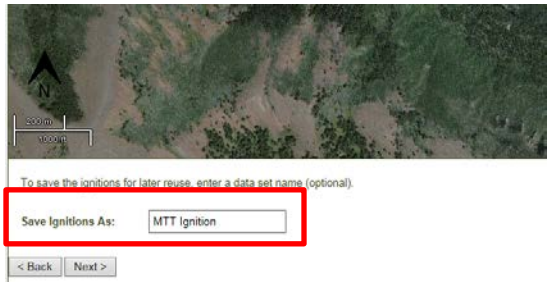
It is possible to draw multiple ignitions across your project area. They are grouped and saved as one ignition file if you choose to **Save Ignitions As**.



You can edit your ignition file by selecting the **Modify Ignition** tool and clicking on the ignition polyline you wish to modify. The **Edit Feature** tab will appear giving you the option to select the feature you would like to edit from the **Edit Feature** drop down box. Once selected you can move individual vertices on your polyline with the cursor or you can delete the feature and create a new one.

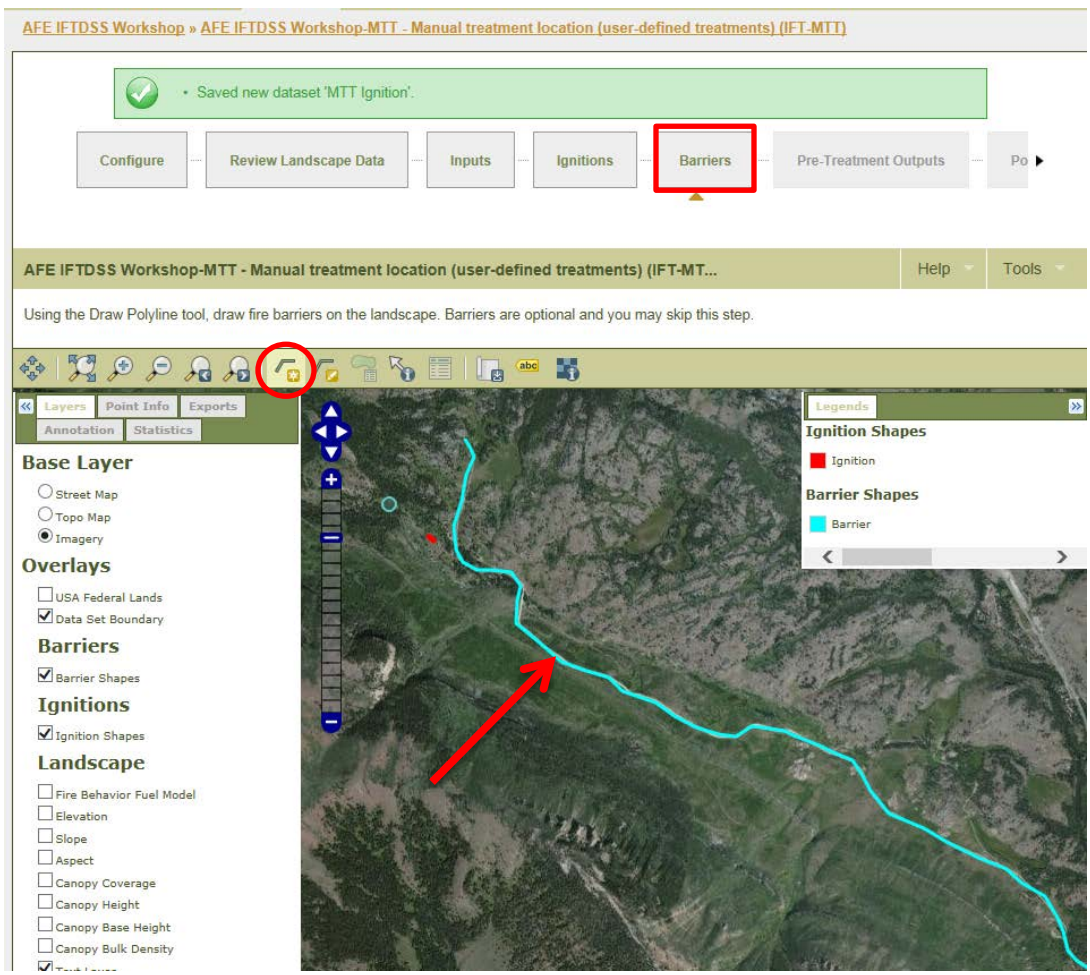


As with the polygons, you can save ignition files for use in future runs. Save the ignition file by naming it at the bottom of the screen and clicking **Next**.

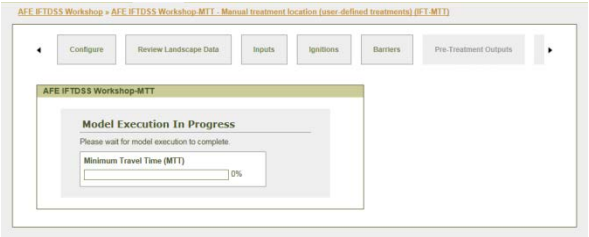


HINT: In Step 9 when you click Next, the pre-treatment IFT-MTT will run so be sure you have all of the steps configured as you wish. Use the workflow boxes at the top of the screen to move back to a previous step if you need to make edits prior to running IFT-MTT.

9. At the **Barriers** step in the IFT-MTT workflow, use the same method to create barrier files as used to create the ignition file. Barriers are optional. However, the east-west county road is defensible and would act as a barrier to fire spread. Zoom in to the west central portion of your project area and use the **Draw Polyline** tool to trace the county road. Name the file and note that when you click **Next** to save, the run will begin.



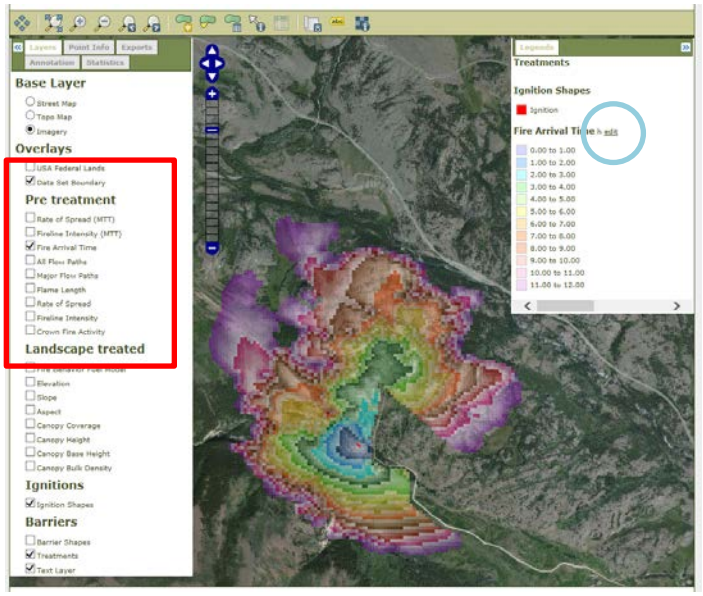
Click **Next** to run the pretreatment IFT-MTT. The **Model Execution** box will appear as IFT-MTT runs. The run will take several minutes to process depending on the extent of fire spread.



NOTE: LANDFIRE represents the landscape with 30m x 30m pixels, which impacts fire modeling. For example, a river would be a barrier to surface fire spread in the real world, but when pixels meet only at the corners on a winding stream, modeled surface fire can spread across.

CHECK IN: At this point you should have created a new project, acquired LANDFIRE data, created a new run using the Fuel Treatment (IFT-MTT) module, configured the run, reviewed/edited landscape data, populated fire environment and duration inputs, created ignition and barrier files, and run your pre-treatment IFT-MTT.

10. The **Pre Treatment Output** window displays **Fire Arrival Time** in 1-hour increments. Activate the **Major Flow Paths** overlay. You can see that the county road barrier stopped modeled surface fire spread to the north and east (but spotting was not enabled in the run). Toggle through the **Pre-treatment** overlays to assess fire behavior and values that may be at risk in the area of the fire. A fuel treatment is needed to protect infrastructure along the highway to the north.

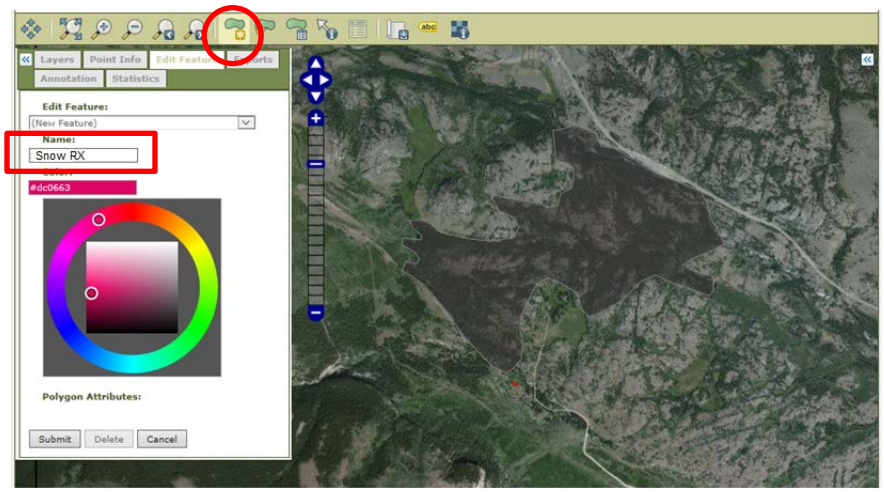


Re-group outputs in the legend by selecting **edit** next to the legend item you wish to regroup. Delete rows by clicking the "-"after a row to remove the bin. Then type new values in the remaining bins.

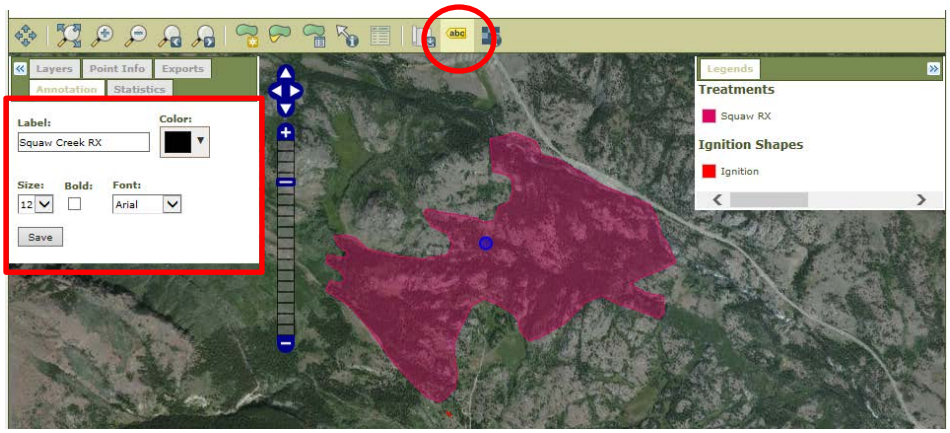
Draw a fuel treatment to protect the identified value at risk. There are two methods: the freeform method and the point-and-click method.

To draw a polygon using the freeform method, select the **Draw Polygon** tool. While holding down the Shift key, click on the map and *hold* the left mouse button down. Start drawing your polygon by moving your mouse as if it were a pencil. Release the left mouse button when you are finished drawing your polygon. This will create your polygon and open the Edit Feature panel to choose a color. **Submit** the shape.

Draw another treatment using the point-and-click method. Select the **Draw Polygon** tool. Click on the map and release the mouse button. Move the mouse to a new point and click and release again to add another point. Continue this process until you have completed drawing your polygon. Double click to create the polygon and open the Edit Feature panel to name the shape, choose a color, and **Submit**.

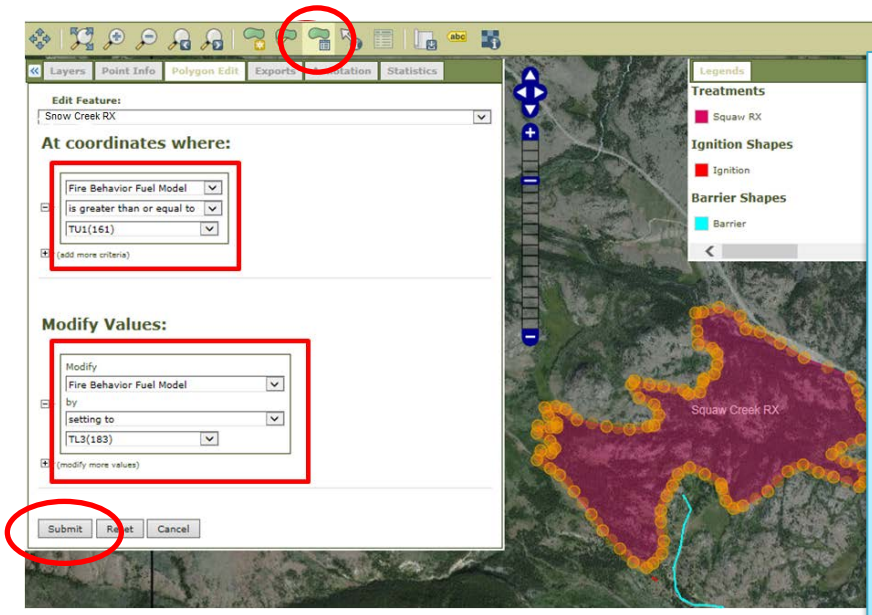


11. Label the polygons using the **Map Annotation** tool. Select the **Map Annotation** tool on the tool bar and click anywhere on the map within the treatment area. The **Annotation** tab will appear. Type **Snow Creek RX** in the **Label** box and adjust your font as needed. Click **Save**. Your label should now appear. To edit or delete your label, select the **Map Annotation** tool and click on the first letter of the label on the map. You should now see a **Save** and **Delete** option in the **Annotation** tab. Label the other Polygon.



12. Now that you have created a fuel treatment polygon, manually edit the landscape (LANDFIRE) data in the treatment to reflect treated fuels that represent a two-year old prescribed burn. Be sure that your **Treatments** layer is turned on in the **Layers** tab. Select the **Polygon Advanced Edit** tool and *click on the treatment polygon* you just created. This opens the **Edit Feature** panel in the **Polygon Edit** tab.

    Be sure that your polygon is showing in the **Edit Features** box and change your landscape features as shown in the image below. The fire behavior fuel model will be adjusted to reflect a two year old prescribed burn. Existing timber fuel models will be changed to a moderate load conifer litter model. Grass models will remain the same. Click **Submit** and review the landscape changes.

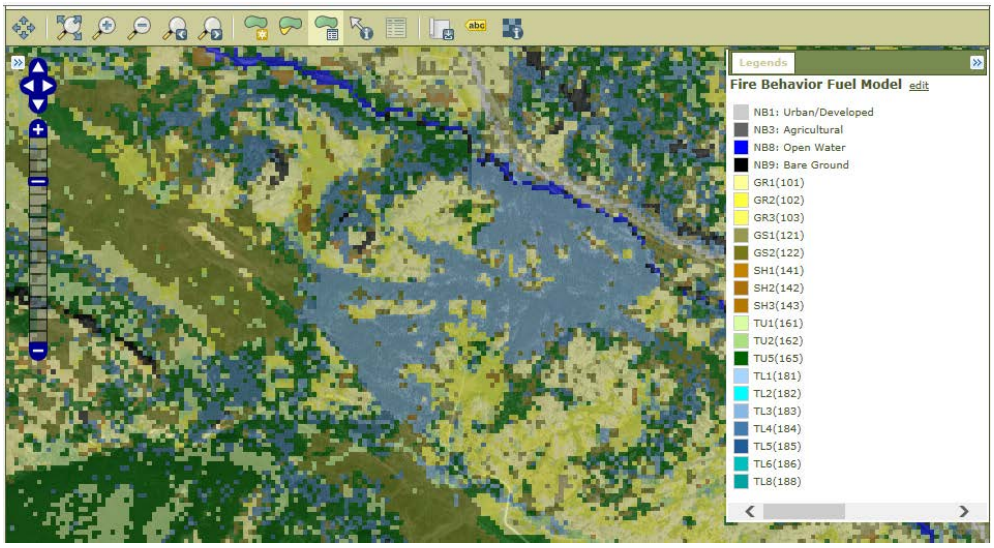


Within the fuels treatment polygons, you can edit:

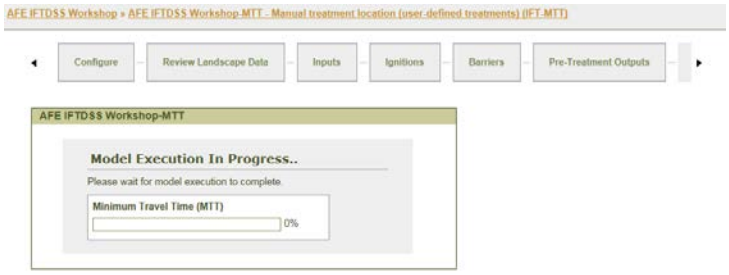
FBFM
Canopy Cover
Canopy Height
Canopy Base Height
Canopy Bulk Density

Multiple features may be edited on each polygon by clicking **Add More Criteria** in the **Polygon Edit** tab.

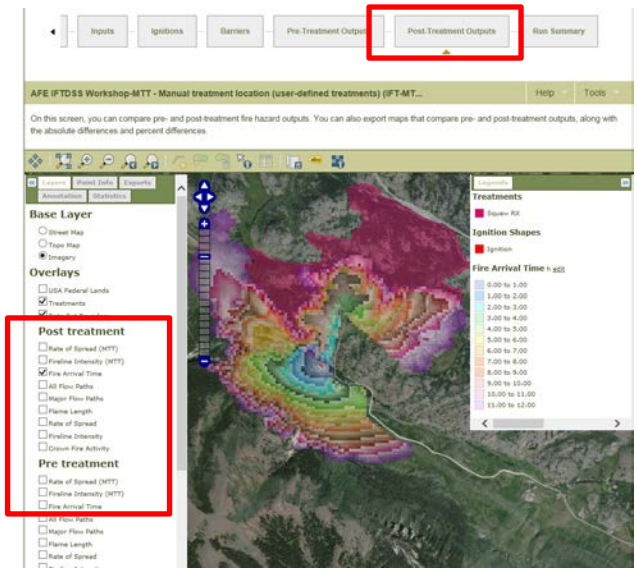
Your fuel model layer should look something similar to the image below.

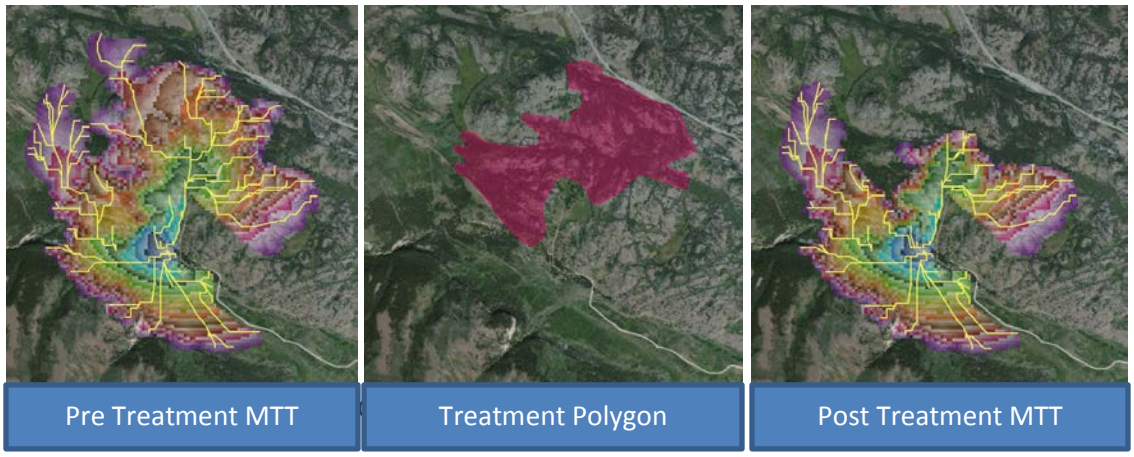


Save your polygon at the bottom of the screen and click **Next** to re-run IFT-MTT under the same environmental conditions but with a "treated" landscape.



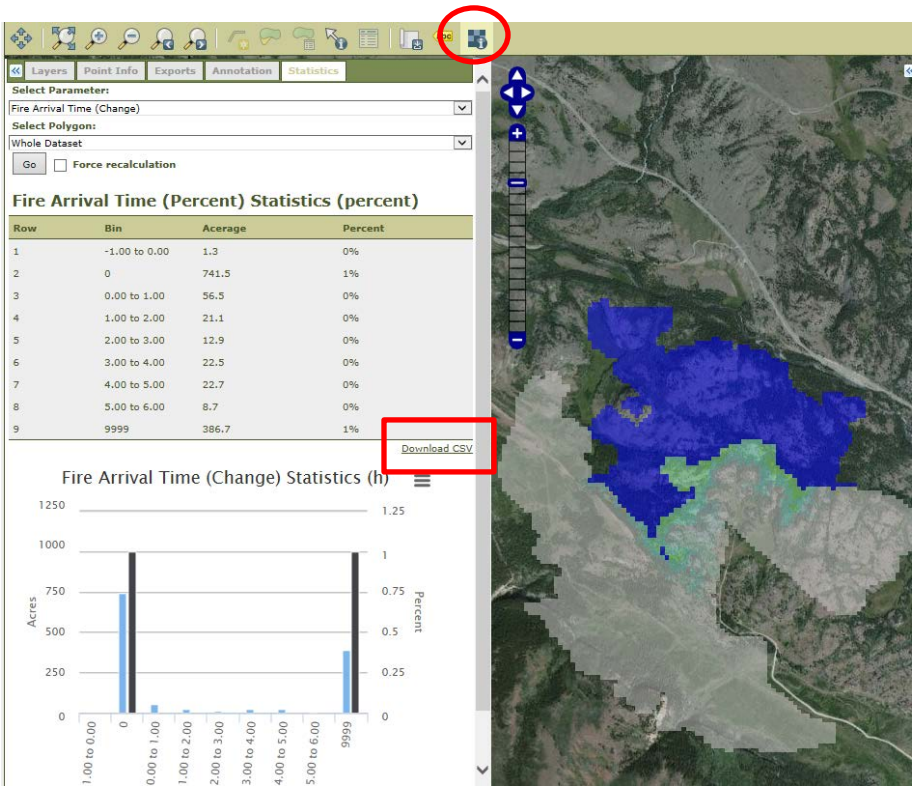
13. The **Post Treatment Outputs** step in the workflow displays **Post Treatment** results in the **Layers** tab. Review the pre and post treatment fire behavior to evaluate fuel treatment effectiveness by clicking layers on/off in the pre/post treatment lists.



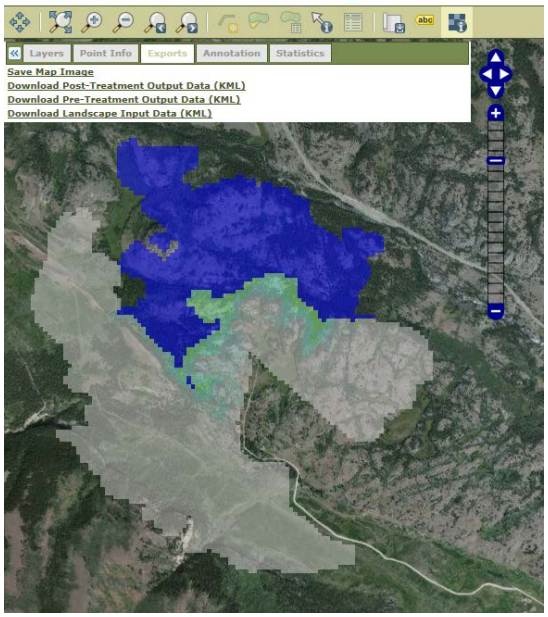


Our objective was to protect infrastructure along the highway. The model predicts that the 2-year-old prescribed burn treatment is effective in keeping fire from reaching infrastructure.

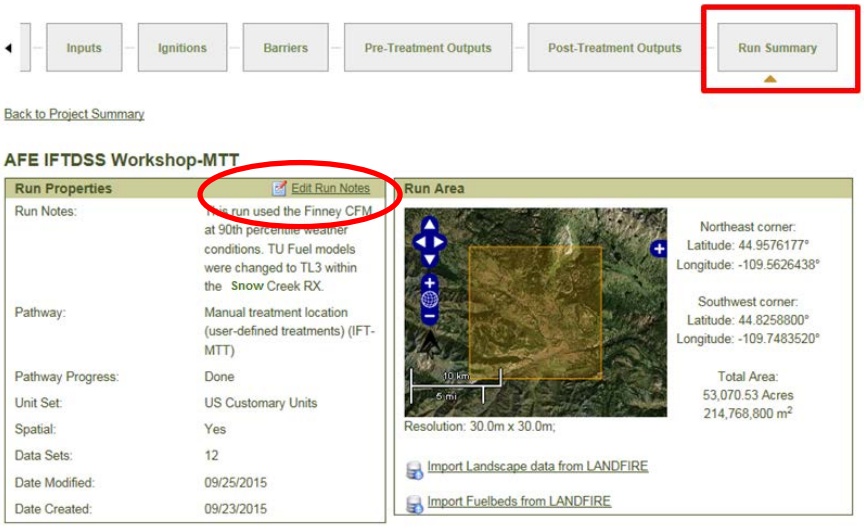
Toggle through the **Differences** outputs in **Layers**. These outputs display change between pre and post treatment outputs and can be helpful in quantifying the change for further analysis or documentation. Use the Landscape Statistics tool to view tabular representations of the outputs. Use the Download CSV button to download tabular outputs for further analysis. Click the Landscape Statistics tool again to close the pop-up.



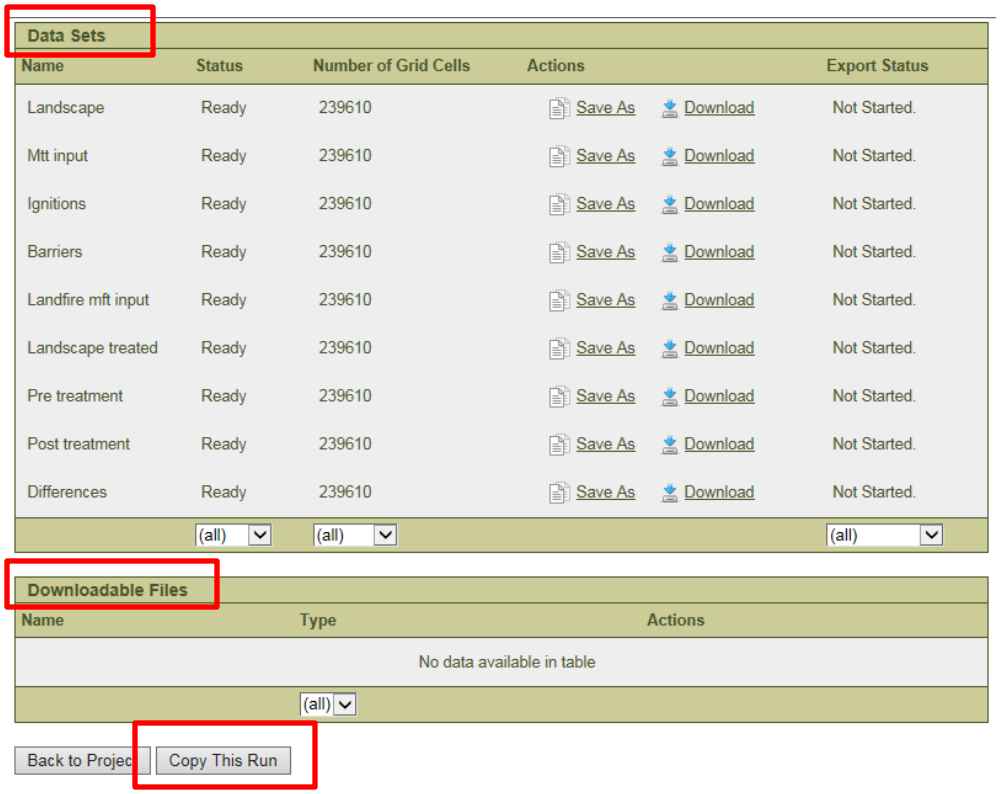
Use the **Exports** tab to download KML files that can be viewed in Google Earth. Open files in Google Earth if you have the application installed. If not, go to the next step. Click **Finish**.



14. The final step in the Fuel Treatment IFT-MTT workflow is to review the **Run Summary** page. Use the **Edit Run Notes** to document decisions and results of your run.



From this page you may copy or download any of the datasets created during the run sequence. Downloads may either be extracted as a shapefile or raster data set. The download files can be further analyzed and/or displayed in ArcGIS. You can also **Copy This Run**, which gives you the ability to use the same run and tweak input values to look at the effects of different environmental variables such as wind direction or speed, or perhaps compare the 97th percentile to the 90th percentile weather.



Data Sets

Name	Status	Number of Grid Cells	Actions		Export Status
Landscape	Ready	239610	Save As	Download	Not Started.
Mtt input	Ready	239610	Save As	Download	Not Started.
Ignitions	Ready	239610	Save As	Download	Not Started.
Barriers	Ready	239610	Save As	Download	Not Started.
Landfire mft input	Ready	239610	Save As	Download	Not Started.
Landscape treated	Ready	239610	Save As	Download	Not Started.
Pre treatment	Ready	239610	Save As	Download	Not Started.
Post treatment	Ready	239610	Save As	Download	Not Started.
Differences	Ready	239610	Save As	Download	Not Started.
	(all)	(all)			(all)

Downloadable Files

Name	Type	Actions
No data available in table		
	(all)	

Back to Projec | Copy This Run

CONGRATULATIONS! You have completed your first IFT-MTT run.

<u>In this tutorial you did the following:</u>

1) Set up a project, acquired LANDFIRE data, and configured an IFT-MTT run
2) Created ignition, barrier, and fuel treatment polygon features
3) Reviewed pretreatment spatial fire behavior outputs
4) Edited LANDFIRE spatial data to reflect changes in vegetation based on fuel treatments
5) Reviewed pre- and post- treatment fire behavior and evaluated fuel treatment effectiveness

Objectives

IFT-RANDIG is a spatial fire modeling tool that randomizes multiple ignitions on a landscape to simulate fire spread over a discrete burning period to assess burn probability for the landscape. The objective for this tutorial is for the student to develop basic skills to assess fire hazard and risk across a landscape using IFT-FlamMap and IFT-RANDIG.

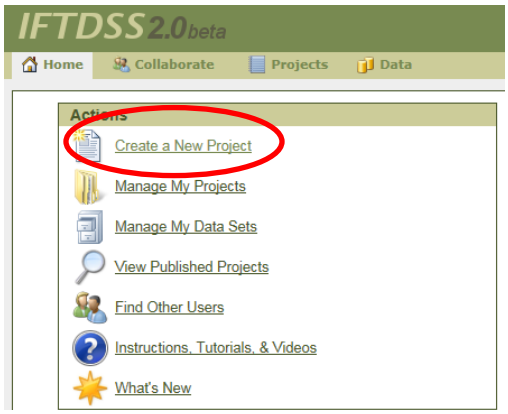
Overview

- Set up a project and acquire LANDFIRE data
- Develop a values-at-risk map and assign response functions
- Establish environmental and simulation parameters for IFT-FlamMap and IFT-RANDIG
- Review and edit LANDFIRE spatial data
- Analyze potential burn probability outputs using relative net value change data
- Evaluate results and identify potential fire risks

Module Output Summary

Basic Fire Behavior: Flame length, rate of spread**,** fireline intensity**,** and crown fire activity outputs are similar to the outputs from other fire behavior models and are useful for assessing the type of fire behavior that can be expected at a particular point or area on the landscape.
Benefit/Loss Summary: Response functions and modeled fire behavior are used to estimate the likelihood an area will burn, and the potential consequences.

1. Navigate to http://iftdss.sonomatech.com/ and log in to IFTDSS. Choose **Create a New Project**.

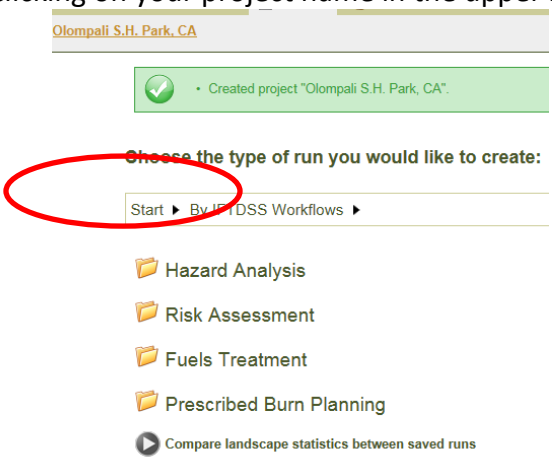


The tabs along the top provide access to general areas within IFTDSS and appear on every page within the interface.

2. On the **Create New Project** page, name your project in the **Project Name** box and populate **Optional Information** if desired. Choose **Next**.

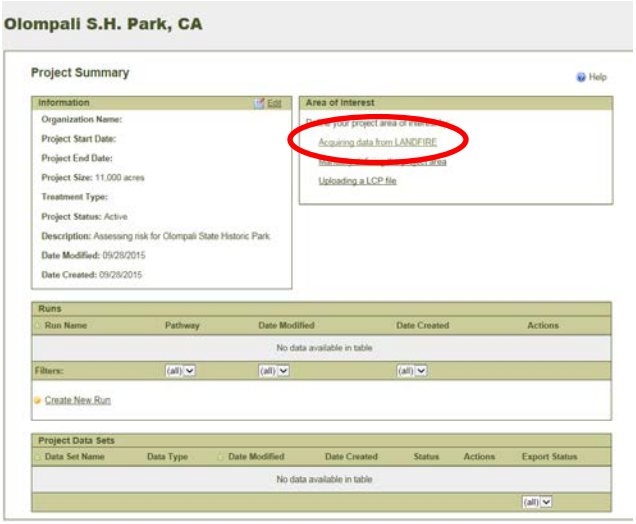
NOTE: You can think of your projects like workspaces. Each will have a defined geographic area of interest and may have one or more runs associated with it.

3. To set up your area of interest and acquire LANDFIRE data, navigate to the **Project Summary** page by clicking on your project name in the upper left corner.

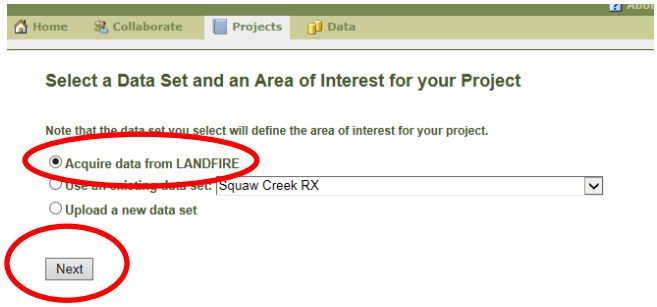


4. The **Project Summary** page displays information entered when you created your project in the **Information** box, lists runs associated with your project in the **Runs** box, and hosts data sets contained within your project in the **Project Data Sets** box.

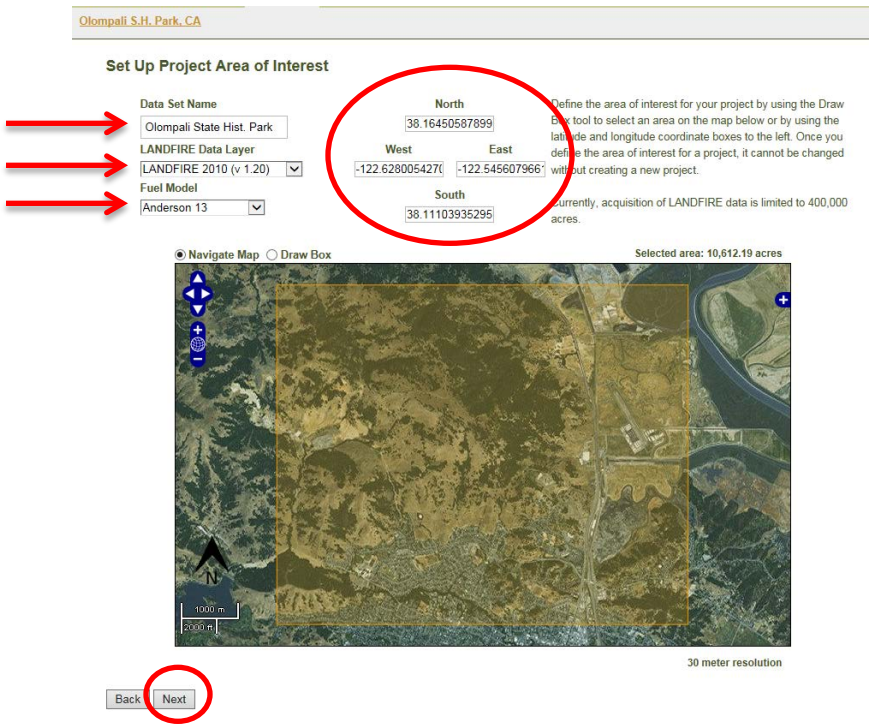
   Click on **Acquiring data from LANDFIRE** to define the Area of Interest and acquire data.



5. **Select a Data Set and an Area of Interest for your Project** page should appear. Three options are: Choose to Acquire data from LANDFIRE, use an existing data set, or upload a new data set. Choose **Acquire data from LANDFIRE**. Click **Next**.



6. On the **Set up Project Area of Interest** page, name the data set in the **Data Set Name** box, select a LANDFIRE data layer in the **LANDFIRE Data Layer** box, and select a fuel model type in the **Fuel Model** box. For this example we will use LANDFIRE 2010 (v 1.20) and Anderson 13 for the fuel model type.



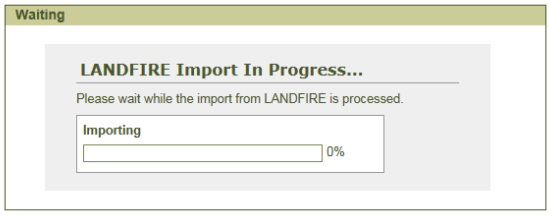
At this point you will define the area of interest for your project by using the **Draw Box** to select an area on the map or by using the latitude and longitude coordinate boxes (See Note). For this exercise we will enter the coordinates that define the Area of Interest.

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

NOTE:

- **Acquisition of LANDFIRE data is limited to 400,000 acres within IFTDSS. Check the acreage of your desired area of interest by looking at the "Selected area" acres located above the upper right hand corner of the map view.**
- **The Area of Interest is final and cannot be changed once the "Next" button is clicked or if you "enter" the fourth coordinate when using lat/long values. To change it, you must create a new Project.**

The **Waiting** page will appear as your LANDFIRE data is being acquired.

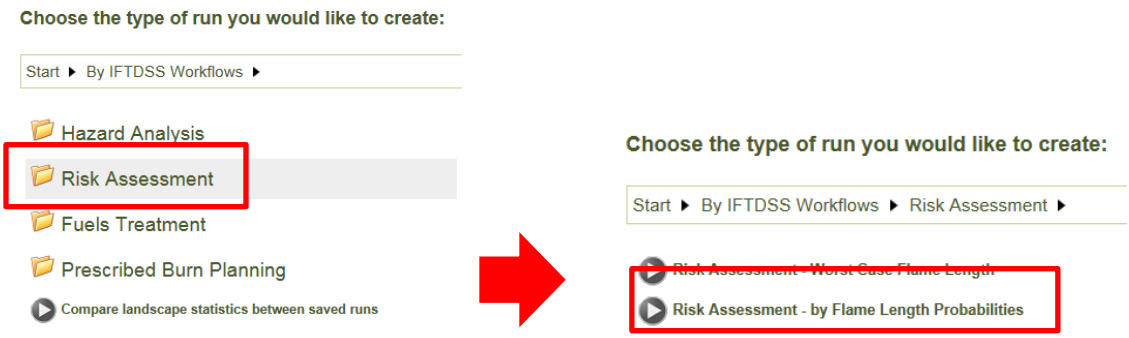


CHECK IN: At this point you have created a new project, defined your project area of interest, acquired LANDFIRE data, and are on the Project Summary page ready to Create a New Run.

7. Once your LANDFIRE data is acquired and your Area of Interest defined, you are returned to the **Project Summary** page where you can either **Create a New Run** or you can **Edit, Copy, Rename, Delete**, or **Download** your new LANDFIRE Data Set.

For this exercise choose **Create New Run**.

8. You are now back on the **Choose the type of run you would like to create** page. Select the **Risk Assessment** Workflow and then the **Risk Assessment-by Flame Length Probabilities** module.



NOTE:

- **The Worst Case Flame Lengths approach is useful when you are interested in identifying situations where flame lengths are important.**
- **The Flame Lengths Probabilities approach considers the likelihood of a fire burning as a backing, flanking, or head fire and is useful in identifying potential consequences of an area burning and/or assessing potential ecological benefits of using fire as a management tool.**

9. On the **Create New Run** page, give your run a unique name in the **Run Name** box. Select a smaller area of interest within the project boundary by entering the following coordinates:

North: 38.155672364916

East: -122.5502871142

South: 38.120028050516

West: -122.5986956225

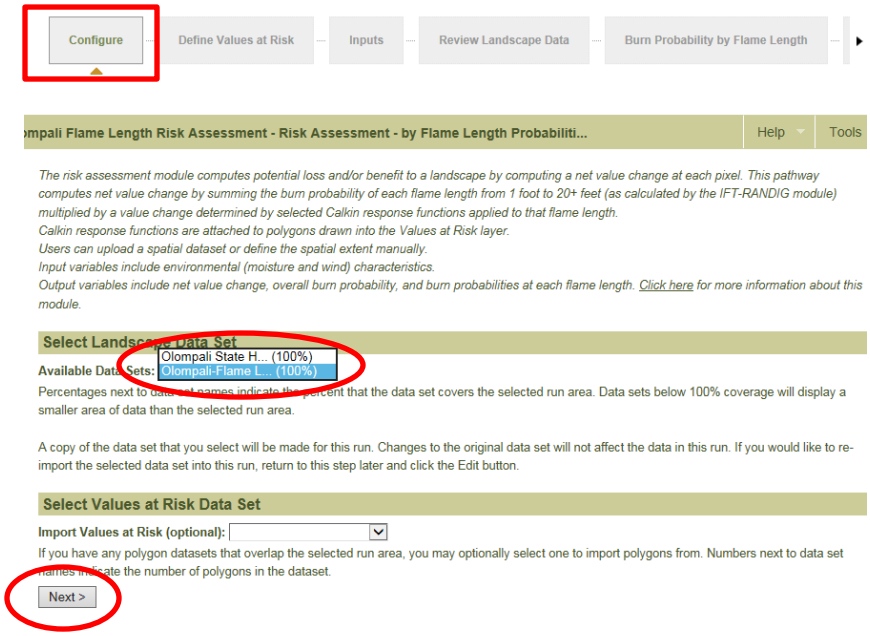
Click **Next**; IFTDSS will move to the Configure screen.

HINT: A run defines the activity you would like to perform and the modules or workflows you will use as part of a run. Selecting the entire project area boundary for your run area is useful if you want to model fire behavior across a landscape.

10. Along the top of the page you will see **Risk Assessment-by Flame Length Probabilities** workflow boxes that will help you walk through the module in a sequential manner. The first step in this workflow is to **Configure** your run.

    The **Select Landscape Data Set** drop down allows you to select the existing project LANDFIRE data set you created when you defined your project area of interest. You defined a unique run area for this project so use the **Available Data Sets** drop down to choose your run area data set (100%).

    You can also import values at risk files. You have not imported or created any these files yet, so you can leave this blank and click **Next; the dataset you defined will process**.



NOTE:

- **The LANDFIRE data resolution is 30X30 meters. Therefore it is only an interpretation of the real landscape.**
- **The flame lengths probabilities approach assumes random ignitions across the area of interest, even though in reality, some areas have higher ignition potentials than others (e.g. human caused ignitions near roads).**

11. It is now time to define your values at risk. You will draw large values at risk first, then proceed with creating smaller values at risk polygons. To create a values at risk map, you will draw polygons across the landscape and assign each one a response function.

Values at risk are features on the landscape that are influenced positively or negatively by fire. A value at risk can have ecological, economic, or social importance.

Response functions describe the effect of fire on values at risk. They are mathematical relationships between fire characteristics and fire outcome. There are 14 predefined response functions.

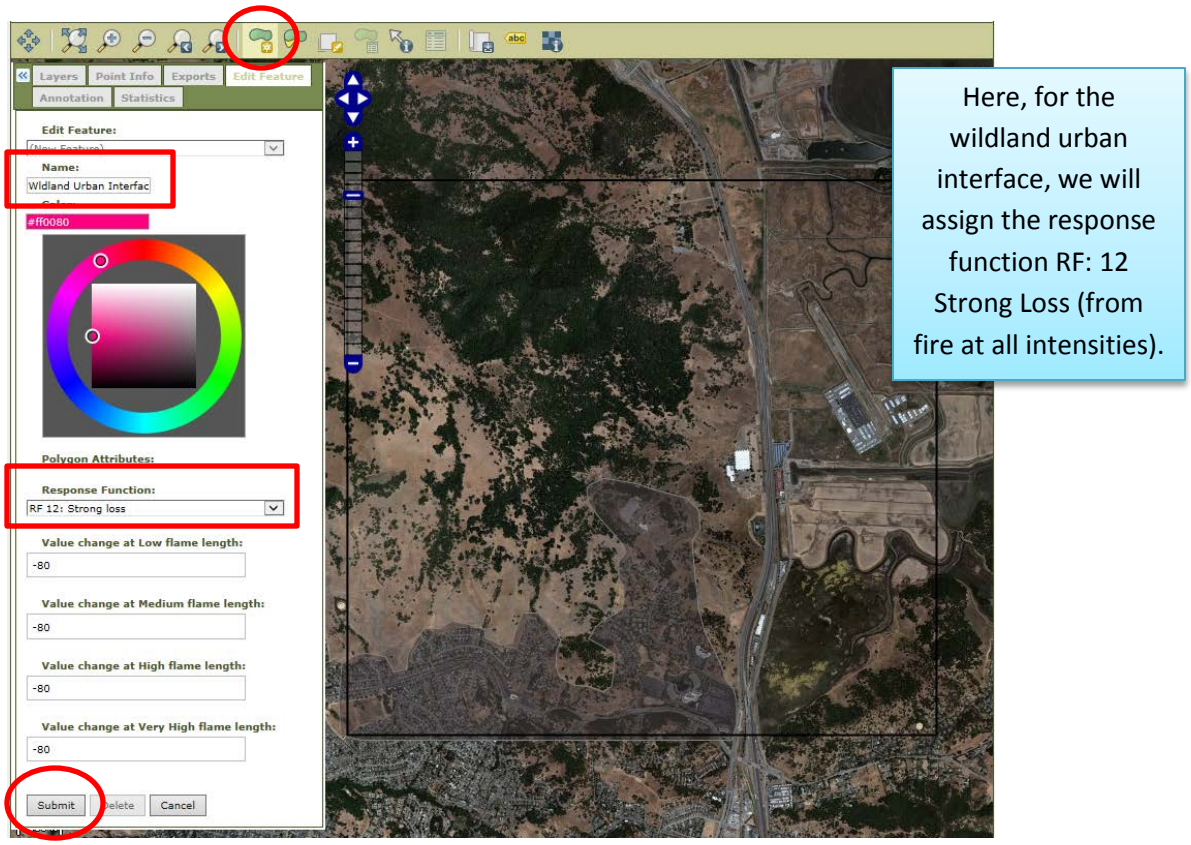
RESPONSE FUNCTION TABLE

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 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

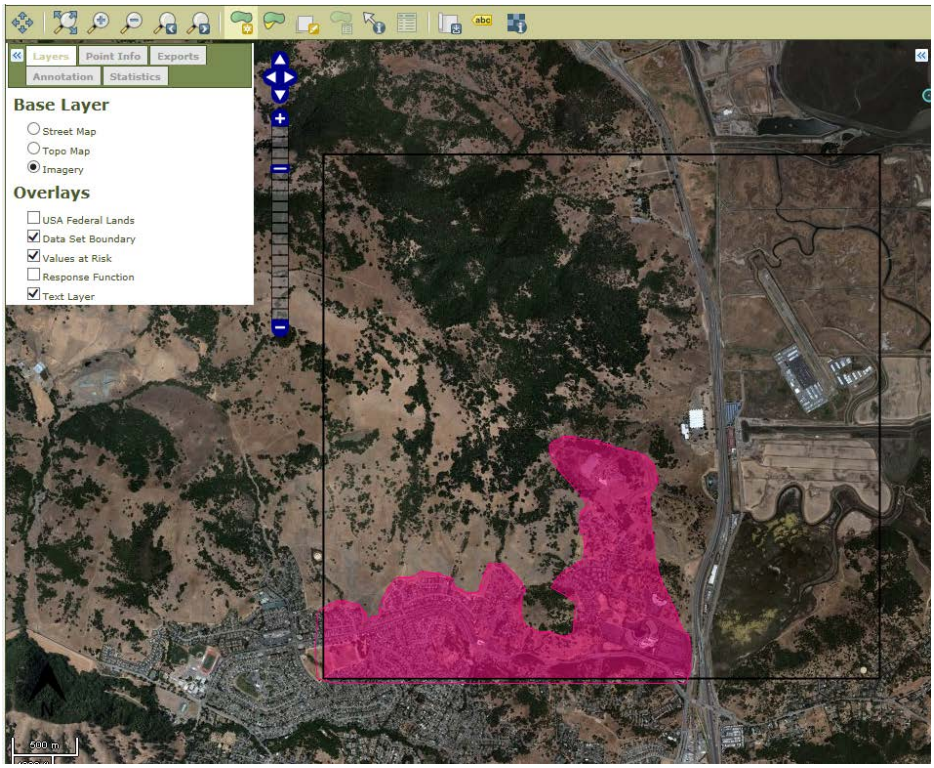
Use the free form drawing method with the **Draw Polygon** tool to define the wildland urban interface towards the bottom of the run area box.

Select the **Draw Polygon** tool. Hold down the shift key and the left mouse button at the map location where you want to start drawing your first polygon. 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 as shown on the screen capture below).

Let go of the left mouse button and shift key when you are done drawing the polygon. This creates the polygon and opens the **Edit Feature** panel.



Name the polygon, choose a color, assign a response function, and choose **Submit**.

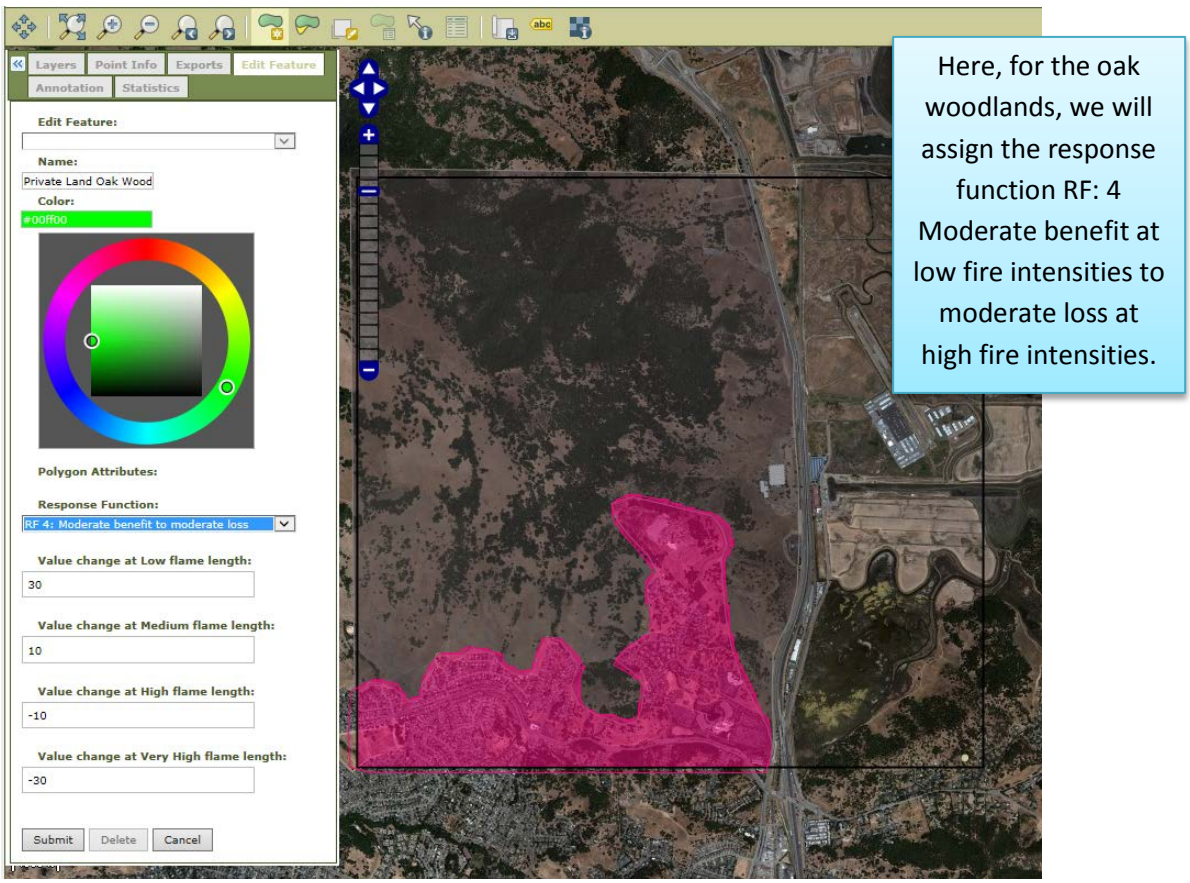


It may be helpful to read the next few steps (through Step 15) to get the "big picture" before continuing with the tutorial before drawing shapes.

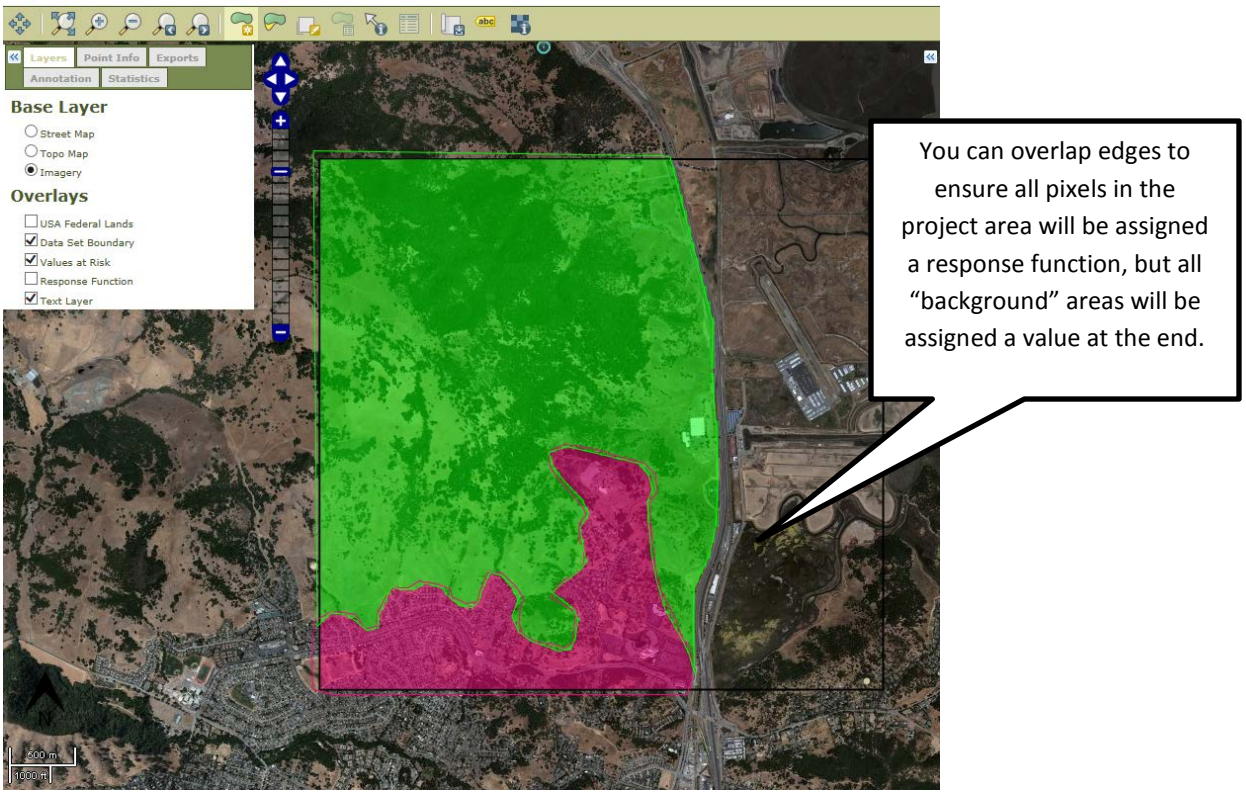
Define your next value at risk using the point and click method to draw a polygon representing the private land/oak woodlands north of the wildland urban interface.

Select the **Draw Polygon** tool. Click on the map and release to start drawing your first polygon. 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.

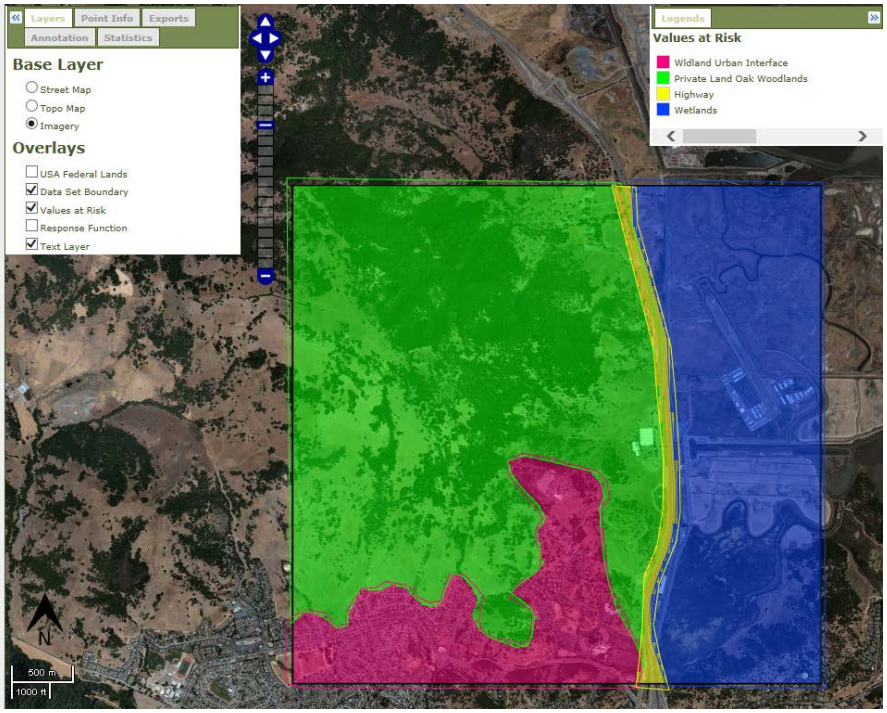
Double-click when you are done drawing the polygon to create the polygon and to open the **Edit Feature** panel.



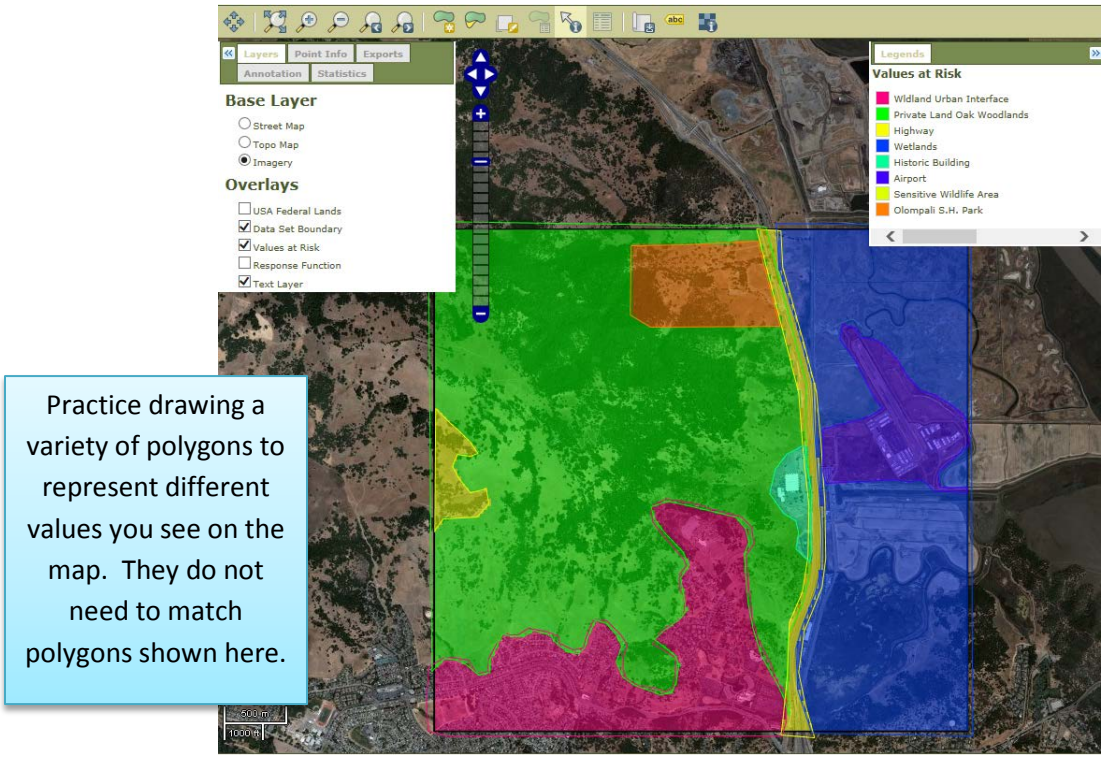
Name the polygon, choose a color, assign a response function, and choose **Submit**.



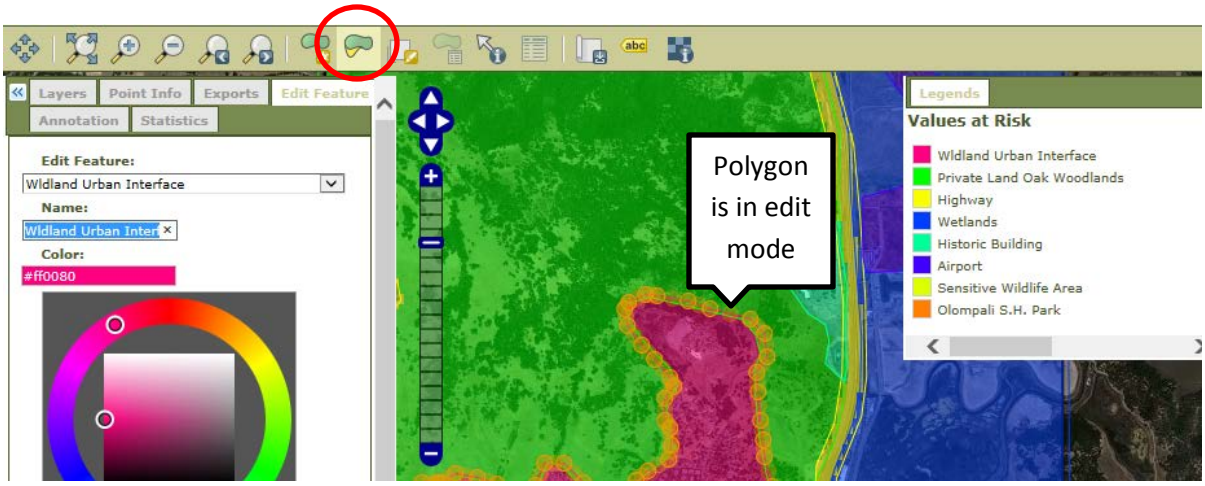
Continue on to fill in your entire area of interest drawing polygons with the free form or point and click methods representing large values at risk. Choose names, colors, and response functions for all of your newly defined large values at risk.



12. Now you will define small values at risk on your landscape over the larger values at risk you have already drawn. The smaller polygons will replace larger polygons beneath. Use the same methodology you used to draw large polygons to create smaller polygons.

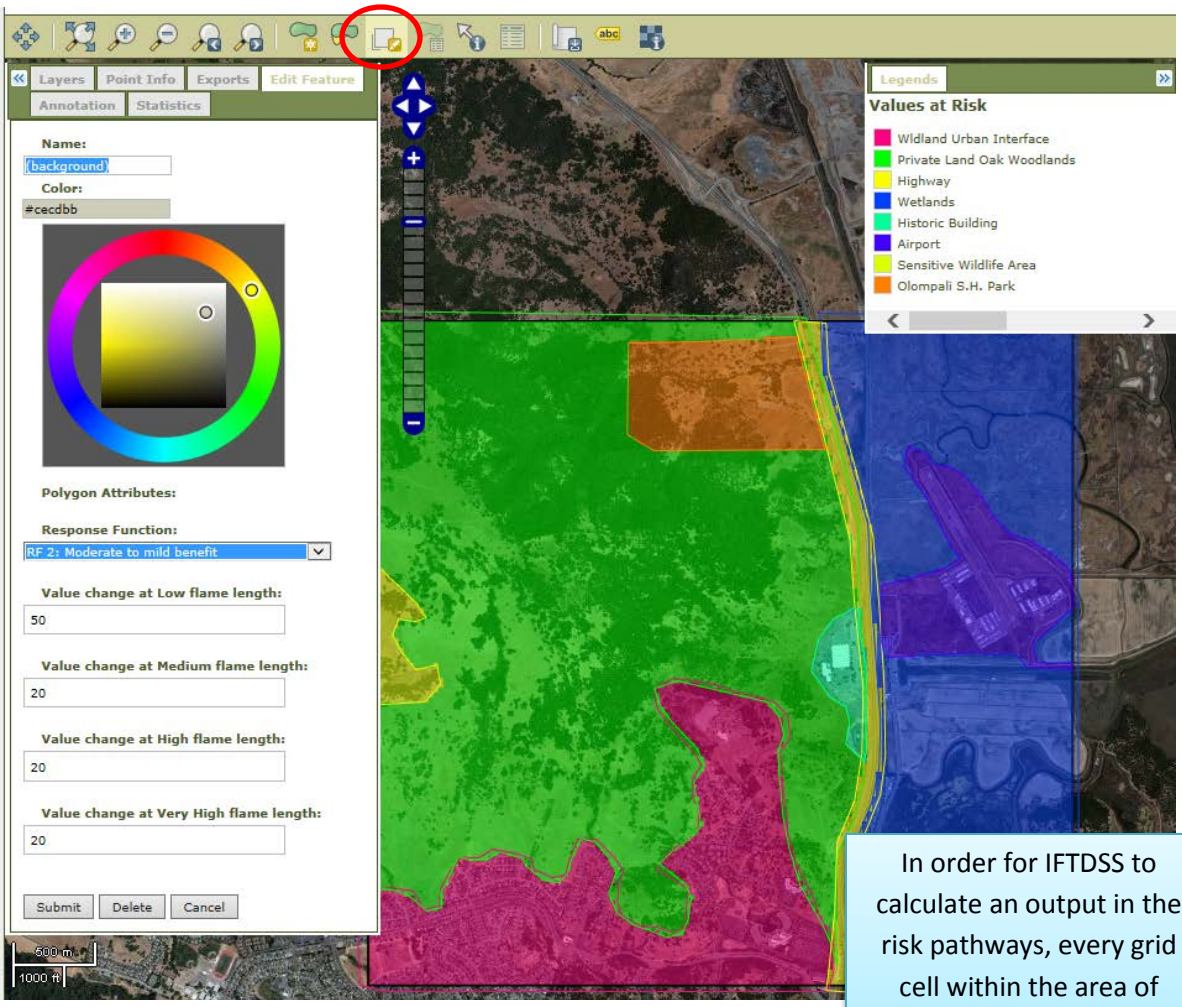


13. You can edit your polygons by selecting the **Modify Polygon** tool, selecting the polygon you would like to edit on the map, and modifying the polygon's name, color or response function in the **Edit Feature** panel. You can also delete a polygon by using the **Delete** button at the bottom of the panel. Practice editing and deleting polygons.



14. Now that you have defined all of your values at risk, you will assign a background to your values at risk map that will ensure each pixel within your run area has been assigned a response function.

    Select **Edit Background** and the **Edit Feature** panel will appear. Assign the background a color and a response function. Assign your background a response function of 4 which 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. Click **Submit**.



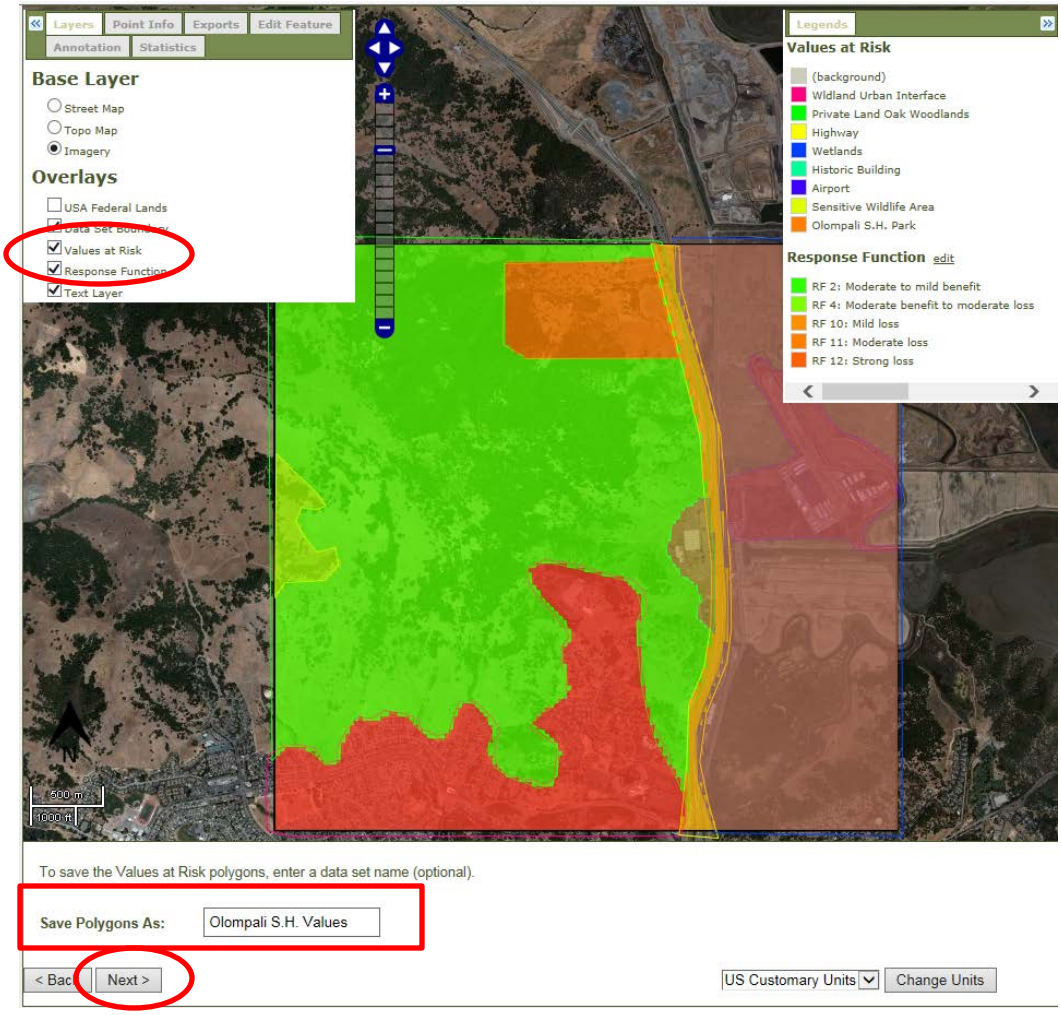
In order for IFTDSS to calculate an output in the risk pathways, every grid cell within the area of interest needs a response function.

NOTE:

- **If you accidentally move to the next screen too soon, use the workflow to come back to "Define Values at Risk" and click Edit at the bottom of the screen.**

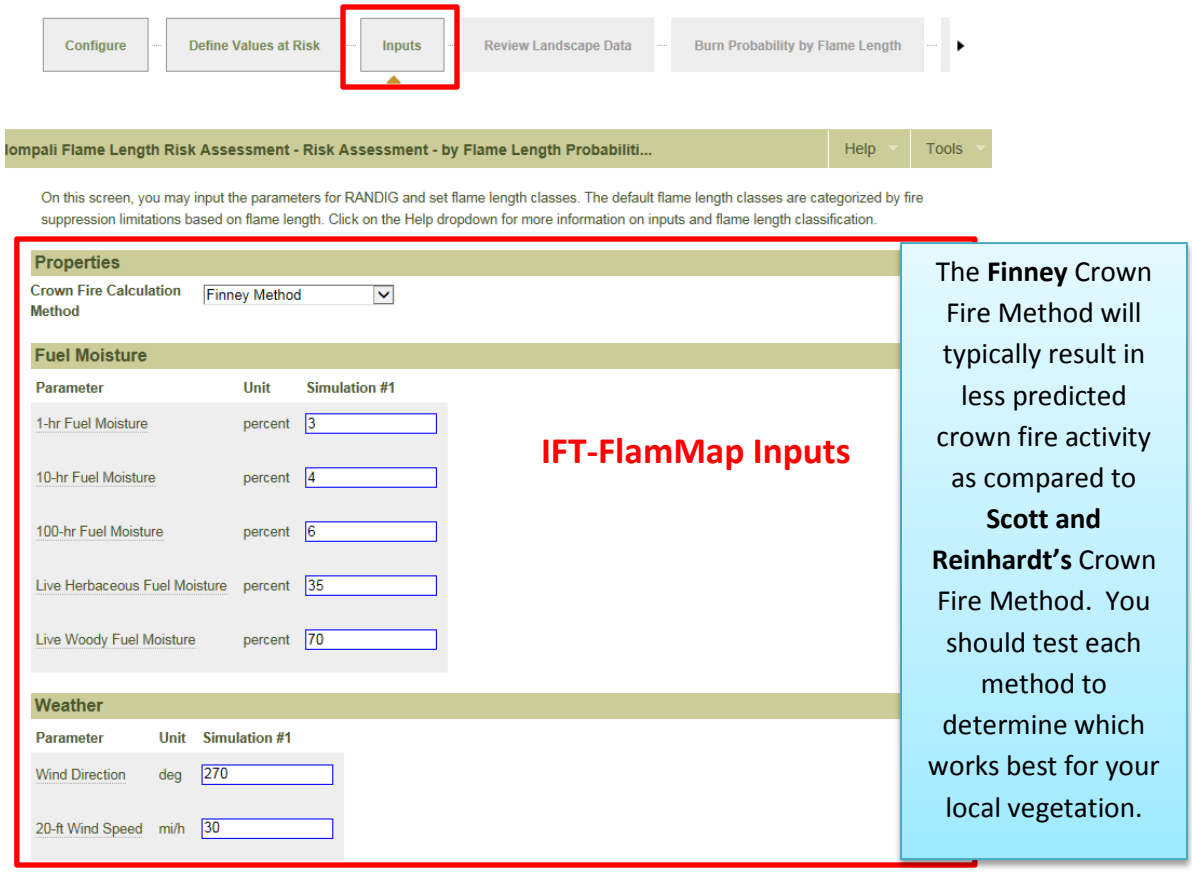
15. Review and save your values at risk map by first selecting **Response Functions** in the **Layers** panel to view your values at risk and the response functions you have assigned.

    Once you have completed your review, name your polygons in the **Save Polygons As** box and click **Next**.



CHECK IN: At this point you have drawn values and risk polygons and assigned response functions to each. You are now ready to populate your model inputs.

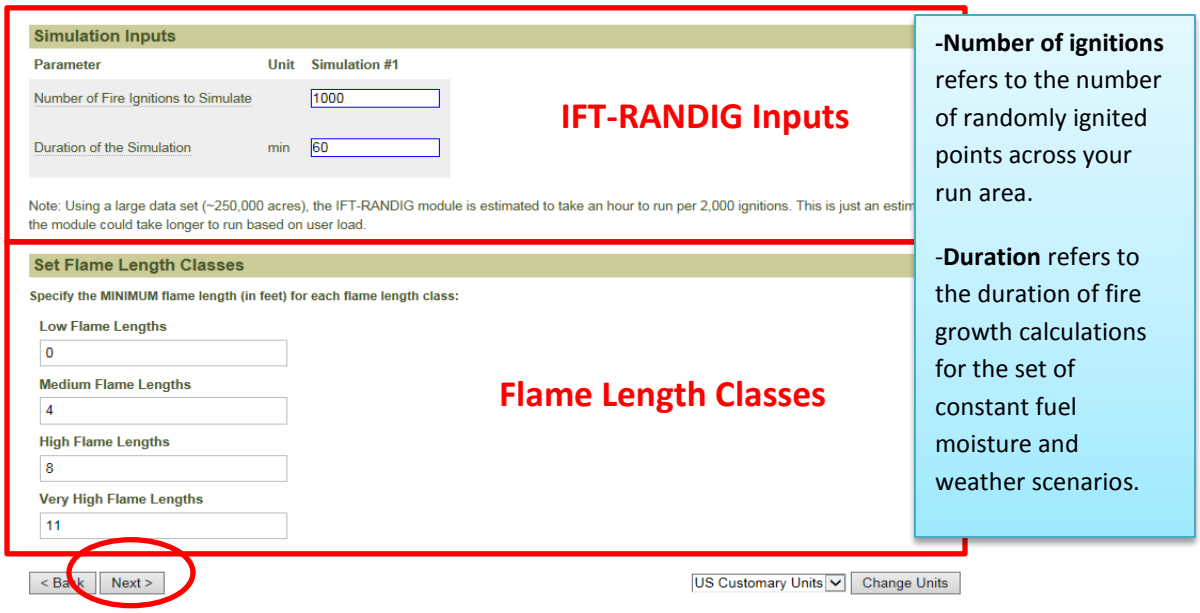
16. Now that values at risk have been identified, you will input environmental and simulation parameters needed to run the model using the **Input** step in the workflow.



For this run, enter red flag weather conditions as shown above.

TIPS on IFT-FlamMap Inputs:

- **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, high, and extreme fire behaviors. The results will help you understand how the inputs are affecting your specific area of interest.**



Start with 1000 fires and increase after reviewing your outputs if necessary. A 60 minute burn duration time was chosen because it is the estimated response time for fire resources to be on scene at the Olompali State Historic Park.

TIPS on IFT-RANDIG Inputs:

- **Every pixel should have a chance of burning; therefore, the larger the run area, the more random ignitions you will want to simulate.**
- **Start with 500 ignitions in small areas and 1000 ignitions in larger areas. Add ignitions until most of the area experiences at least one fire.**
- **Create multiple runs to model burn probability using (a) low, medium, and high numbers of fire ignitions, and (b) short and long simulation durations. The results will help you understand how these inputs are affecting your specific area of interest.**

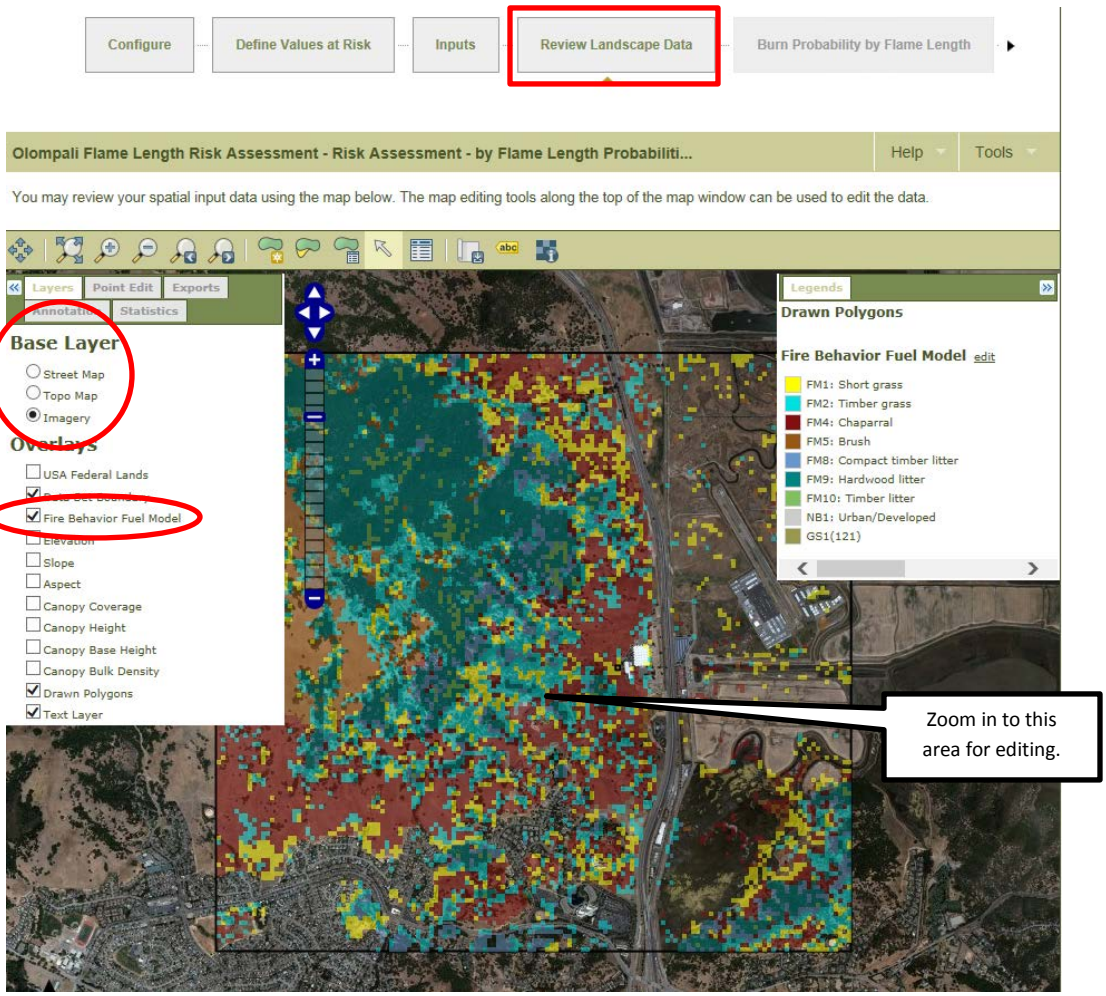
For **Flame Length Classes**, you can enter your own or accept default values. Default values are categorized by fire suppression limitations based on flame length.

Low flame lengths will always be 0 with the upper level for low flame lengths being determined by the value you enter for medium flame lengths (i.e.: low FL = 0-4 ft)

FLAME LENGTH CLASS	FLAME LENGTH	FIRE SUPPRESSION INTERPRETATIONS
Low	<4	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.

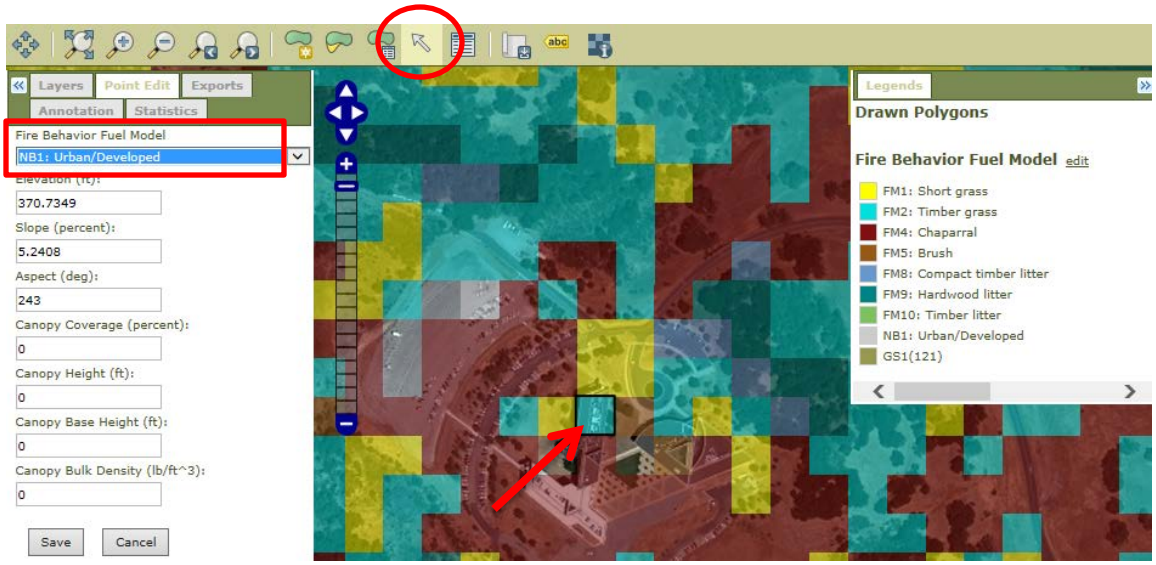
Choose **Next** to submit your inputs.

17. Review and edit your acquired landscape data on the **Review Landscape Data** step by assessing the different LANDFIRE data layers within your area of interest. Explore base layers (imagery, topography, or street maps) as the background, which may help you review and assess potential modifications to your landscape data.



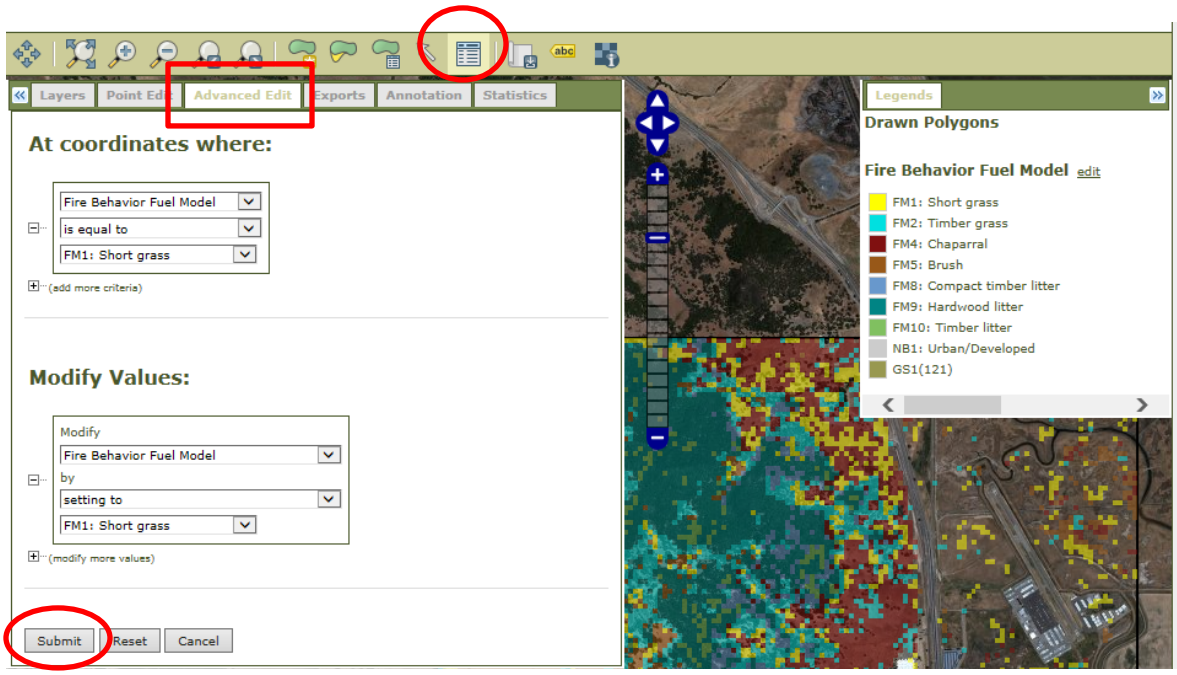
Use the **Point Edit** and **Advanced Edit** tools to make modifications to your landscape data.

First, zoom in to the middle of the area of interest where you will see a school with a large parking lot and a large building complex. Turn on the **Fire Behavior Fuel Model** layer. Find a few pixels on or around the building that are assigned burnable fuel models. Use the **Point Edit** tool to highlight these pixels and set them to NB1.



Click **Save**. Navigate around your landscape and make modifications as needed using the **Point Edit** tool.

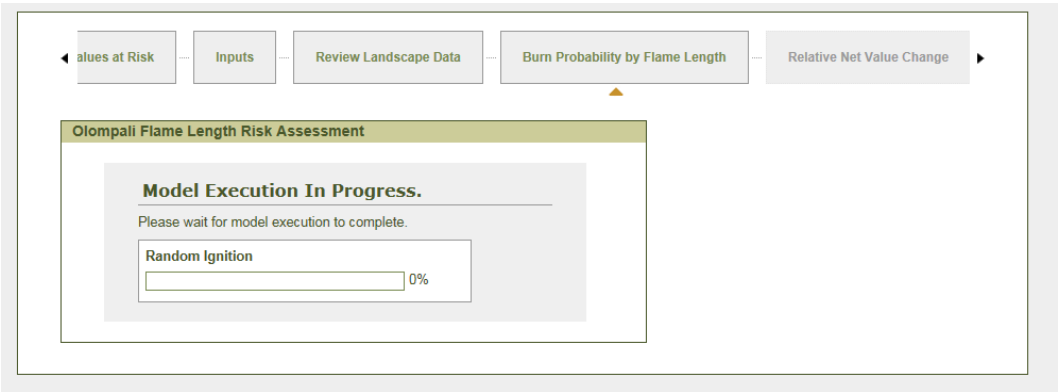
Next, use the **Advanced Edit** tool to edit multiple cells at once. Make any advanced edits of your choosing. Select the **Advanced Edit** tool and use the **Advanced Edit Panel** to modify spatial data in query form to change multiple cells at once.



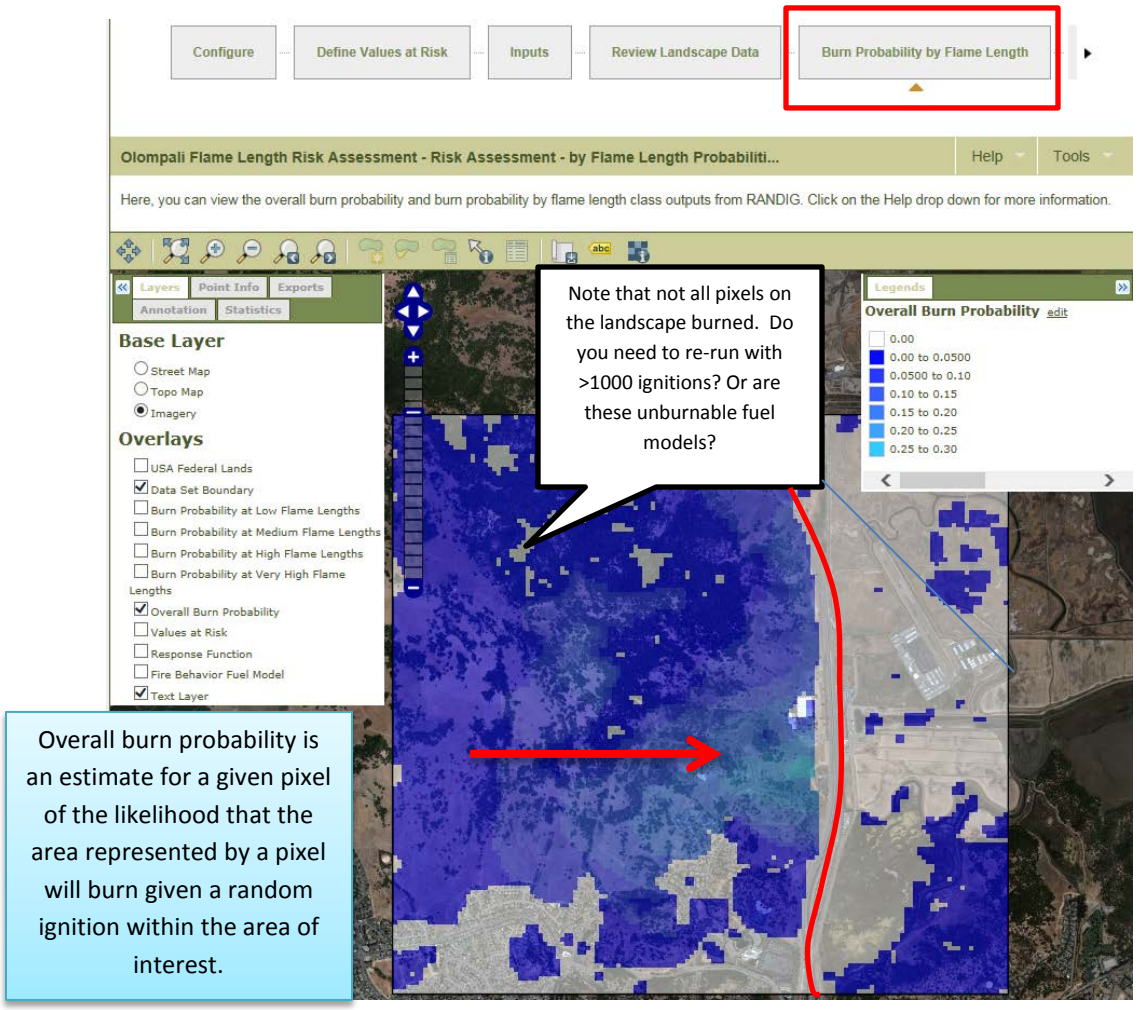
Click **Submit**.

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

The **Model Execution Progress** page will appear while the models run. This could take several minutes depending on how many ignitions you choose on the **Inputs** page.

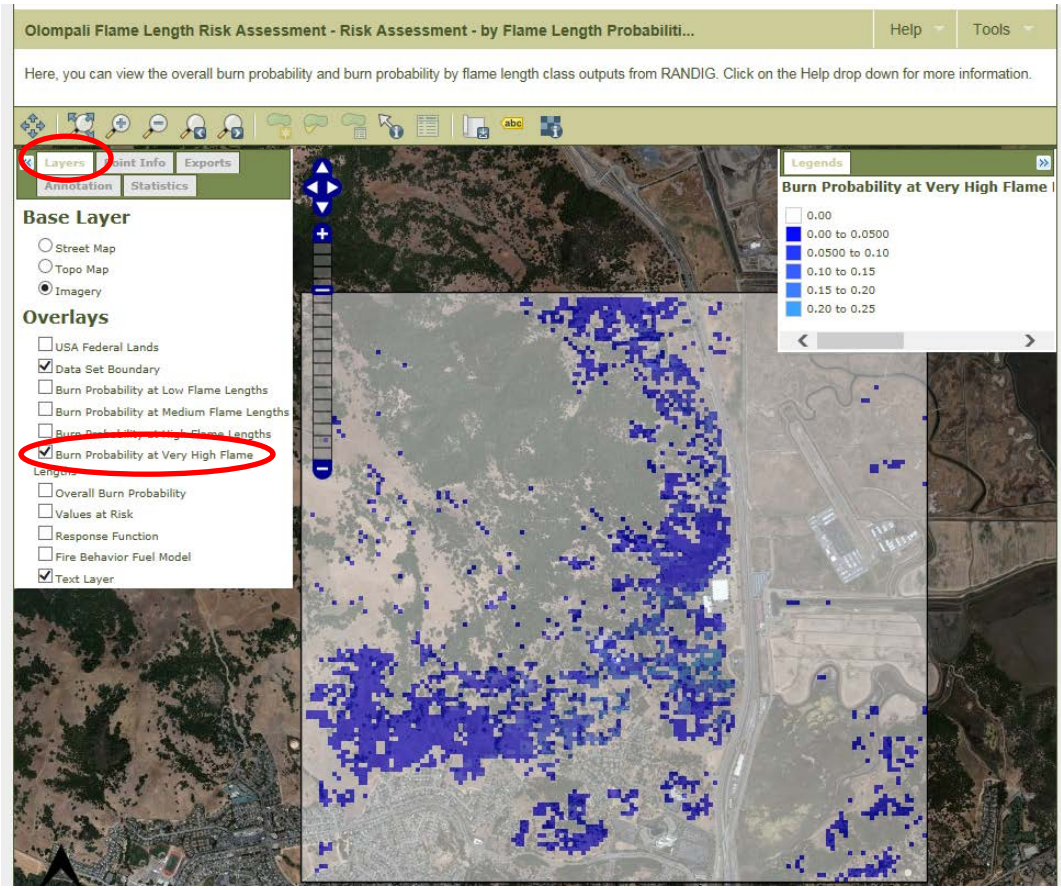


18. You should now be on the **Burn Probability by Flame Length** step in the workflow. Review the overall burn probability.

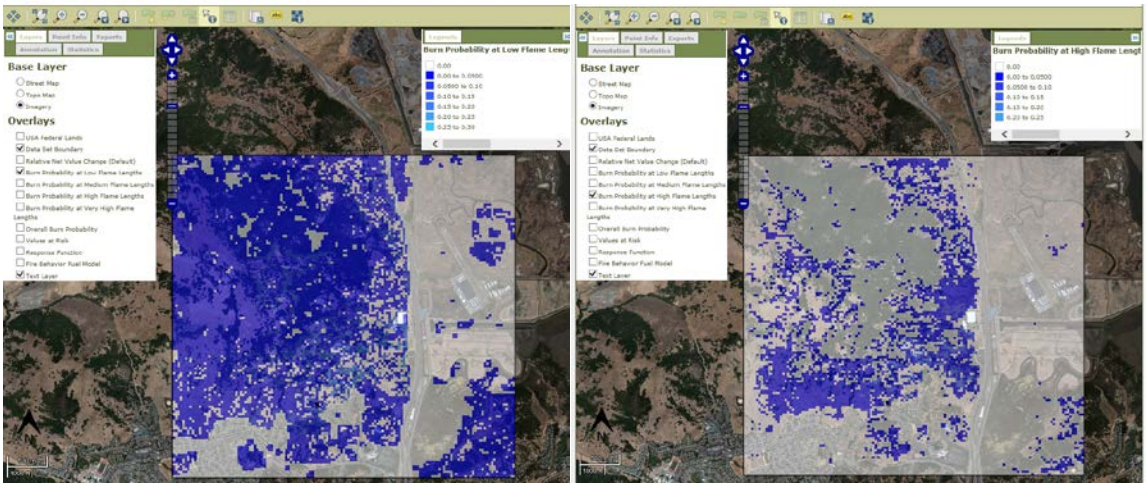


Taking a simple first look at the **Overall Burn Probability** output, note that some areas south/southeast of the school burn more readily. Why? It can be helpful to look at outputs in Google Earth.

Turn off **Overall Burn Probability** in the **Layers** tab and turn on **Burn Probability** at Very High Flame Lengths. Darker pixels represent areas that, if they burn, have a higher likelihood of burning at flame lengths greater than 11 feet.

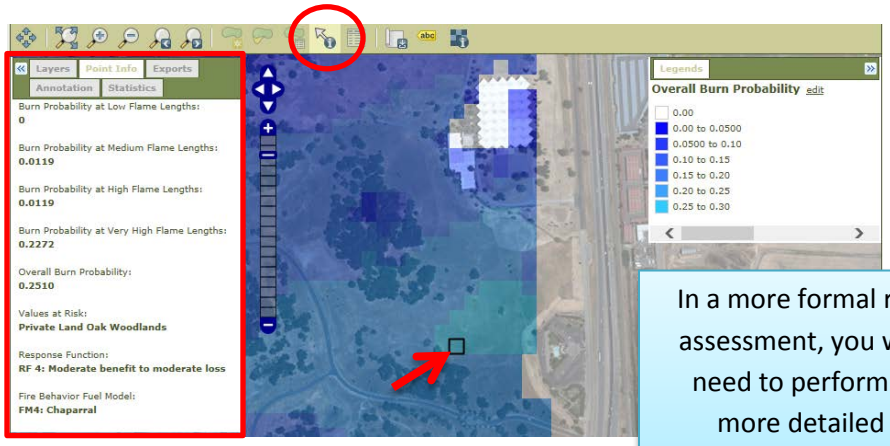


Compare burn probability between the different flame length classes. Take a minute to toggle between the Low and High flame length classes.



Under red flag conditions the model predicts more likelihood of low flame lengths (4-8 feet) than high flame lengths (8-11 feet).

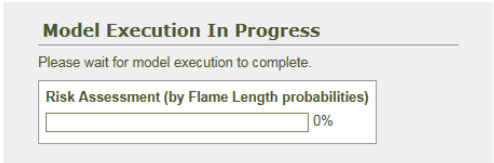
Turn the **Overall Burn Probability** layer back on and the **Very High Flame Lengths** layer off. Assess results by using the **Point Info** tool to click on several pixels of interest. The **Point Info Panel** will appear to show data.



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

CHECK IN: At this point you have populated IFT-RANDIG and IFT-FlamMap inputs and set initial flame length classes. You have also reviewed and edited your landscape data and run the IFT-RANDIG and IFT-FlamMap models. Lastly, you have reviewed and compared overall burn probability and burn probability by flame length class outputs. Next, you will process and review burn process and review your flame lengths using relative net value change inputs.

19. Click **Next** at the bottom of the **Burn Probability by Flame Length** step in the workflow to process and review your Flame Lengths using Relative Net Value Change inputs. The **Model Execution Progress** box will appear.



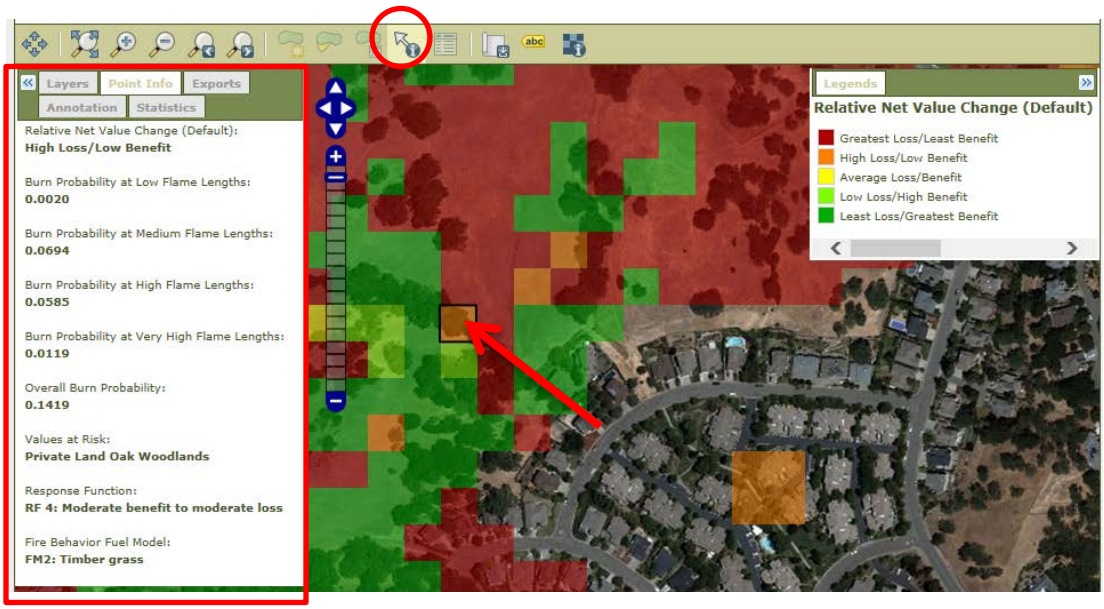
RISK is defined as the expected **NET VALUE CHANGE** per pixel calculated as the product of:

1) The probability that the area represented by the pixel burns at each flame length class given a random ignition within the project area, and
2) The resulting changes in user-defined value (**RESPONSE FUNCTION**) if the area represented by the pixel burns with a specific flame length for a single, static IFT-FlamMap run.

You should be looking at the **Relative Net Value Change** map and the **Relative Net Value Change** overlay.

Walk through this example of how Net Value Change is calculated per pixel to help you understand this concept.

Zoom into an area of interest and select an individual pixel using the **Point Info** tool.



NOTE: Relative net value change is the main output of the risk assessment pathways in IFTDSS. The relative net value change in land value due to fire is assumed to be a function of fire behavior, and includes both positive and negative effects for fire.

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 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

The pixel in the image above has been assigned a response function of 4. Burn probabilities at low, medium, high, and very high flame lengths have been calculated for each grid cell, which you can see on the **Point Info Panel** on the map view for this cell are 0.0020, 0.0694, 0.0585, and 0.119 respectively.

The Net Value Multiplier (NVC) for each of the flame length classes (circled in the table above) is multiplied by the burn probability for each flame length class, and these values are summed to calculate the relative net value change.

The equation takes into account all flame lengths as shown in the table below.

Flame Length Class	Response Function # 4 Multipliers	Operator	Burn Probability for Each Flame Length Class	Operator	Sum the Values in this Column to Calculate Relative NVC
Low	30	X	0.0020	=	0.060
Medium	10	X	0.0694	=	0.694
High	-10	X	0.0585	=	-0.585
Very High	-30	X	0.0119	=	-0.357
				Net Value Change	-0.188

The Relative Net Value Change for this specific cell is -0.188.

20. Now that you understand how Net Value Change is calculated, let's take a look at how Relative Net Value Change is classified.

    As you can see, Relative Net Value Change is automatically classified into five data subsets:

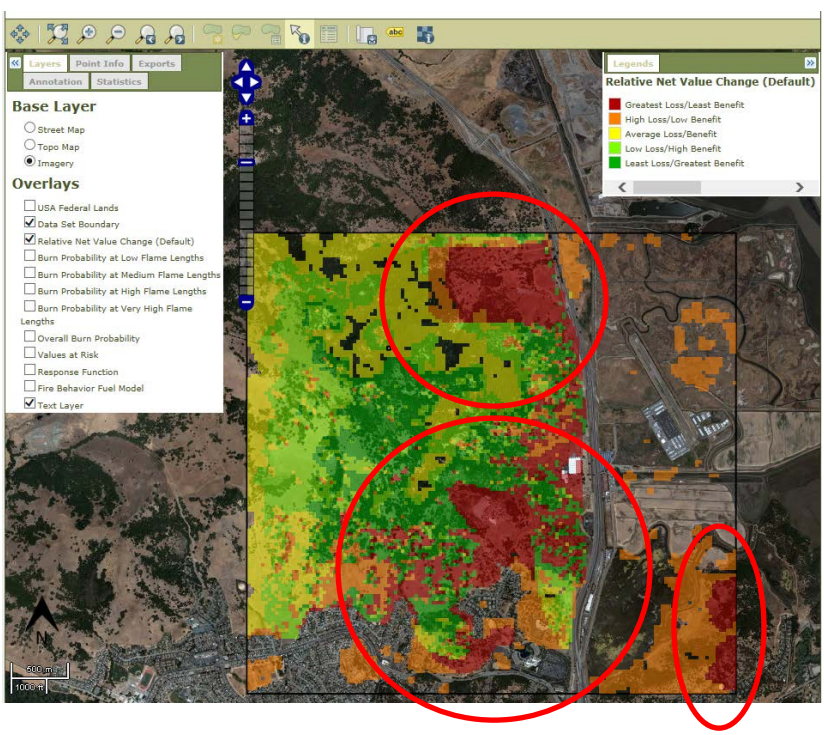
Greatest Loss/Least Benefit
High Loss/Low Benefit
Average Loss/Benefit
Low Loss/High Benefit
Least Loss/Greatest Benefit

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 -5 to +10, the data subsets will be binned into the following data ranges: -5 to -2, -2 to 1, 1 to 4, 4 to 7, and 7 to 10.

The relative net value change you calculated in the previous step was -0.188 and was therefore binned into the High Loss/Low Benefit category.

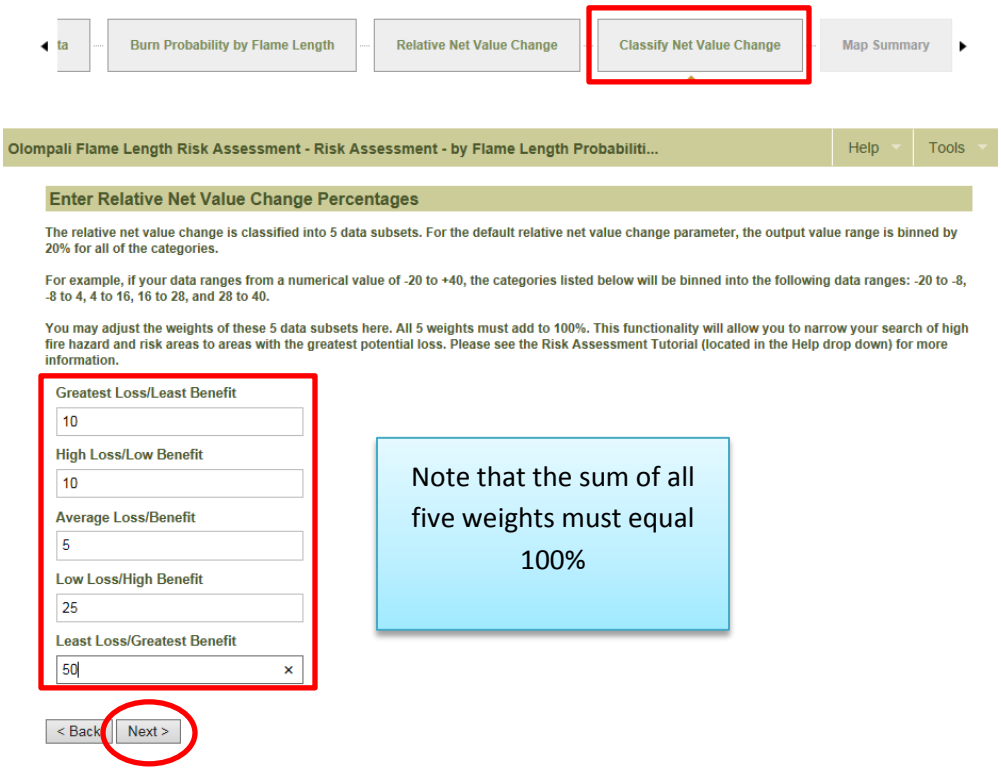
Turn on the **Relative Net Value Change** overlay if it is not already on.



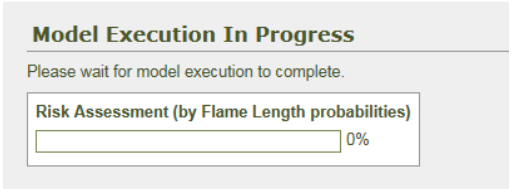
At first glance, you can see that with the default relative net value change parameters, the majority of the pixels classified in the Greatest Loss/Least Benefit category are primarily represented by the wildland urban interface and the Olompali State Historic Park values at risk polygons.

Choose **Next**.

21. To find the areas within the wildland urban interface and the Olompali State Historic Park, refine the area of interest by classifying these categories into different data ranges. On the **Classify Net Value Change** step you can adjust the breakpoints of the five data subsets to include more of the high fire hazard and risk areas to focus on more likely potential losses. Adjust your output ranges as shown below and click **Next**.

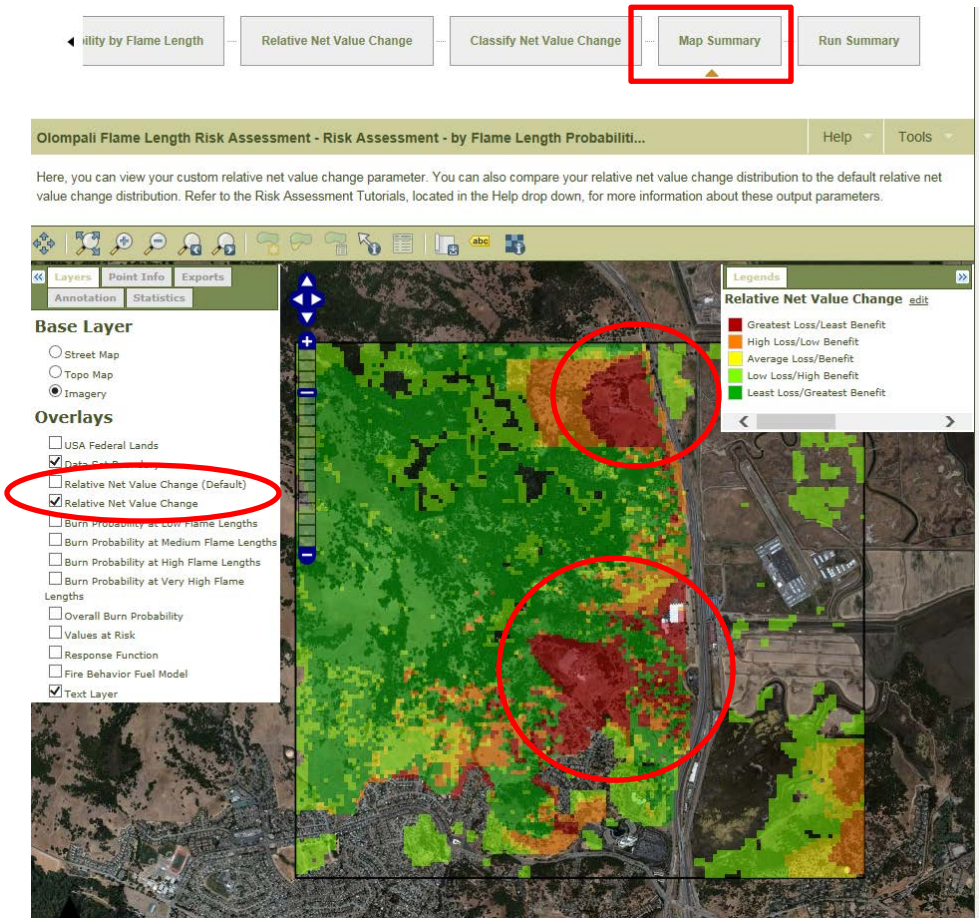


The **Model Execution Progress** box will appear.



Now you can see how your custom relative net value change distribution turned out compared to the default values. Toggle between the two in the legend to assess how well your custom bins focused attention on the highest risk areas.

Find the areas across your landscape that are predicted to have the Greatest Loss/Least Benefit due to fire.

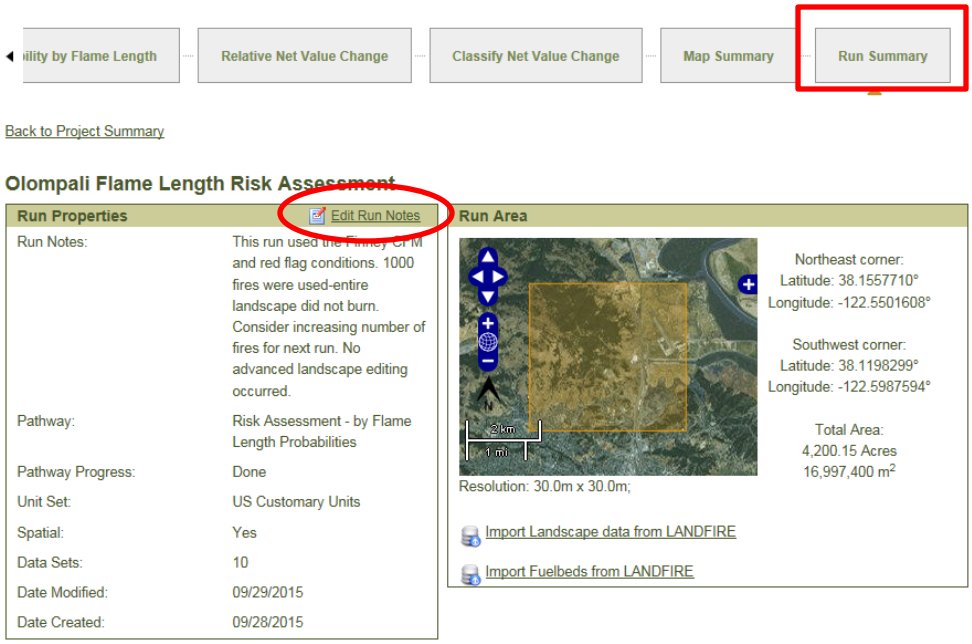


In this example, you can see that the custom relative net value change reduced the area in the Greatest Loss/Least Benefit category.

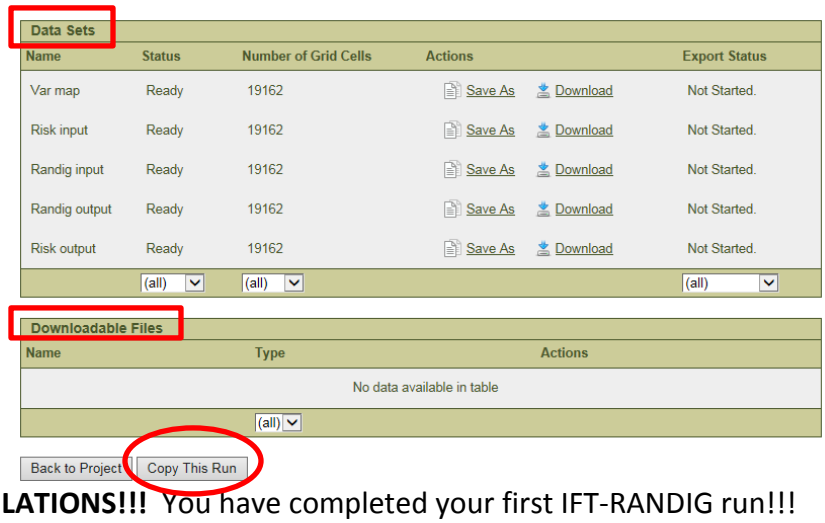
If you have Google Earth installed on your computer you can further assess your landscape data and outputs by downloading KML files from the Exports tab.

Select **Finish** when you have completed your review of your custom relative net value change outputs.

22. The final step in the Risk Assessment IFT-RANDIG workflow is to review the **Run Summary** page. Use the **Edit Run Notes** to document decisions and results of your run.



From this page you may copy or download any of the data sets created during the run sequence. Downloads may be extracted as a shapefile or raster data set. The download files can be further analyzed and/or displayed in ArcGIS. You can also **Copy This Run** to use the same run with varied input values. This helps assess different environmental variables such as wind direction or speed, increased ignitions/duration, or perhaps compare the 97th percentile to the 90th percentile weather.



CONGRATULATIONS!!! You have completed your first IFT-RANDIG run!!!

In this tutorial you did the following:

1. Set up a project and acquired LANDFIRE data
2. Developed a values-at-risk map and assigned response functions
3. Established environmental and simulation parameters for IFT-FlamMap and IFT-RANDIG
4. Reviewed and edited LANDFIRE spatial data
5. Analyzed potential burn probability outputs using relative net value change data
6. Customized relative net value change bins and compared to default values
7. Evaluated results and identified potential fire risks

Using IFT-FOFEM: An example of comparing emissions

Overview & Background

Modeling the consumption of fuels and subsequent emissions is an important step in planning for smoke management. Running fuel consumption and emission production in IFTDSS can provide insight into potential emissions generated when a given area burns, as well as gauging the emissions impacts of fuels treatments by modeling consumption using pre and post treatment fuels data. There are two options for modeling fuel consumption and emissions in IFTDSS.

1) FOFEM: First Order Fire Effects Model: A consumption, emission, and fire effects model based on the BurnUp model (Albini 1994), fuel loading, moisture content, region, season, and other variables. IFT-FOFEM can be populated with different inputs for different simulations, and is intended to be used at the stand-level.

2) Consume: A decision-making tool designed to assist planning for prescribed burns and wildfires using realistic fuels data. Consume predicts fuel consumption, pollutant emissions, and heat release based on fuel characteristics, lighting patterns, fuel moistures and other environmental variables. Consume includes separate equations for calculating consumption of activity and natural fuels. Consume may be used to generate consumption and emissions data across the landscape, while Consume for Activity Fuels or Natural fuels may be used to generate information on the stand-level.

This tutorial will focus on predicting consumption and emissions using FOFEM and provides information and step by step instructions on the following:

- Setting up a project
- Selecting and Configuring FOFEM
- Acquiring data to run IFT-FOFEM
- Populating and running IFT-FOFEM
- Viewing Output and Summary Data
- Re-running and Comparing Runs
- Review and wrap-up

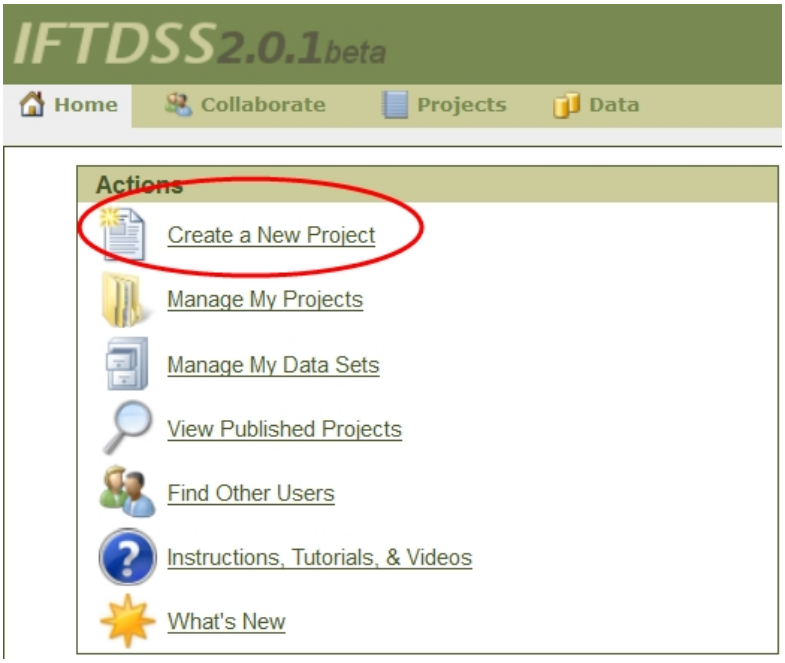
Note

We will begin by setting up a project area for this example, which contains several fuel cover types. To run IFT-FOFEM with more than one fuel type, you must run several simulations within the run, using one fuel type per scenario. This can be done as batch, so that one run produces results for numerous simulations. The results for IFT-FOFEM are displayed in tabular format, and summarized by charts, but not geospatially.

For this tutorial we will run IFT-FOFEM to compare the emissions that may result from consumption of fuel in an untreated stand, with those of a stand treated with prescribed fire.

Setting up the project

To begin, click **Create a New Project** from the actions menu.



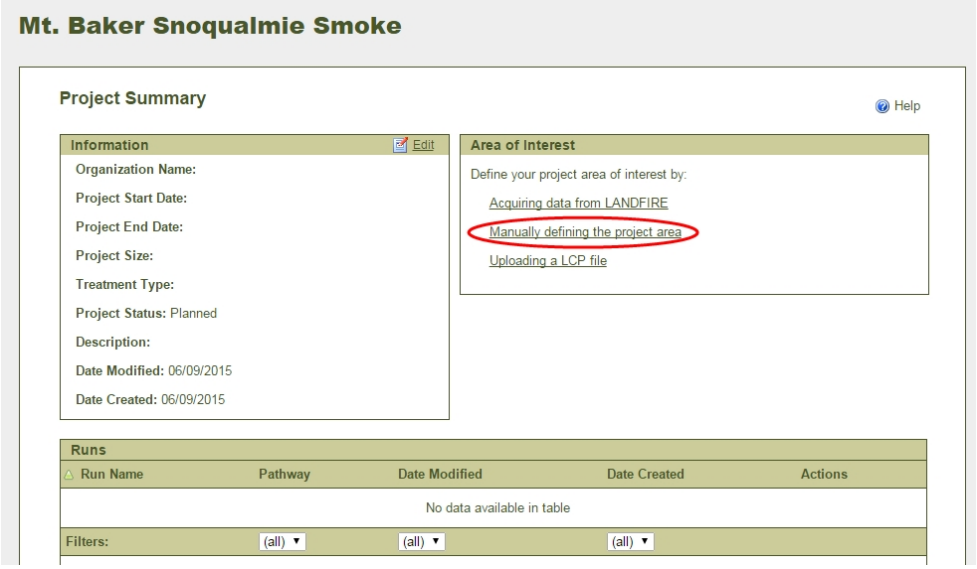
Choose a descriptive project name.

If desired, fill in the optional information.

Choose **Next**.

Upon clicking **Next** you will be taken to the workflow page. Before starting the workflow we will define the project area.

Click the **Projects** tab, at the top of the page, and select the Mt. Baker Snoqualmie Smoke project. In the Area of Interest window, choose to define your project area of interest by **Manually defining the project**.



For this example, we will select the following coordinates

North: 48.34953368145102

South: 48.24904128853667

West: -121.8202500471653

East: -121.57580424635472

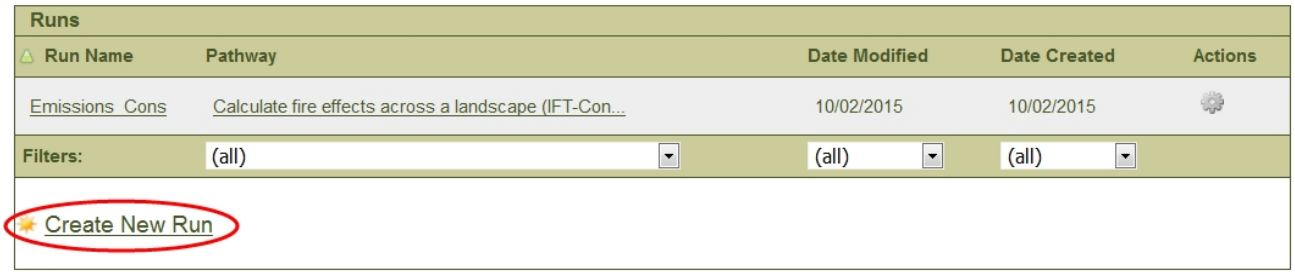
> **Note**
> You may also define your area of interest by selecting the **Draw Box** option and drawing your area of interest.

When finished, click **Next** at the bottom of the page, this will return you to the project summary page.

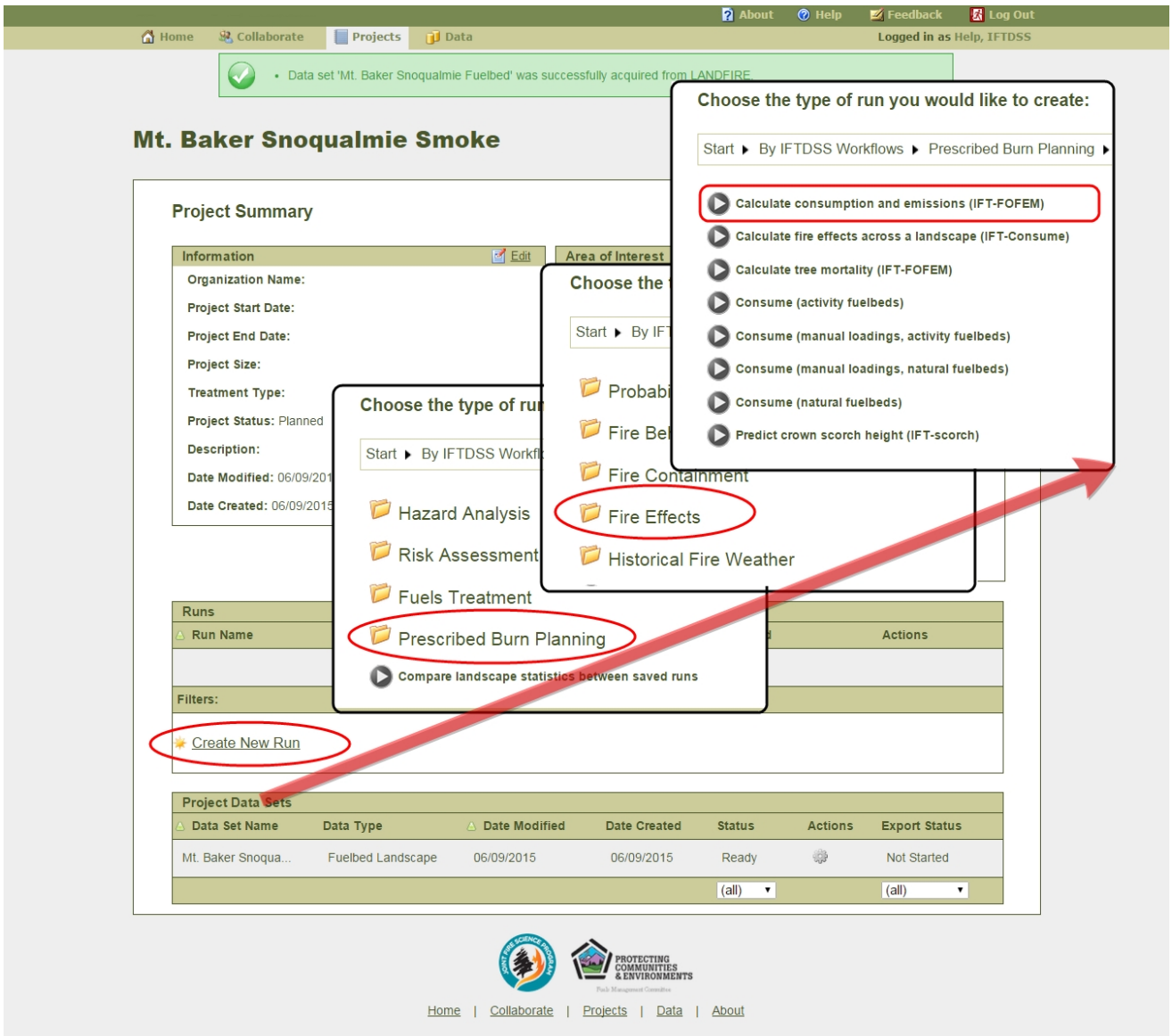
> **Note**
> While there are multiple stands and fuel types in a project area of this size, we will focus on comparing differing fuels in one stand to keep this tutorial brief. However, you may choose to represent multiple stands or multiple fuel types when running IFT-FOFEM.

Selecting and Configuring IFT-FOFEM from the IFTDSS workflows

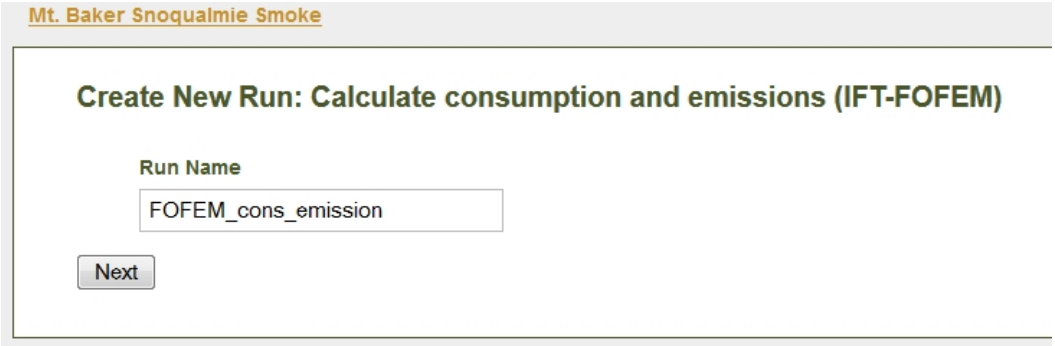
Select **Create New Run**from the **Project Summary** page



From the **Create New Run** menu, Select **Prescribed Burn Planning, Fire Effects, Calculate consumption and emissions (IFT-FOEM)**.



Name your Run, ensure the coordinates are corrects, and click **Next.**

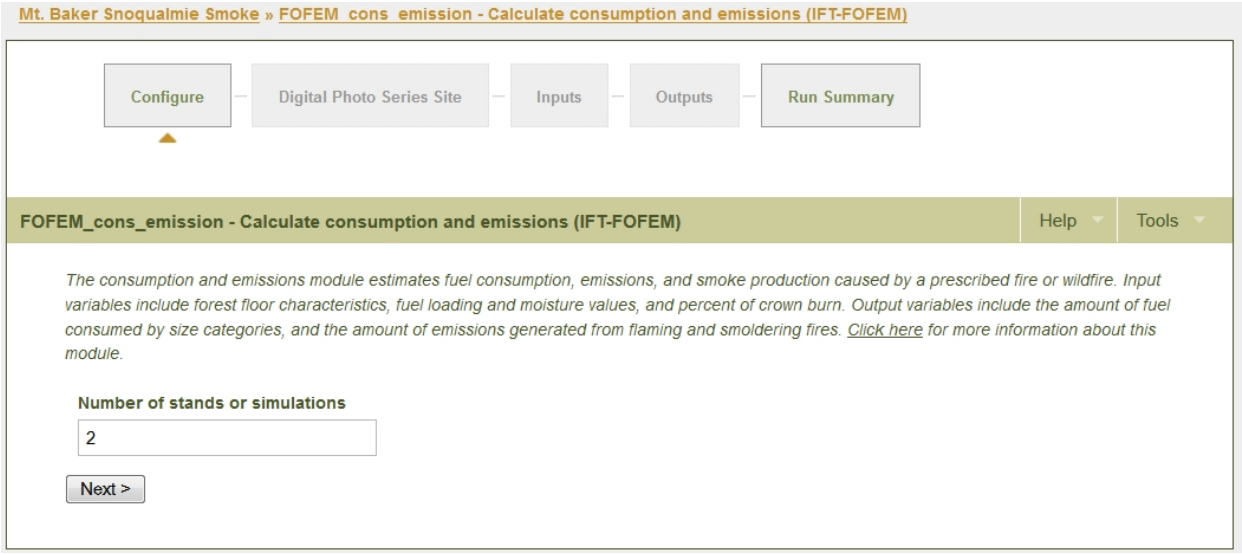


Next you will be prompted to configure the IFT-FOFEM run with the number of simulations.

For this example we will compare the emissions generated by untreated and treated fuels during a hypothetical summer fire in northwestern Washington. Specifically, we will compare emissions from two **simulations**, one using the original fuel loadings, and one in which a prior prescribed fire treatment had reduced duff, 100 hr, and coarse woody debris loadings by 50%, and litter, 1, and 10 hour fuel loadings by 75%.

Under the **number of simulations**, enter **2**. While we evaluate two simulations here, users may enter many different simulations.

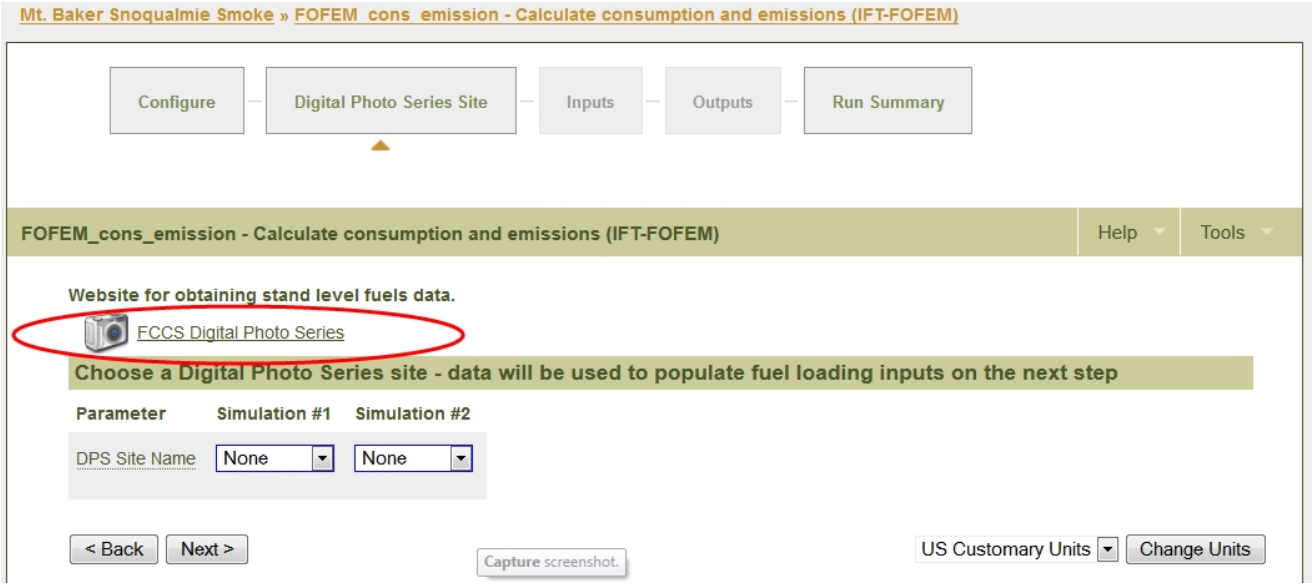
When finished, click **Next** to proceed.



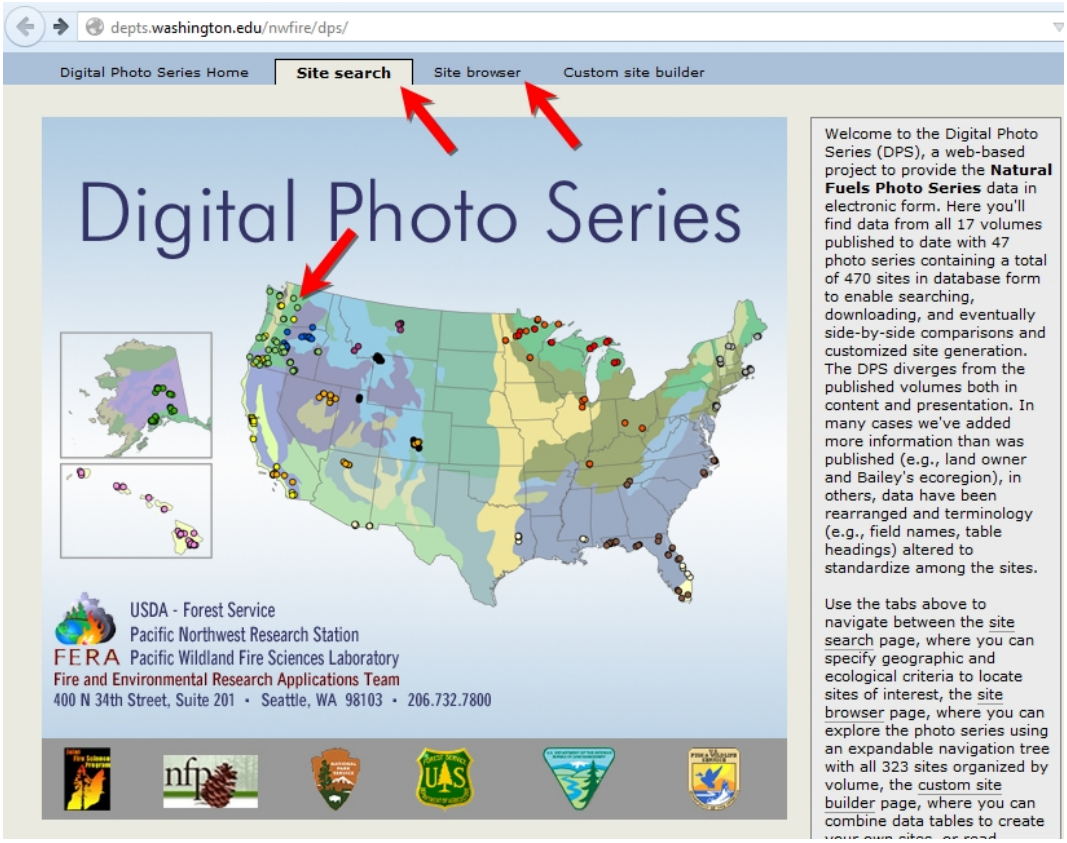
Acquiring data to run IFT-FOFEM

Next, you will be prompted to choose an **FCCS Digital Photo Series (DPS)** from which fuel loading will be drawn. If you have your own data, you may leave these blank and continue with the workflow, populating the fuel loadings without the DPS. For this example we will select a DPS.

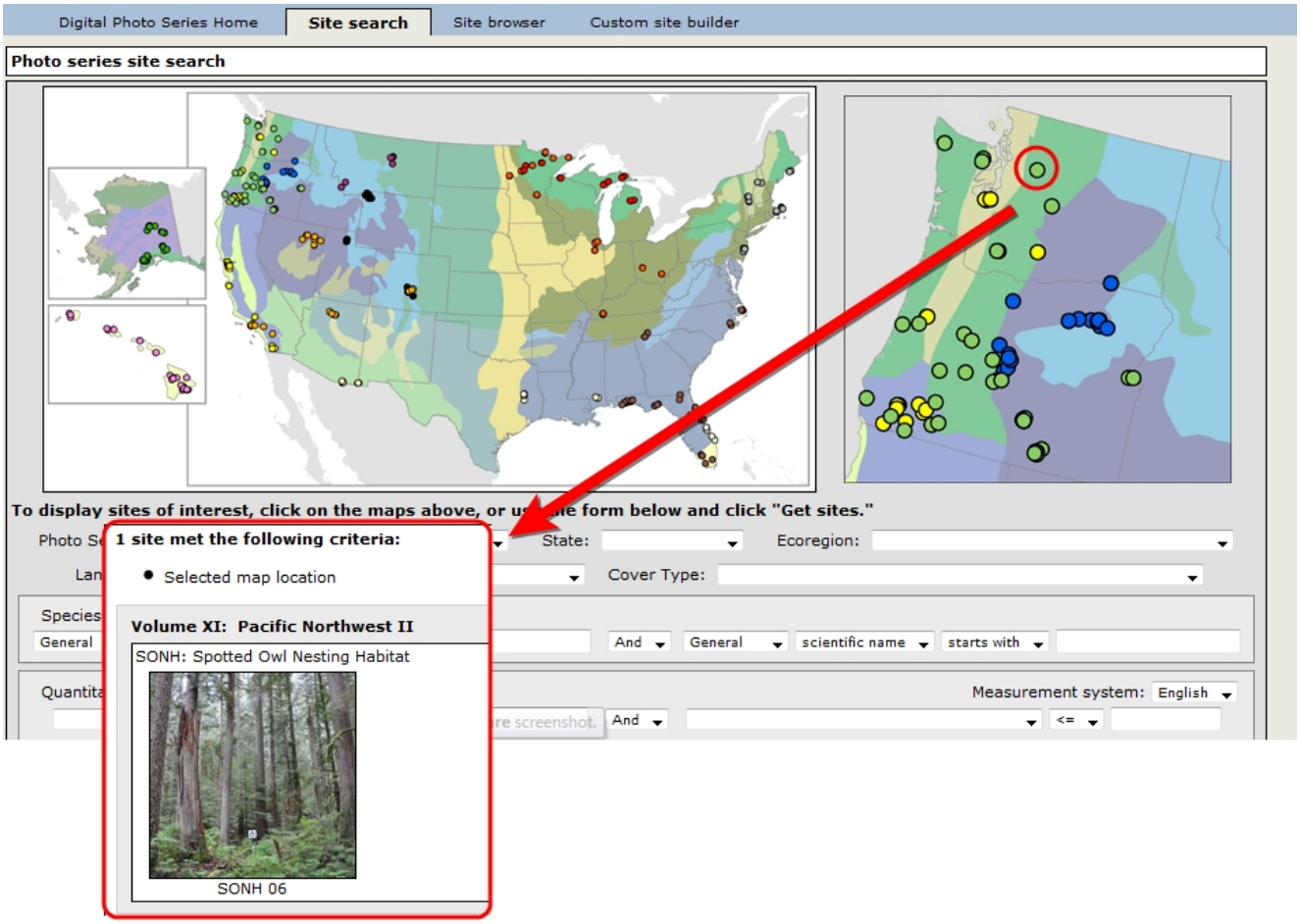
First, click on the **FCCS Digital Photo Series** option (circled in red) to see which DPS are available



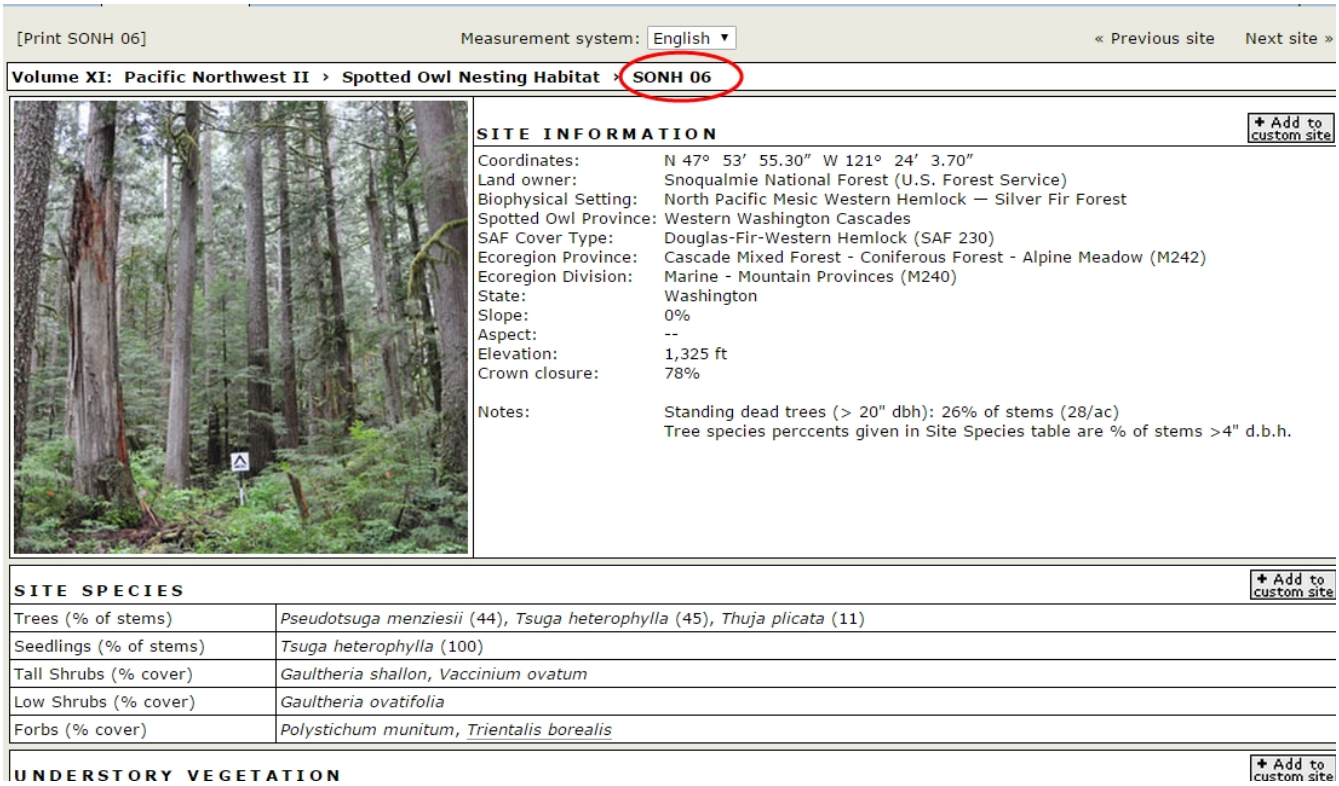
This will take you to a new page in your browser - the **Digital Photo Series** home page. Here, you may search for a specific site or browse for your site to obtain fuel loading data. You may also click on the sites indicated on the map.



Selecting **Site Search** brings up a national map with fuels sampling sites. For this example we will select the closest point to our stand (circled in red). Once a point is clicked upon, corresponding sites will appear at the bottom of the page.



Clicking on the image of the site brings up the DPS number (circled in red), site information and fuel loading details.



[Print SONH 06] Measurement system: English « Previous site Next site »

Volume XI: Pacific Northwest II › Spotted Owl Nesting Habitat › SONH 06

SITE INFORMATION

+ Add to custom site

Coordinates:	N 47° 53′ 55.30″ W 121° 24′ 3.70″
Land owner:	Snoqualmie National Forest (U.S. Forest Service)
Biophysical Setting:	North Pacific Mesic Western Hemlock — Silver Fir Forest
Spotted Owl Province:	Western Washington Cascades
SAF Cover Type:	Douglas-Fir-Western Hemlock (SAF 230)
Ecoregion Province:	Cascade Mixed Forest - Coniferous Forest - Alpine Meadow (M242)
Ecoregion Division:	Marine - Mountain Provinces (M240)
State:	Washington
Slope:	0%
Aspect:	--
Elevation:	1,325 ft
Crown closure:	78%
Notes:	Standing dead trees (> 20" dbh): 26% of stems (28/ac) Tree species perccents given in Site Species table are % of stems >4" d.b.h.

SITE SPECIES

+ Add to custom site

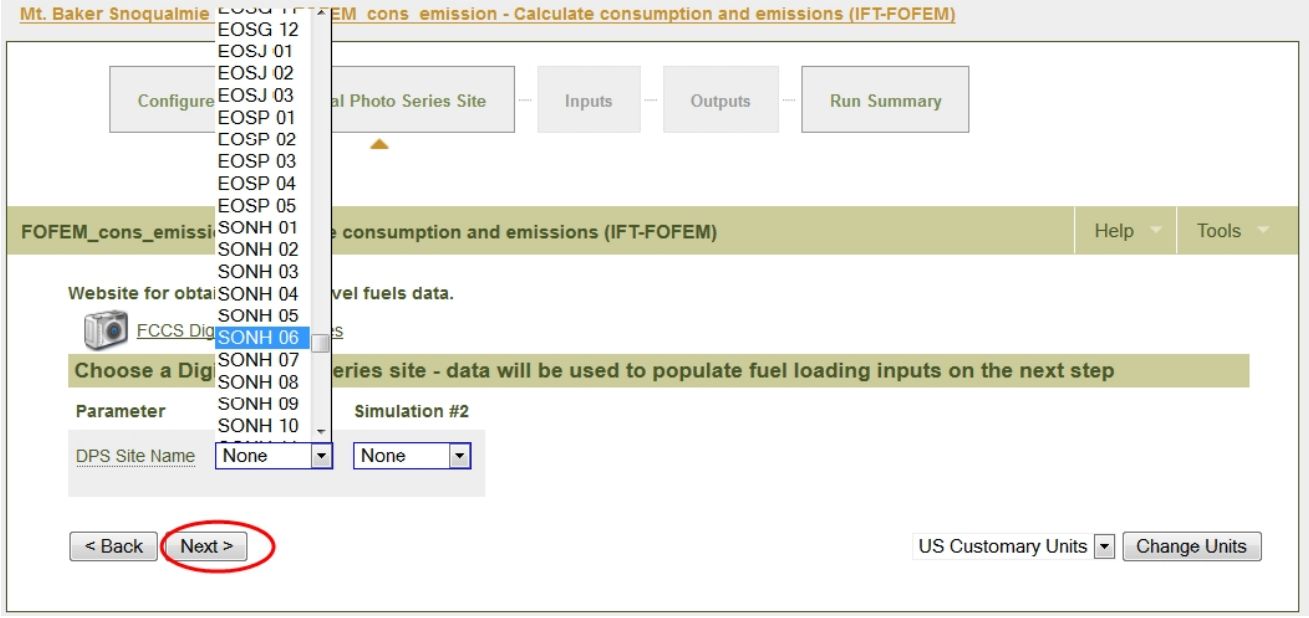
Trees (% of stems)	*Pseudotsuga menziesii* (44), *Tsuga heterophylla* (45), *Thuja plicata* (11)
Seedlings (% of stems)	*Tsuga heterophylla* (100)
Tall Shrubs (% cover)	*Gaultheria shallon*, *Vaccinium ovatum*
Low Shrubs (% cover)	*Gaultheria ovatifolia*
Forbs (% cover)	*Polystichum munitum*, *Trientalis borealis*

UNDERSTORY VEGETATION

+ Add to custom site

Review the image, site information, and fuel loading data for your chosen site. If it matches your stand, note the **DPS number** and return to the IFTDSS Digital Photo Series page. In this example we will use the DPS **SONH 6**, a site dominated by Douglas fir, hemlock, and cedar.

Select the IFTDSS Digital Photo Series number from the dropdown menu for IFTDSS simulation 1. We will leave simulation 2 blank and input the changes in fuel loading manually in the next step. You may close the browser window containing the DPS website, it will no longer be needed. Select **Next** at the bottom of the page.


Mt. Baker Snoqualmie
EM_cons_emission - Calculate consumption and emissions (IFT-FOFEM)
EOSG 12
EOSJ 01
EOSJ 02
EOSJ 03
EOSP 01
EOSP 02
EOSP 03
EOSP 04
EOSP 05
SONH 01
SONH 02
SONH 03
SONH 04
SONH 05
SONH 06
SONH 07
SONH 08
SONH 09
SONH 10
Configure
al Photo Series Site
Inputs
Outputs
Run Summary
FOFEM_cons_emissi
e consumption and emissions (IFT-FOFEM)
Help
Tools
Website for obtai
vel fuels data.
FCCS Dig
Choose a Dig
eries site - data will be used to populate fuel loading inputs on the next step
Parameter
Simulation #2
DPS Site Name
None
None
< Back
Next >
US Customary Units
Change Units

Populating and running IFT-FOFEM

For each scenario, environmental conditions, moisture, and fuel loading inputs are needed to run IFT-FOFEM. In the example below we will begin with the default fuel data acquired previously for simulation one, and reduce the fuel loadings in scenario two as per our post-prescribed fire loadings outlined earlier. Inputs needed to run FOFEM for emissions are summarized in the table below.

Input	Purpose
Environmental Inputs	
Region	Algorithm selection for shrub and duff consumption
Season	Predictive variable for herb and shrub consumption
Fuel category	Algorithm selection for duff calculation
Cover group	Algorithm selection for herb, shrub, and duff consumption
Percent of crown burn	Determines quantity of foliage consumed
Fuel Moisture	
Duff moisture method	Input to specify the degree of consumption
10 hr woody fuel moisture	
1000 hr woody fuel moisture	
Duff moisture	
Above Ground Fuels	
Crown foliage fuel loading	Input for calculating above ground fuel consumption
Crown branch fuel loading	
Shrub fuel loading	
Herbaceous fuel loading	
Woody Fuel Loading	

Input	Purpose
1 hr woody fuel loading	Input for calculating woody fuel consumption
10 hr woody fuel loading	
100 hr woody fuel loading	
1000 hr sound woody fuel loading 3-6 in.	
1000 hr sound woody fuel loading 6-9 in.	
1000 hr sound woody fuel loading 9-20 in.	
1000 hr sound woody fuel loading 20+ in.	
1000 hr rotten woody fuel loading 3-6 in.	
1000 hr rotten woody fuel loading 6-9 in.	
1000 hr rotten woody fuel loading 9-20 in.	
1000 hr rotten woody fuel loading 20+ in.	
Ground Fuels	
Litter fuel loading	Input for calculating ground fuel consumption
Duff fuel loading	
Duff depth	

Environmental inputs

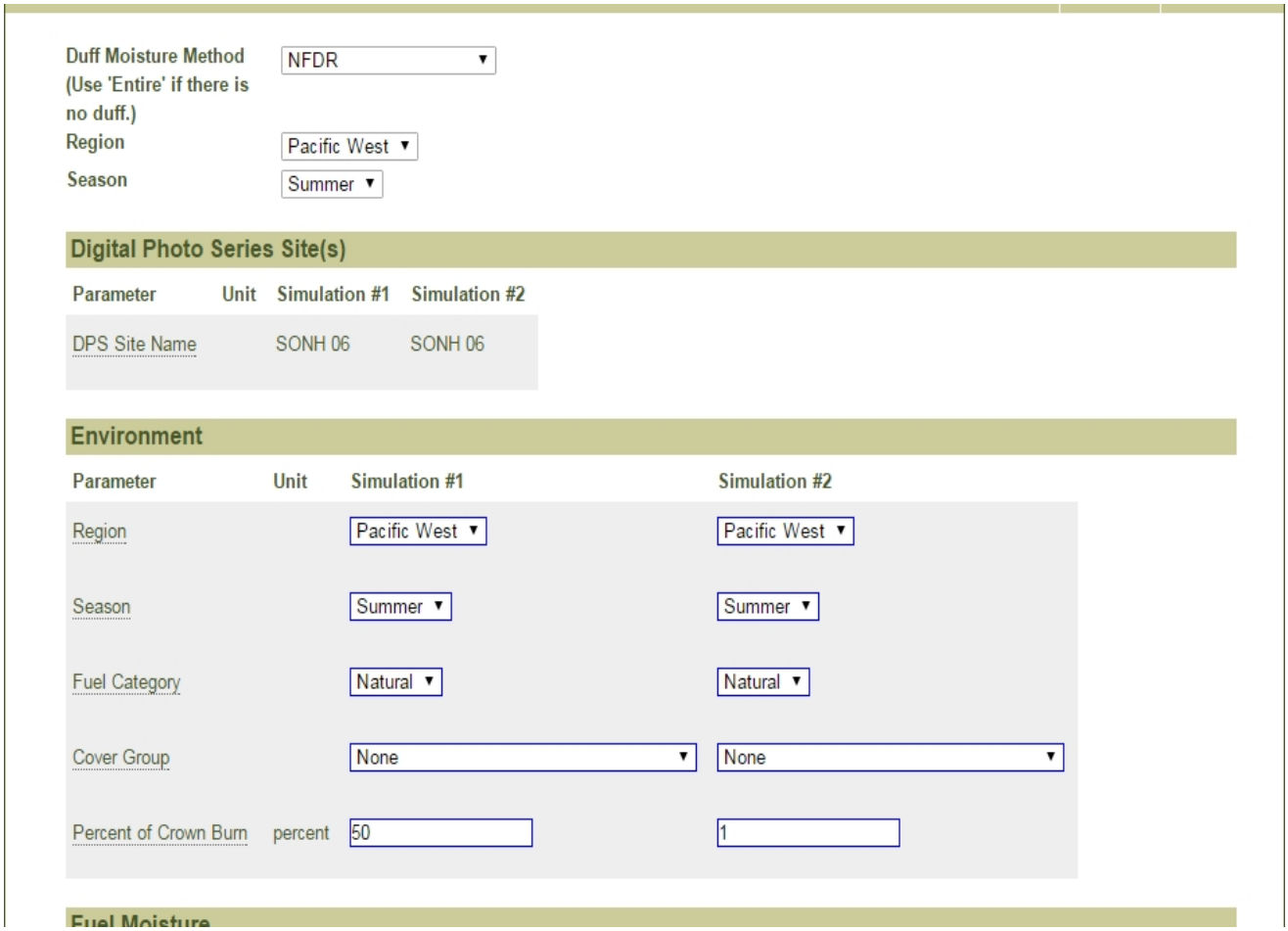
To ensure the correct consumption equations are used, information on environmental inputs must be provided. For both simulations in this example, set the **region** to **Pacific West** and the **Season** to **summer**, to evaluate the results of a fire ignited over the summer. Because the area in question is natural, rather than activity fuels, set the **Fuel category** to **Natural**.

The Cover Group[1] determines the equations used by the run to calculate fire effects. ‘**None**’ was chosen for this example as none of the choices adequately described the example area.

The percent of crown burn expected from a fire will likely need to come from experience, or local expertise. For this hypothetical example, we will assume a fire burning through the untreated simulation will result in **50% crown burn**, while the percent crown burn resulting from the post-treatment simulation 2 is set to **1%**.

> **Note**
> The value for Percent of Crown Burn must be between 1 and 100

[1]When you select a cover group in the consumption and emissions module (IFT-FOFEM), that determines the equations the module uses to calculate fire effects. These equations are based on cover types; for example, Pocosin (PC) or Ponderosa (PN). IFTDSS uses FOFEM desktop's batch mode functionality; IFTDSS does not have the direct links to the SAF/SFM, NVCS, or FCC cover classifications that are present in FOFEM desktop. In IFTDSS, you select a cover group directly based on the broad general cover groups. In FOFEM desktop, you select a SAF/SFM, NVCS, or FCC cover type, which is then mapped to a cover group. If your desired cover type does not fit into one of the cover groups provided, select “none” to use the general consumption algorithms.



Duff Moisture Method (Use 'Entire' if there is no duff.): NFDR
Region: Pacific West
Season: Summer

Digital Photo Series Site(s)

Parameter	Unit	Simulation #1	Simulation #2
DPS Site Name		SONH 06	SONH 06

Environment

Parameter	Unit	Simulation #1	Simulation #2
Region		Pacific West	Pacific West
Season		Summer	Summer
Fuel Category		Natural	Natural
Cover Group		None	None
Percent of Crown Burn	percent	50	1

Fuel Moisture

Fuel moisture inputs

For this example we will set the moisture parameters equal for both simulations, since we are primarily concerned with the emission differences resulting from the fuels. Duff moisture method, in part, determines the equations used by FOFEM. Choices for duff moisture methods include **Entire**, **Lower**, **NFDR**, **Adj_ NFDR**. For this example we'll assume duff moisture was calculated using the National Fire Danger Rating method, so we will select **NFDR** for **Duff Moisture Method**.

To represent extremely dry conditions we will set the **10-hr Woody Fuel Moisture** to **3%** and the **1000-hr Woody Fuel Moisture** and **Duff Fuel Moisture** to **11%**, for both simulations.

Fuel Moisture

Parameter	Unit	Simulation #1	Simulation #2
Duff Mositure Method		NFDR	NFDR
10-hr Woody Fuel Moisture	percent	3	3
1000-hr Woody Fuel Moisture	percent	11	11
Duff Fuel Moisture	percent	11	11

Note
Duff moisture method, in part, determines the equations used by FOFEM. For more information on duff moisture methods and FOFEM consult Reinhardt et al. 1997.

Above Ground Inputs

For above ground fuel loading, simulation 1 has been automatically filled by IFTDSS based upon the selection of Digital Photo Series Site **SONH 6**. We will assume the same crown foliage, branch, and herbaceous loading for both simulations, and half the shrub loading on the post-treatment simulation 2.

Above Ground Fuels

Parameter	Unit	Simulation #1	Simulation #2
Crown Foliage Fuel Loading	tons/ac	0.0080	0.0080
Crown Branch Fuel Loading	tons/ac	0.00	0.00
Shrub Fuel Loading	tons/ac	0.46	0.23
Herbaceous Fuel Loading	tons/ac	0.0200	0.0200

Woody Fuel Inputs

Woody fuel loadings for simulation 1 have been automatically filled by IFTDSS based upon the selection of Digital Photo Series Site **SONH 6**. For simulation 2, we'll assume 75% reduction of simulation 1 loading for 1 and 10-hr fuels, and

50% reduction for all other fuels loadings; this will represent post prescribed burn conditions in Simulation 2.

Woody Fuels

Parameter	Unit	Simulation #1	Simulation #2
1-hr Woody Fuel Loading	tons/ac	0.60	0.15
10-hr Woody Fuel Loading	tons/ac	1.90	0.475
100-hr Woody Fuel Loading	tons/ac	3.30	1.65
1000-hr Sound Woody Fuel Loading 3-6 in.	tons/ac	0.78	0.39
1000-hr Sound Woody Fuel Loading 6-9 in.	tons/ac	0.52	0.26
1000-hr Sound Woody Fuel Loading 9-20 in.	tons/ac	5.60	2.80
1000-hr Sound Woody Fuel Loading 20+ in.	tons/ac	4.10	2.05
1000-hr Rotten Woody Fuel Loading 3-6 in.	tons/ac	5.04	2.52
1000-hr Rotten Woody Fuel Loading 6-9 in.	tons/ac	3.36	1.68
1000-hr Rotten Woody Fuel Loading 9-20 in.	tons/ac	29.80	14.9
1000-hr Rotten Woody Fuel Loading 20+ in.	tons/ac	52.80	26.4

Ground Fuel Inputs

Ground fuel loadings for simulation 1 have been automatically filled by IFTDSS based upon the selection of Digital Photo Series Site SONH 6. For simulation 2, we'll assume 75% reduction of litter loadings and a 50% reduction of duff loading and depth to represent post prescribed burn conditions. When these selections are made, click **Next**.

Ground Fuels

Parameter	Unit	Simulation #1	Simulation #2
Litter Fuel Loading	tons/ac	1.00	0.25
Duff Fuel Loading	tons/ac	96.80	48.4
Duff Depth	in	12.10	6.05

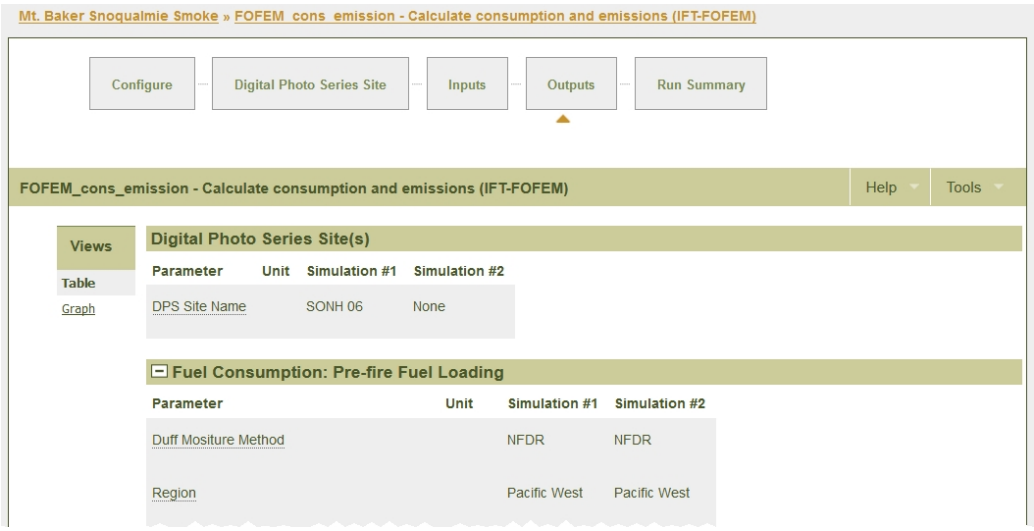
< Back | Next >

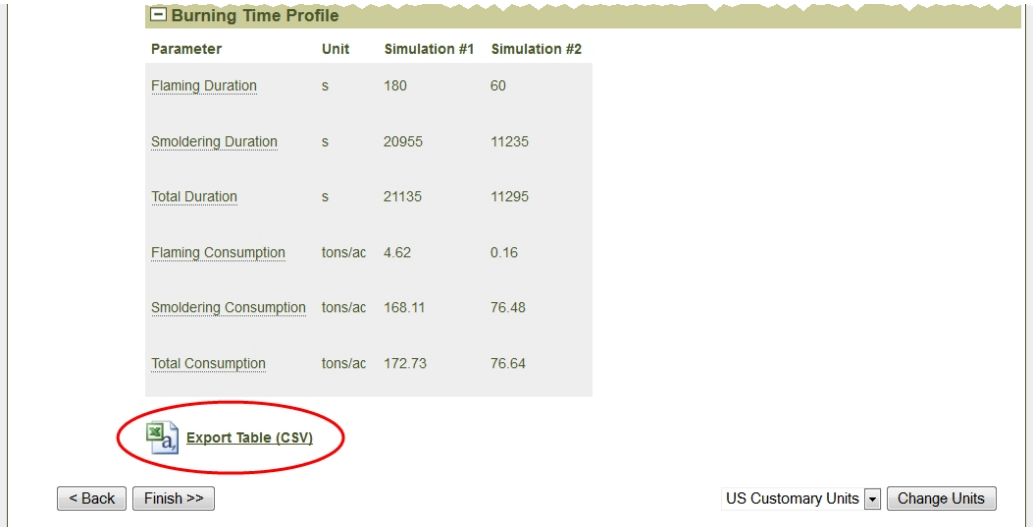
Viewing output and summary data

Emission outputs are listed in the table below. For details on all the outputs provided by IFT-FOFEM, consult the IFT-FOFEM outputs topic.

Emissions Outputs
Carbon dioxide (CO_2)generated during flaming and smoldering combustion phases.
Carbon monoxide(CO) generated during flaming and smoldering combustion phases.
Methane (CH_4) generated during flaming and smoldering combustion phases.
Nitrogen oxides (NO_x)generated during flaming and smoldering combustion phases.
Particulate matter 10 (PM_{10}) Carbon dioxide generated during flaming and smoldering combustion phases.
Particulate matter 2.5 ($PM_{2.5}$) generated during flaming and smoldering combustion phases.
Sulfur dioxide (SO_2) generated during flaming and smoldering combustion phases.

When the model is finished running, you can view the outputs as a table or export them to an Excel Spreadsheet as a CSV file.



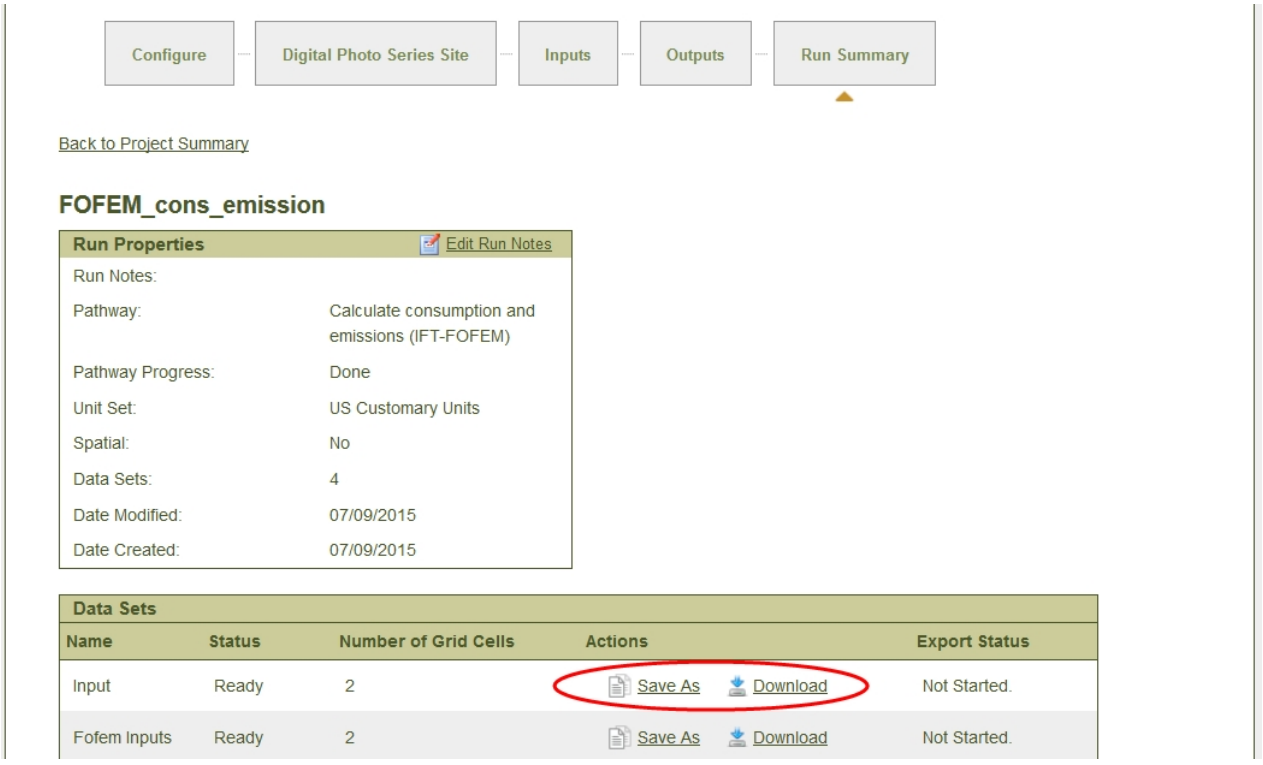


Burning Time Profile

Parameter	Unit	Simulation #1	Simulation #2
Flaming Duration	s	180	60
Smoldering Duration	s	20955	11235
Total Duration	s	21135	11295
Flaming Consumption	tons/ac	4.62	0.16
Smoldering Consumption	tons/ac	168.11	76.48
Total Consumption	tons/ac	172.73	76.64

Click finish to proceed to the **Run Summary** page.

On the summaries page you may choose to save the data from your model run, with other IFTDSS data files.



Scrolling down, there is also the option of saving the project run data as a CSV table, or downloading comparison charts for each parameter.

Downloadable Files

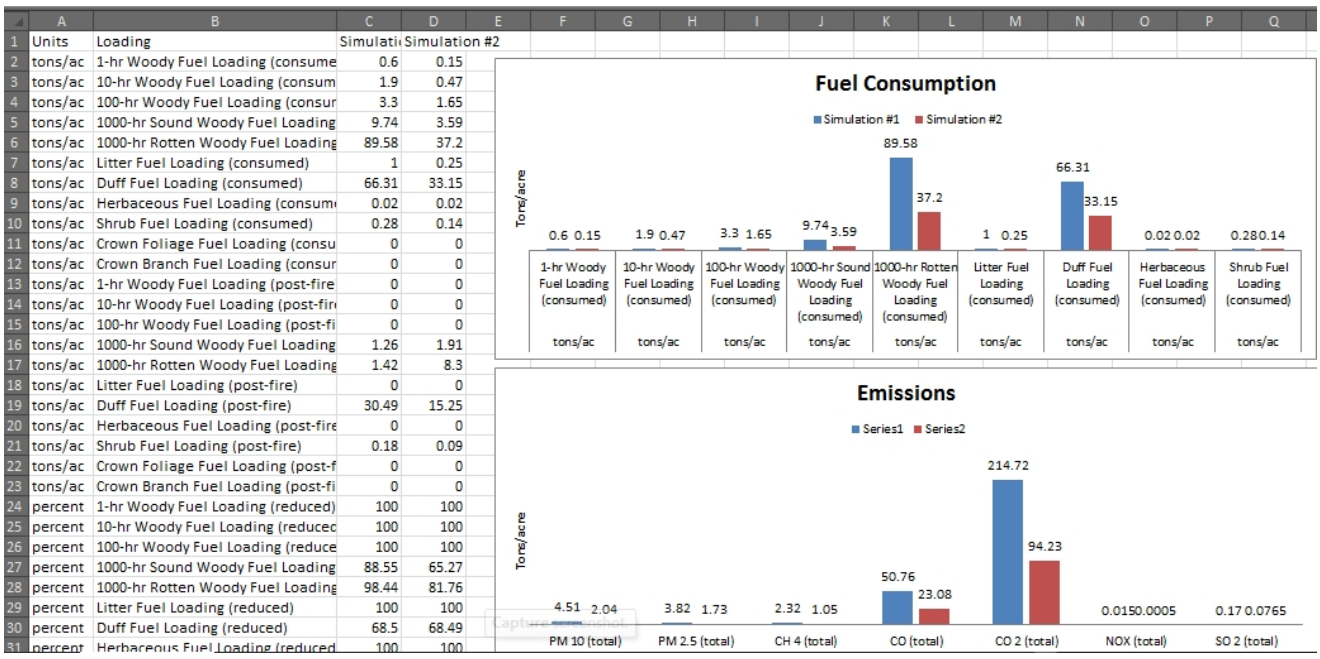
Show 10 entries Search:

Name	Type	Actions
fofem_table	Excel CSV	Download
chart.fofem_c.fuels.duffMoistureMethod	Chart	Download
chart.fofem_c.fuels.region	Chart	Download
chart.fofem_c.fuels.season	Chart	Download
chart.fofem_c.fuels.category	Chart	Download
chart.fofem_c.fuels.coverGroup	Chart	Download
chart.fofem_c.fuels.prefire.woody1hr	Chart	Download
chart.fofem_c.fuels.prefire.woody10hr	Chart	Download
chart.fofem_c.fuels.prefire.woody100hr	Chart	Download
chart.fofem_c.fuels.prefire.woody1kSound3	Chart	Download

(all)

Showing 1 to 10 of 91 entries First Previous 1 2 3 4 5 Next Last

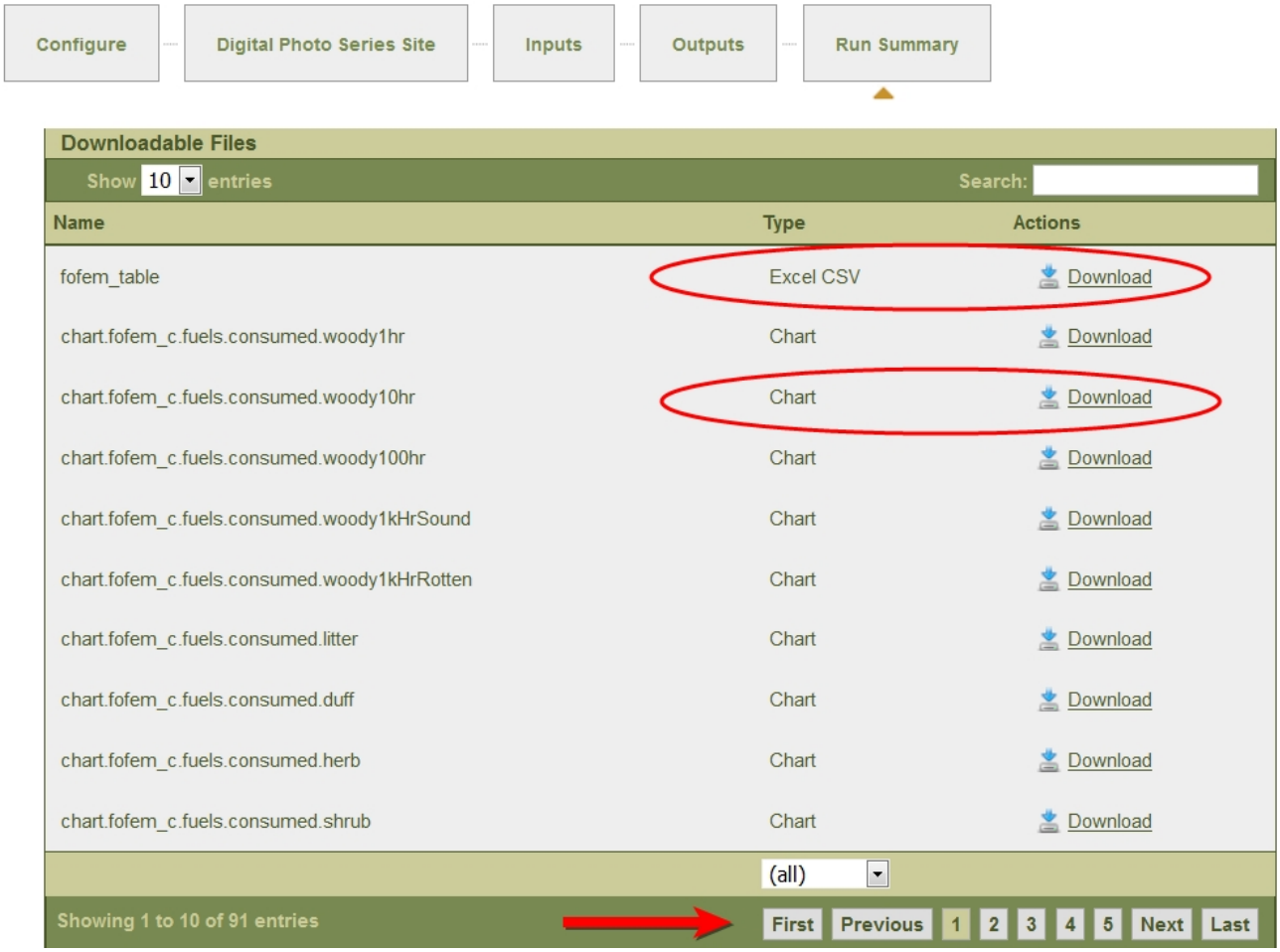
Saving a CSV table of the data allows for further analysis, or graphical representation.

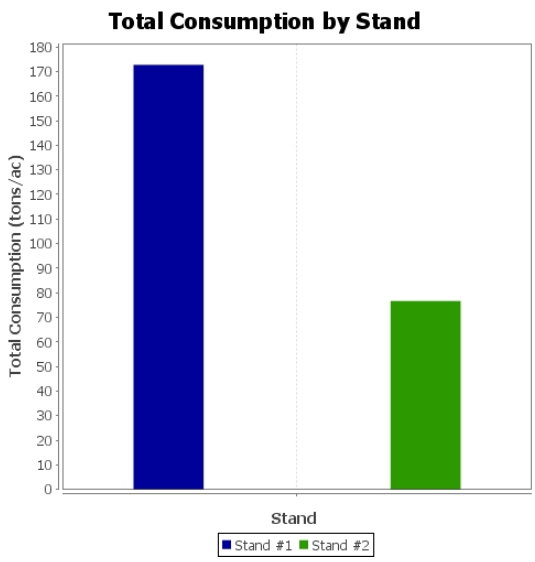


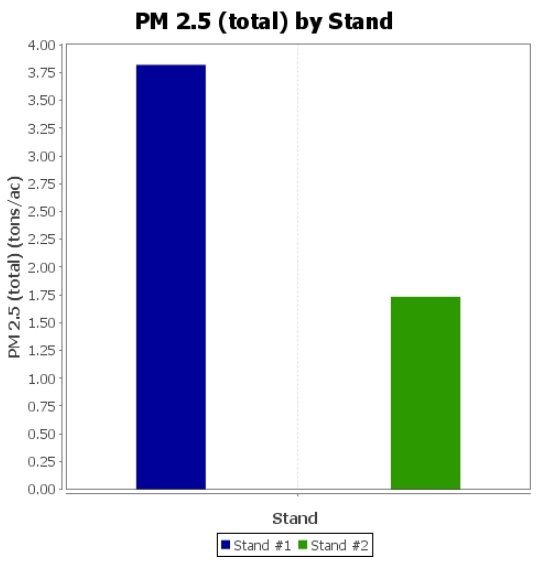
	A	B	C	D
1	Units	Loading	Simulati	Simulation #2
2	tons/ac	1-hr Woody Fuel Loading (consume	0.6	0.15
3	tons/ac	10-hr Woody Fuel Loading (consum	1.9	0.47
4	tons/ac	100-hr Woody Fuel Loading (consur	3.3	1.65
5	tons/ac	1000-hr Sound Woody Fuel Loading	9.74	3.59
6	tons/ac	1000-hr Rotten Woody Fuel Loading	89.58	37.2
7	tons/ac	Litter Fuel Loading (consumed)	1	0.25
8	tons/ac	Duff Fuel Loading (consumed)	66.31	33.15
9	tons/ac	Herbaceous Fuel Loading (consum	0.02	0.02
10	tons/ac	Shrub Fuel Loading (consumed)	0.28	0.14
11	tons/ac	Crown Foliage Fuel Loading (consu	0	0
12	tons/ac	Crown Branch Fuel Loading (consur	0	0
13	tons/ac	1-hr Woody Fuel Loading (post-fire	0	0
14	tons/ac	10-hr Woody Fuel Loading (post-fir	0	0
15	tons/ac	100-hr Woody Fuel Loading (post-fi	0	0
16	tons/ac	1000-hr Sound Woody Fuel Loading	1.26	1.91
17	tons/ac	1000-hr Rotten Woody Fuel Loading	1.42	8.3
18	tons/ac	Litter Fuel Loading (post-fire)	0	0
19	tons/ac	Duff Fuel Loading (post-fire)	30.49	15.25
20	tons/ac	Herbaceous Fuel Loading (post-fire	0	0
21	tons/ac	Shrub Fuel Loading (post-fire)	0.18	0.09
22	tons/ac	Crown Foliage Fuel Loading (post-f	0	0
23	tons/ac	Crown Branch Fuel Loading (post-fi	0	0
24	percent	1-hr Woody Fuel Loading (reduced)	100	100
25	percent	10-hr Woody Fuel Loading (reducec	100	100
26	percent	100-hr Woody Fuel Loading (reduce	100	100
27	percent	1000-hr Sound Woody Fuel Loading	88.55	65.27
28	percent	1000-hr Rotten Woody Fuel Loading	98.44	81.76
29	percent	Litter Fuel Loading (reduced)	100	100
30	percent	Duff Fuel Loading (reduced)	68.5	68.49
31	percent	Herbaceous Fuel Loading (reduced	100	100

For a quick graphic comparing specific parameters from each scenarios, you may find the IFTDSS-generated charts useful. These FOFEM output charts can

be downloaded in IFTDSS on the Run Summary page under Downloads. Note on the images below the word stand is used in place of simulation, but these are describing the same thing.







Note
There may be several pages of downloadable data. If you don't see your output of interest, check the other pages.

From the outputs generated, we can demonstrate the degree of emission reduction that would take place in the prescribed fire-treated scenario, represented by simulation 2, relative to the untreated scenario, represented by simulation 1.

In this example we compared two scenarios in one Run. But what if we needed to use numerous simulations to describe different fuel types across a large area? Using simulations to describe many different stands AND different treatment scenarios can become confusing. In such a circumstance it is better to use the simulations as stands, one for each fuel type. Then, run the simulations under pre-treatment specifications, save the outputs, and re-run the simulations under the post-treatment specifications. An outline of how to do this, is described in the next section.

Comparing Runs

One of the strengths of IFTDSS is the ability to save run inputs and results to be compared against different fuel treatment outcomes, weather conditions, moisture conditions, etc. Here we will outline the steps needed to re-run different parameters in a run while not losing data.

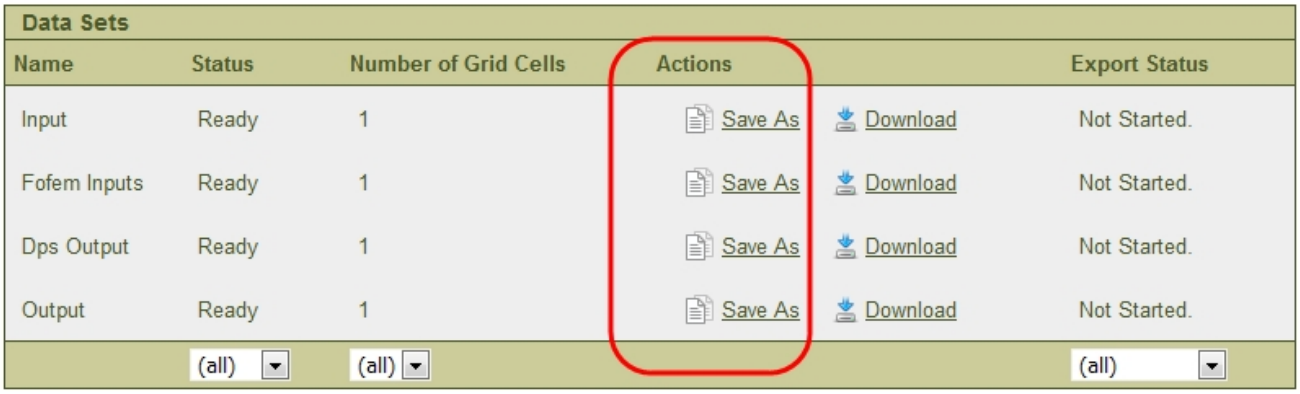
When re-running parameters it is critical that you save copies of your run inputs and outputs before re-running, as they will be automatically be overridden when the new outputs are generated.

Saving Run Inputs and Outputs

Once you have completed an initial run, record and export all the data you wish to compare from the **Outputs** page.

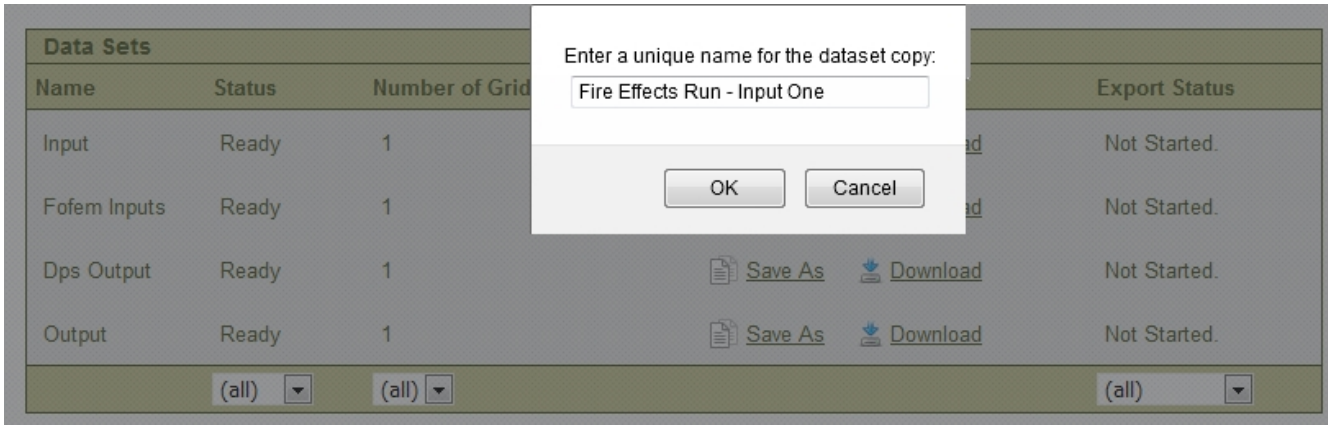
Next, proceed to the **Run Summary** page and save all the inputs and outputs for that run in case they are needed for future use.

From the run summary page, ensure to save both the Inputs and the Outputs from the Run Data set section.

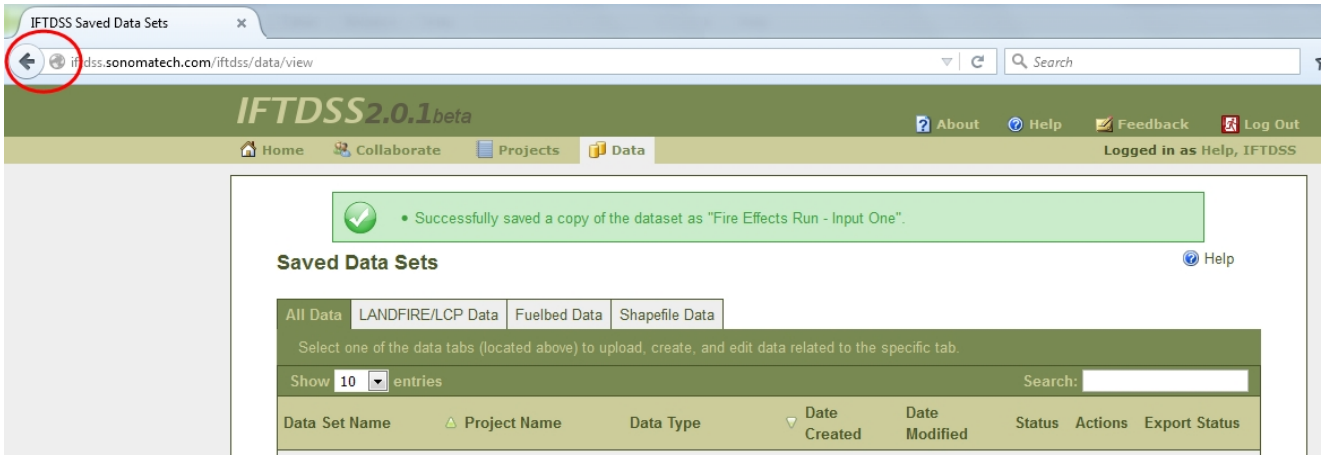


Data Sets					
Name	Status	Number of Grid Cells	Actions		Export Status
Input	Ready	1	Save As	Download	Not Started.
Fofem Inputs	Ready	1	Save As	Download	Not Started.
Dps Output	Ready	1	Save As	Download	Not Started.
Output	Ready	1	Save As	Download	Not Started.
	(all)	(all)			(all)

Be sure to save each set of inputs and outputs with a name that will be easy to recognize later.



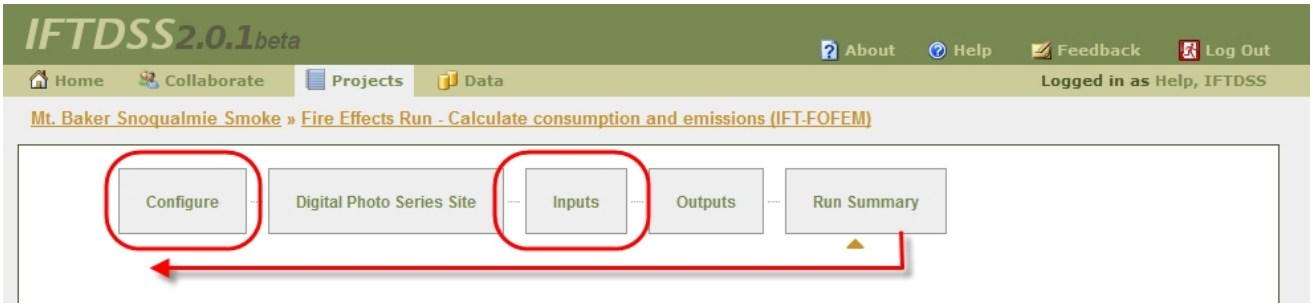
When the first data set is saved you will automatically be taken the Data Sets page. Use your browser back button to navigate back to the Run Summary page and continue saving each data set.



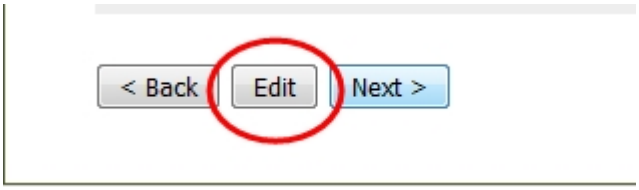
Ensure that all data sets from the run are saved.

Re-run and Save

Once all the inputs and data are saved from the initial run, you may use the top progress bar to navigate back to the desired stage in the run that requires alteration.



To start editing data click the **Edit** button at the bottom of the page.

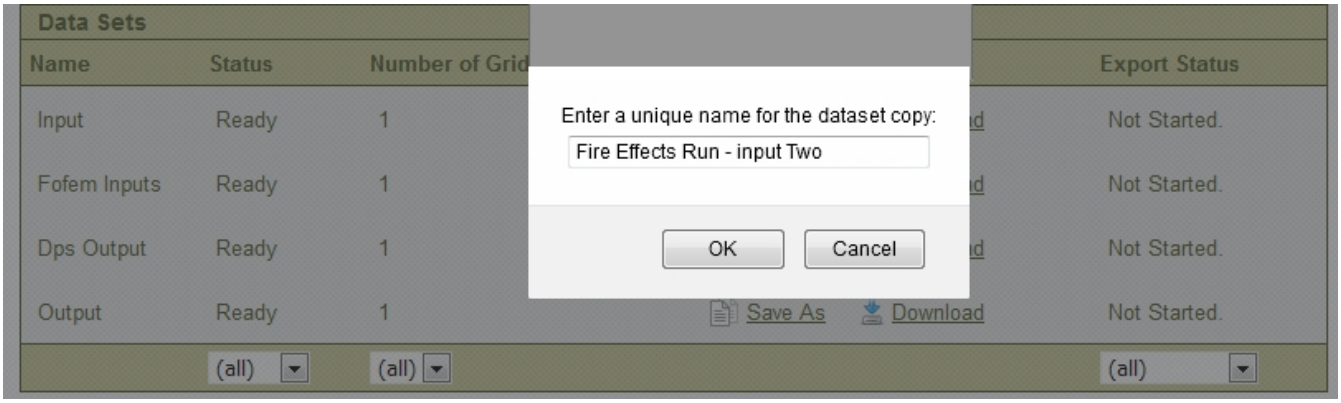


Once the alterations are made, click **Next** and proceed through the remainder of the Run until you are again at the **Outputs** page.

Like before, you can record or export all the outputs of interest and make your comparisons.

To save these inputs and outputs for future use, proceed to the **Run Summary** page and

save your altered inputs and outputs using a name that will be easily recognized.



Review

In this tutorial we walked through the steps needed to predict consumption and emissions using IFT-FOFEM. The tutorial provided information and step by step instructions on:

- Setting up a project
- Selecting and Configuring FOFEM
- Acquiring data to run IFT-FOFEM
- Populating and running IFT-FOFEM
- Viewing Output and Summary Data
- Re-running and Comparing Runs

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, prescribed burn planning, fuels treatment, spatial analysis across a landscape, and many more.

Using IFT-Consume for Landscape Smoke Management Planning

Overview & Background

Modeling the consumption of fuels and subsequent emissions is an important step in planning for smoke management. Running fuel consumption and emission production in IFTDSS can provide insight into potential emissions generated when a given area burns, as well as gauging the emissions impacts of fuels treatments by modeling consumption using pre and post treatment fuels
data. IFTDSS workflows are laid out to either calculate fire effects at the stand level (Fire Effects>Calculate consumption or emissions), or at the landscape level (Fire Effects>Fire effects across the landscape). To calculate fire effects at the landscape level, you will run IFT-Consume.

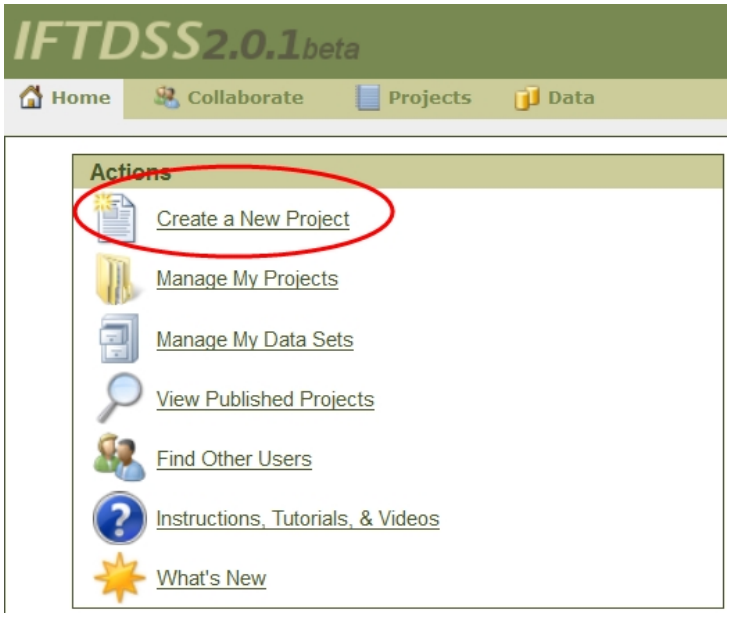
IFT-Consume is a decision-making tool designed to assist planning for prescribed burns and wildfires using fuels data. IFT-Consume predicts fuel consumption, pollutant emissions, and heat release based on input fuel characteristics, lighting patterns, fuel moistures and other environmental variables. IFT-Consume includes separate equations for calculating consumption of activity and natural fuels. IFT-Consume may be used to generate consumption and emissions data across the landscape, while Consume for Activity Fuels or Natural fuels may be used to generate information on the stand-level.

This tutorial will focus on predicting consumption and emissions using Consume. It will provide information and step by step instructions on the following:

- Setting up a project
- Acquiring FCCS fuelbed data to run IFT-Consume
- Selecting -IFT Consume from the IFTDSS workflows
- Populating and running the IFT-Consume model
- Viewing output data
- Exporting data as raster layers to ArcMap for analysis
- Evaluating results (in ArcMap)
- Review and wrap-up

Setting up the project

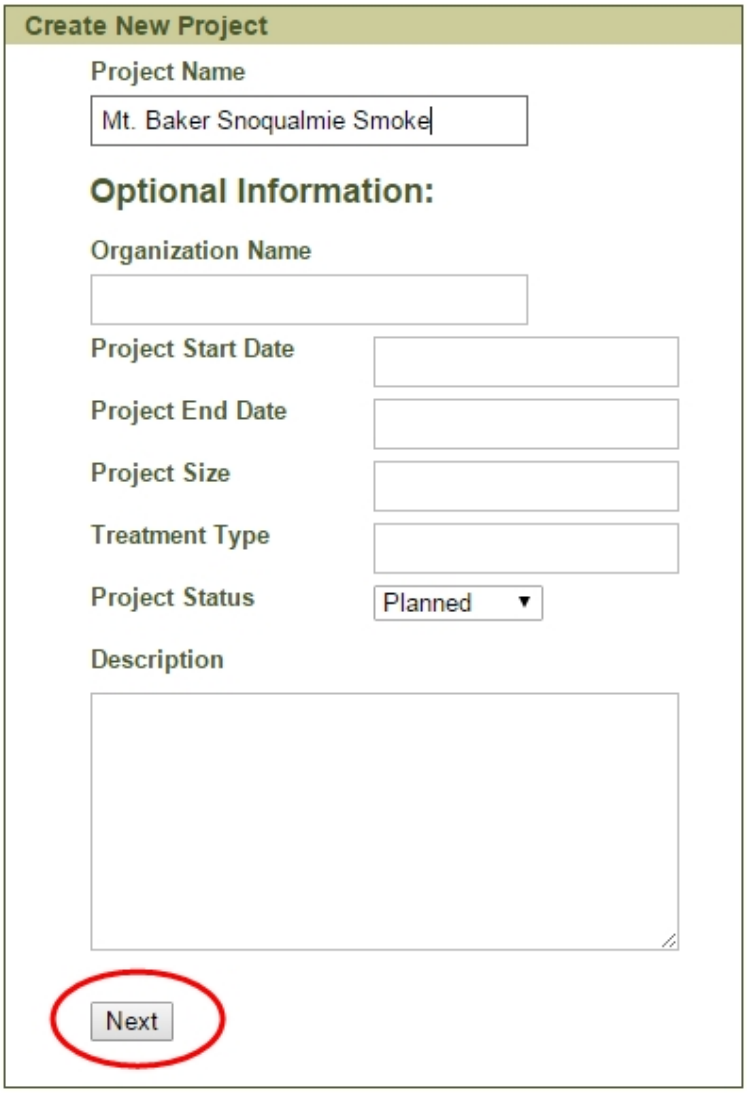
To begin, click **Create a New Project** from the actions menu.



Choose a descriptive project name.

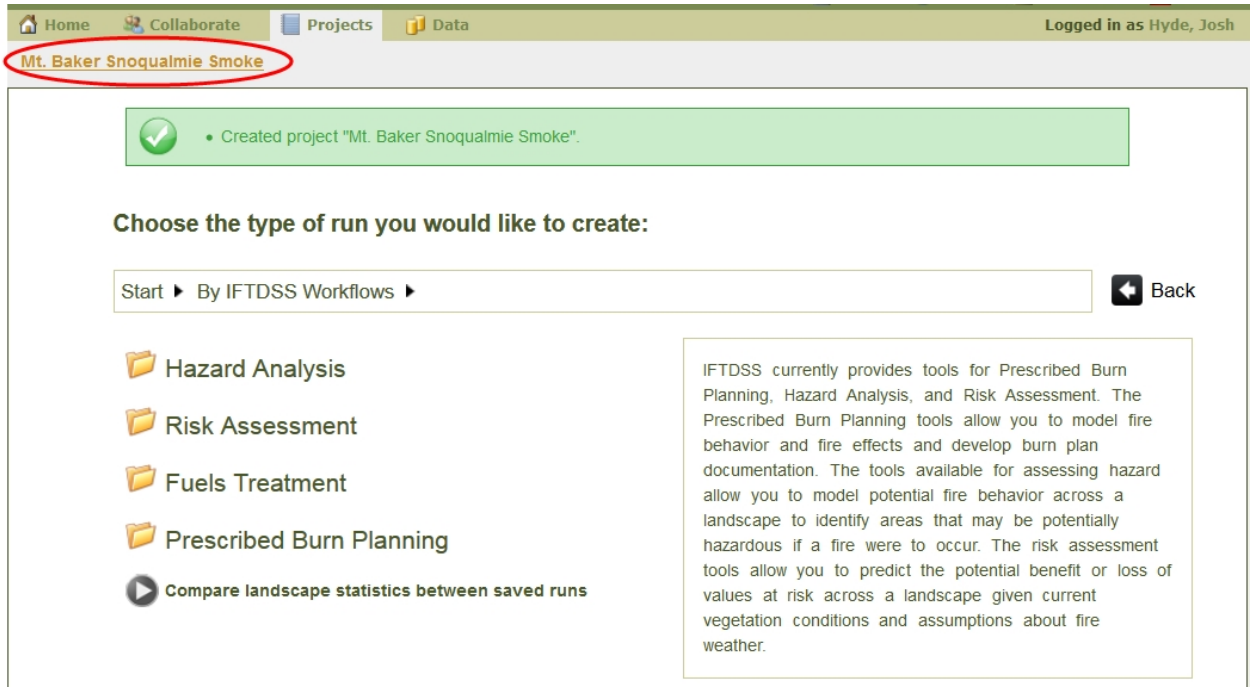
If desired, fill in the optional information.

Choose **Next**.

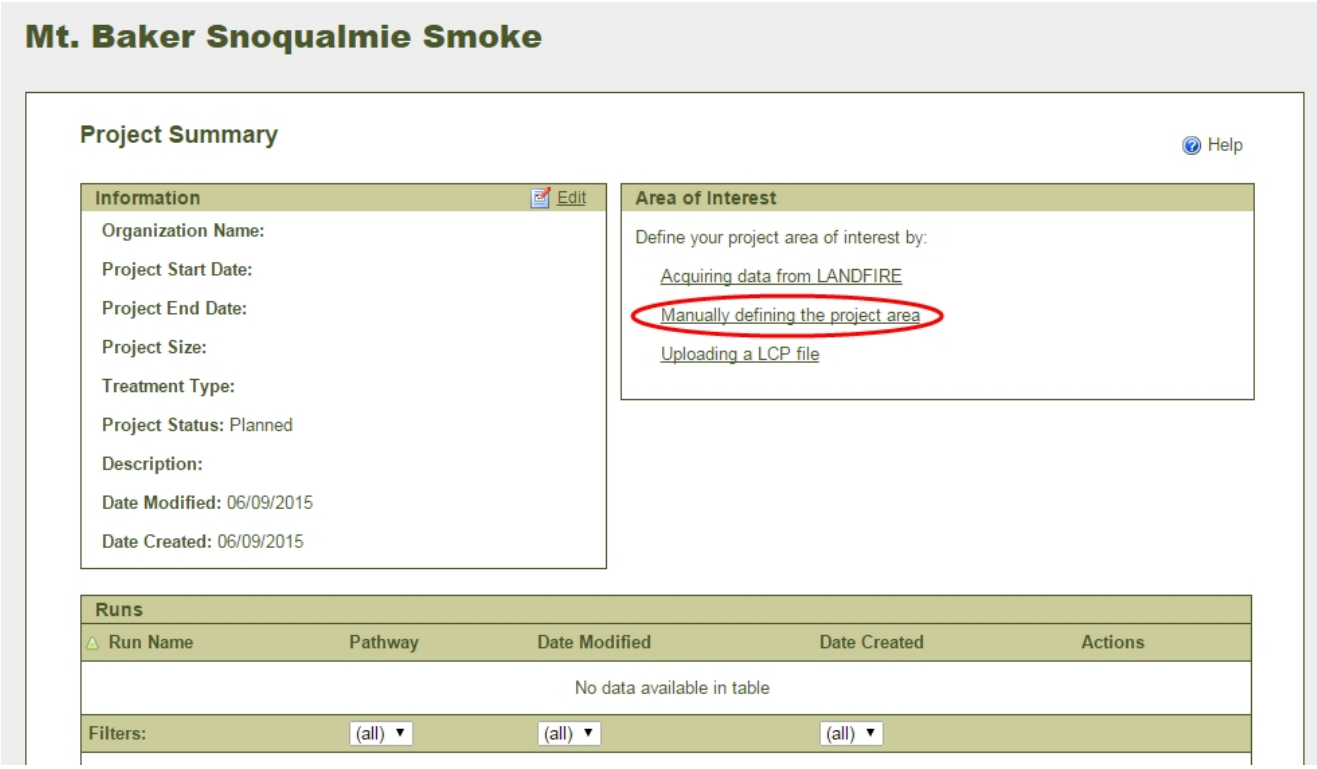


After creating a new project, you will see the page for **creating a new run**.

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).



In the Area of Interest window of the Project summary page, choose to define your project area of interest by **Manually defining the project**.



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, we will select the following coordinates

North: 48.34953368145102

South: 48.24904128853667

West: -121.8202500471653

East: -121.57580424635472

> **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.

> **Note**

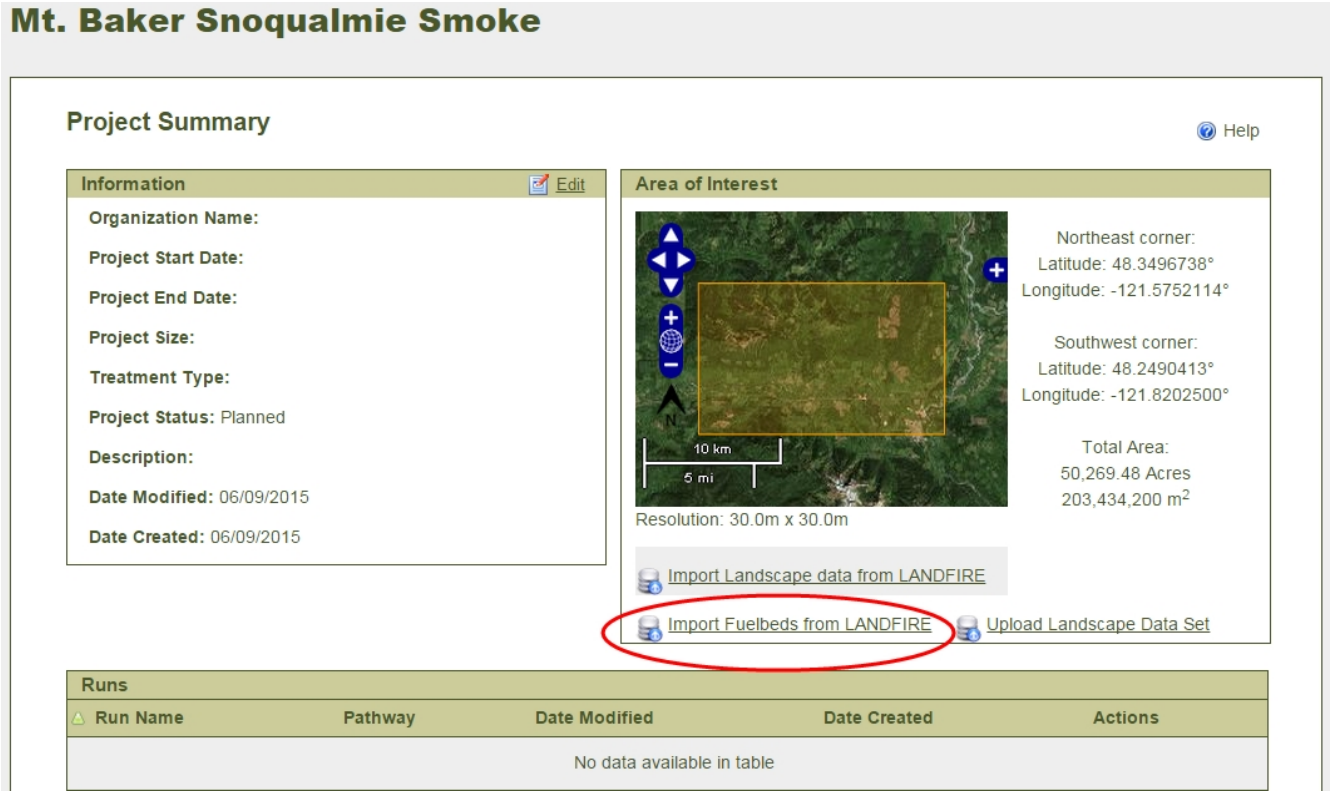
Once you select your dataset, the project area **cannot** be changed.
To change a project area, you must create a new project.

When finished, click **Next** at the bottom of the page, this will return you to the project summary page.

Next we will acquire the Fuels Characteristic Classification System (FCCS) fuelbed data needed to run Consume.

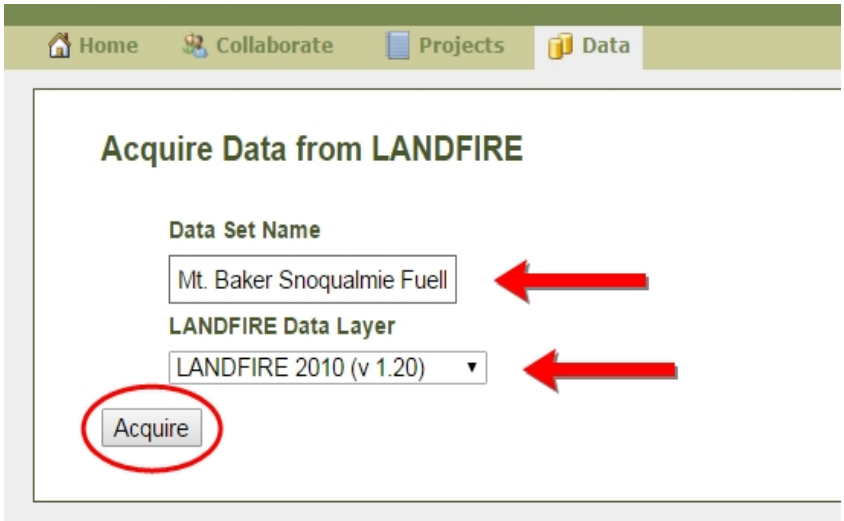
Acquiring FCCS fuelbed data to run IFT-Consume

From the Project Summary page, select **Import Fuelbeds from LANDFIRE**.



> **Note**
> You may also import LANDFIRE Fuelbeds, or upload a fuelbed dataset by clicking the **Data** tab and selecting **Fuelbed data** tab.

On the '**Acquire Data from LANDFIRE**' page, choose a name for your dataset, and the version of LANDFIRE you want to use. For this example we are downloading LANDFIRE 2010 version 1.20. When finished, click **Acquire**.



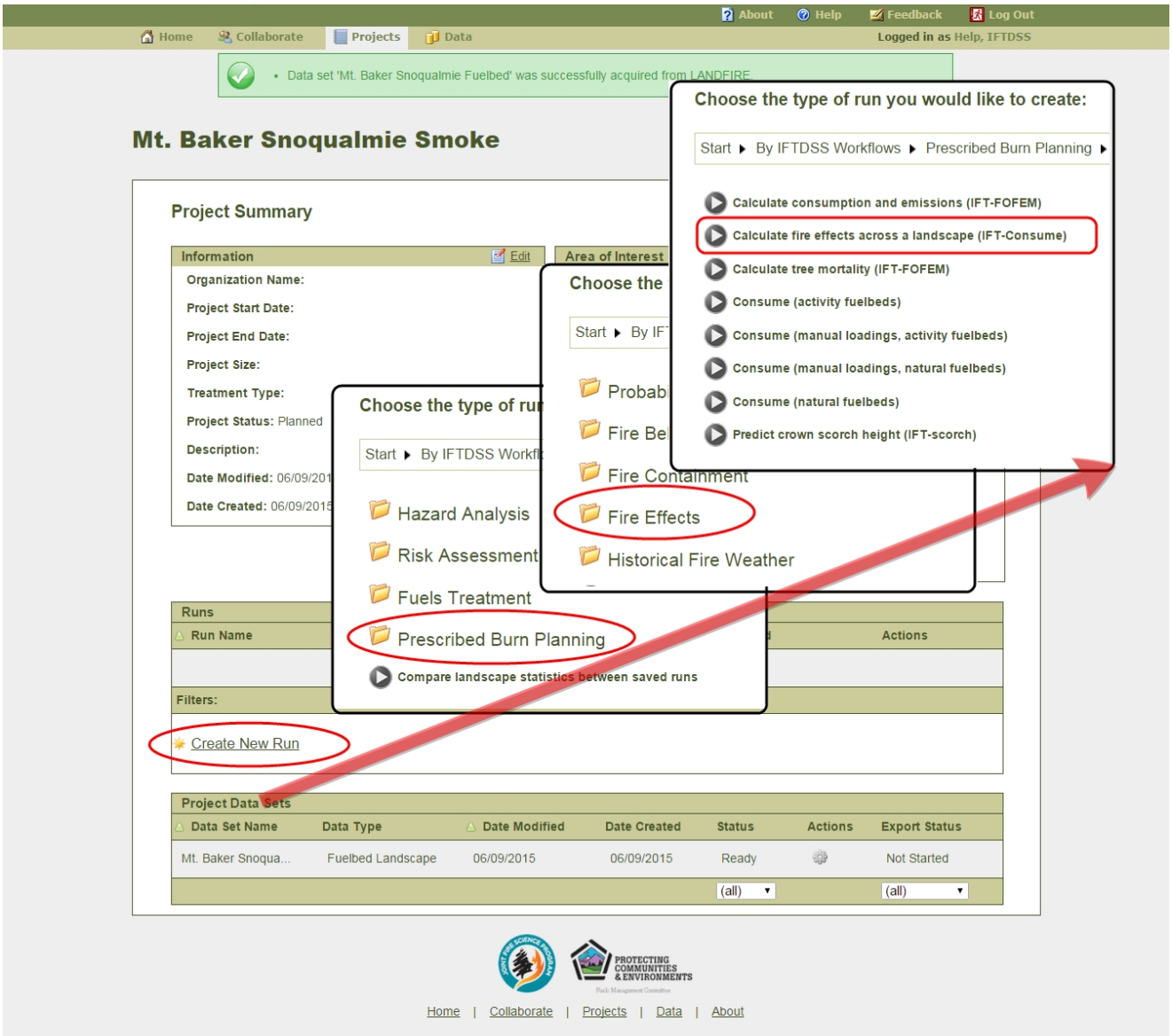
Once the data have downloaded you will be returned to the project summary page.

Next you will scroll down to the **Runs** section of the project summary page.

Selecting IFT-Consume from the IFTDSS workflows

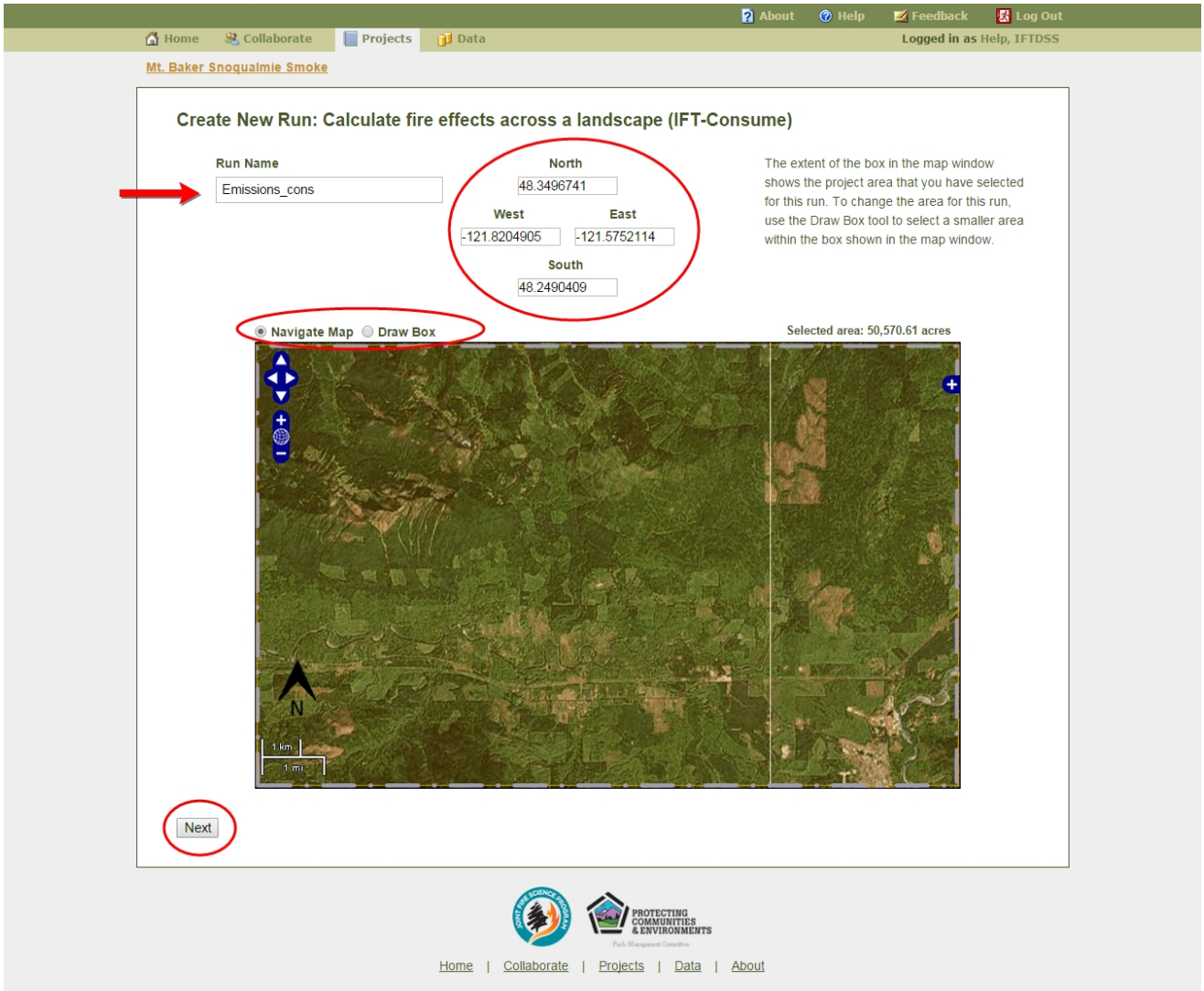
Select **Create New Run**

From the **Create New Run** menu, Select **Prescribed Burn Planning, Fire Effects, Calculate fire effects across a landscape (IFT-Consume)**.

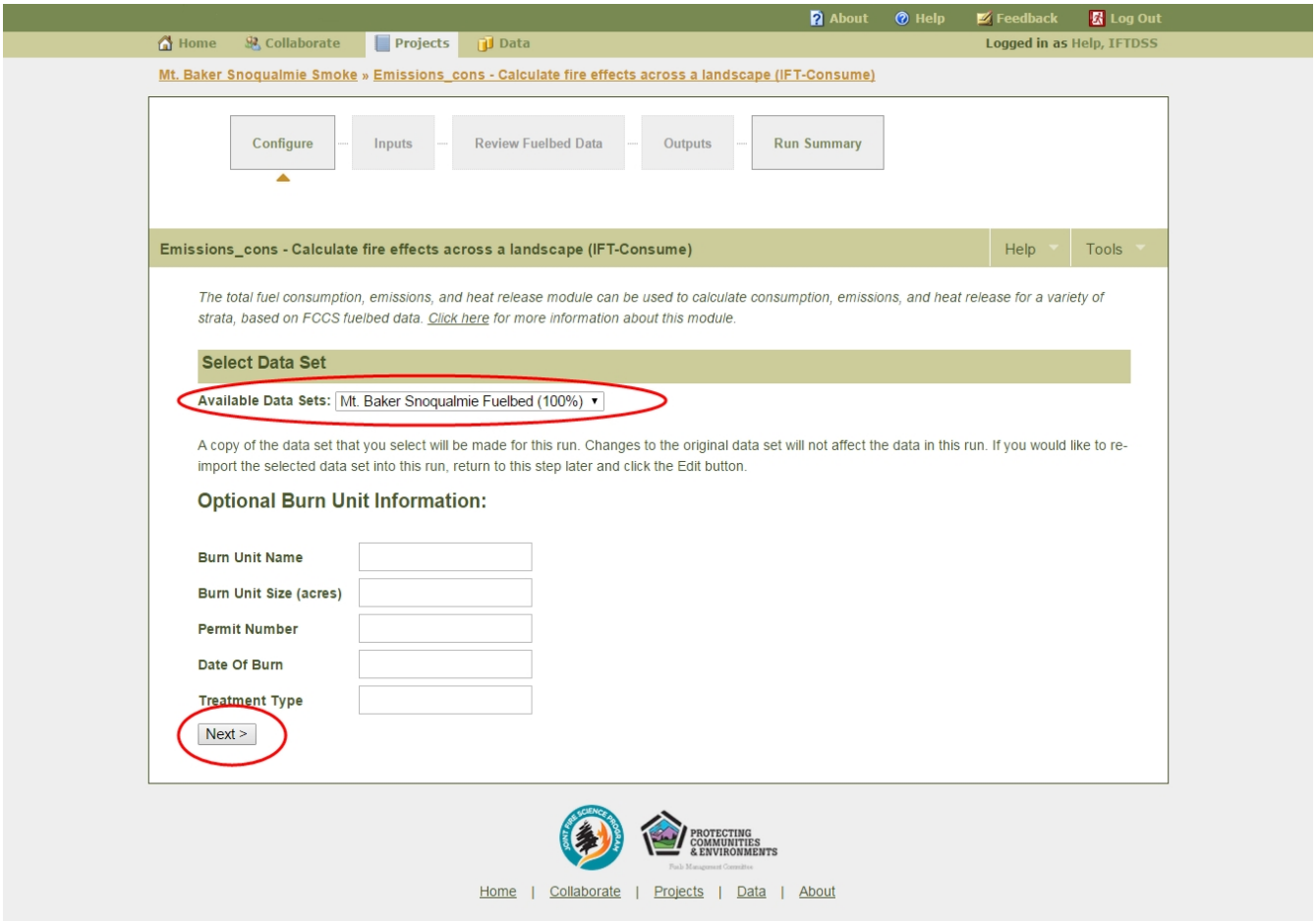


Note
Within the **Prescribed Burn** workflow under **fire effects**, there are several run options using the Consume fire effects model, depending on the inputs, outputs, and output format desired. These are detailed elsewhere in IFTDSS help.

Name your Run, ensure the coordinates are correct, and click **Next.**



Confirm that the fuelbed data set selected by default is the one which you created for this project. You are given the option of populating additional information such as burn unit name, size, etc. For this example we will leave these blank. Click **Next**.


About
Help
Feedback
Log Out
Home
Collaborate
Projects
Data
Logged in as Help, IFTDSS
Mt. Baker Snoqualmie Smoke » Emissions_cons - Calculate fire effects across a landscape (IFT-Consume)
Configure
Inputs
Review Fuelbed Data
Outputs
Run Summary
Emissions_cons - Calculate fire effects across a landscape (IFT-Consume)
Help
Tools
The total fuel consumption, emissions, and heat release module can be used to calculate consumption, emissions, and heat release for a variety of strata, based on FCCS fuelbed data. Click here for more information about this module.
Select Data Set
Available Data Sets: Mt. Baker Snoqualmie Fuelbed (100%)
A copy of the data set that you select will be made for this run. Changes to the original data set will not affect the data in this run. If you would like to re-import the selected data set into this run, return to this step later and click the Edit button.
Optional Burn Unit Information:
Burn Unit Name
Burn Unit Size (acres)
Permit Number
Date Of Burn
Treatment Type
Next >
PROTECTING COMMUNITIES & ENVIRONMENTS
Home | Collaborate | Projects | Data | About

Populating and running the IFT-Consume model

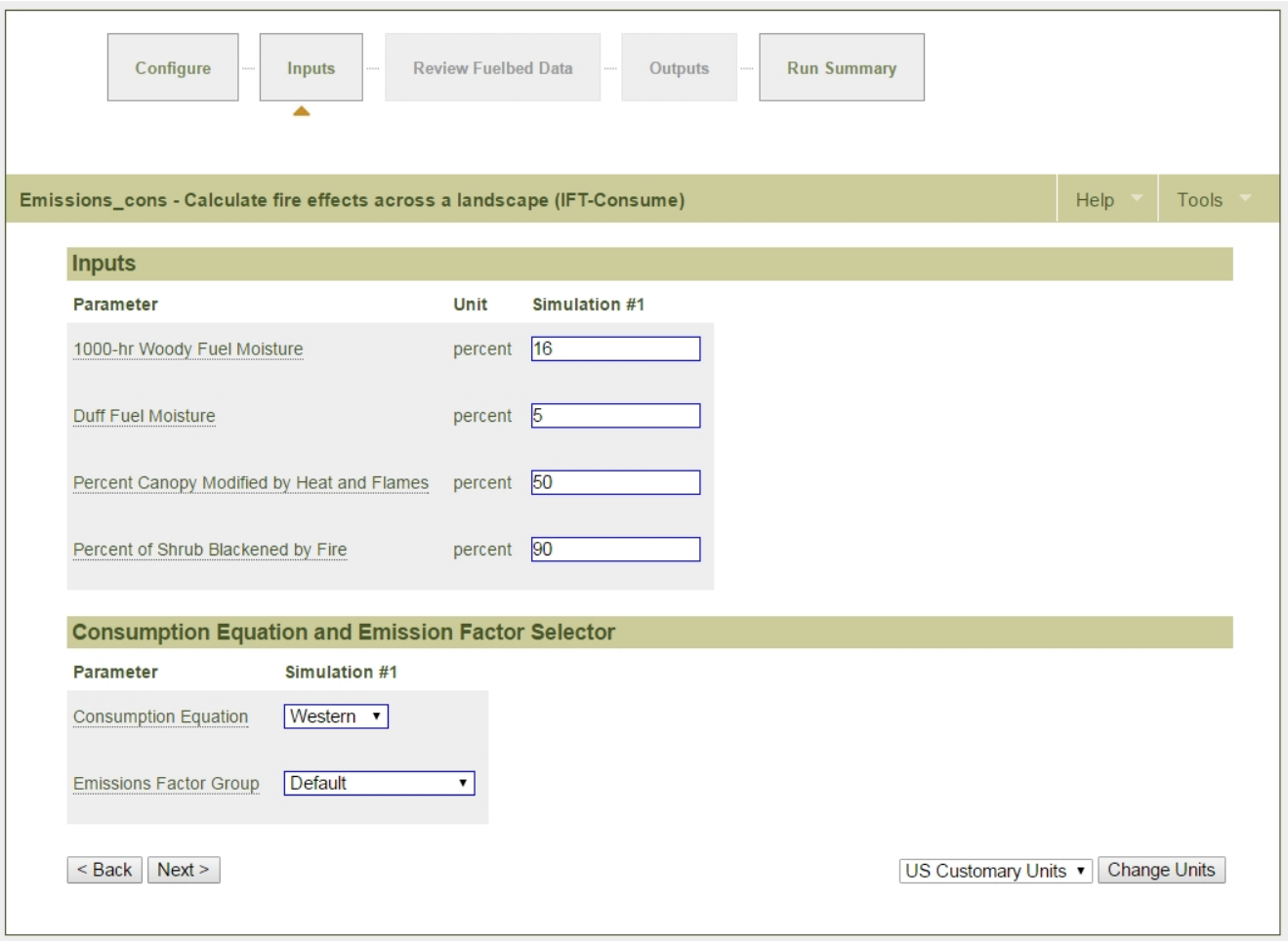
The parameters needed to run the IFT-Consume model for landscapes are listed in the table below:

Name	Units	Brief Description
Duff Moisture	Percentage	The moisture content of duff, expressed as a percentage of oven dry weight.
Eco Region	(A choice)	Fuelbeds are organized geographically into Bailey's ecoregion divisions, which are • Hot Continental • Marine • Mediterranean • Prairie • Rainforest • Savanna • Subarctic • Subtropical • Temperate Desert • Temperate Steppe • Tropical/Subtropical Desert • Tropical/Subtropical Steppe Desert • Tundra • Warm Continental
Moisture of 1000-hr Fuels	Percentage	The moisture content of sound, woody material 3 to 9 inches in diameter. Moisture content can be directly measured or estimated using the ADJ-Th or NFDRS-Th fuel moisture models.
Percent Canopy Loading Consumed	Percentage	Percentage of canopy loading consumed by the fire. If you do not know the value and choose not to enter this variable, Consume uses the following defaults: Prescribed burn = 0% Wildland fire use = 40% Wildfire = 60%.
Percent	Percentage	Percent of the shrub stratum that is blackened by

Name	Units	Brief Description
Shrub Blackened		the burn. This value is input (as a percentage) to the algorithm for calculating shrub consumption.

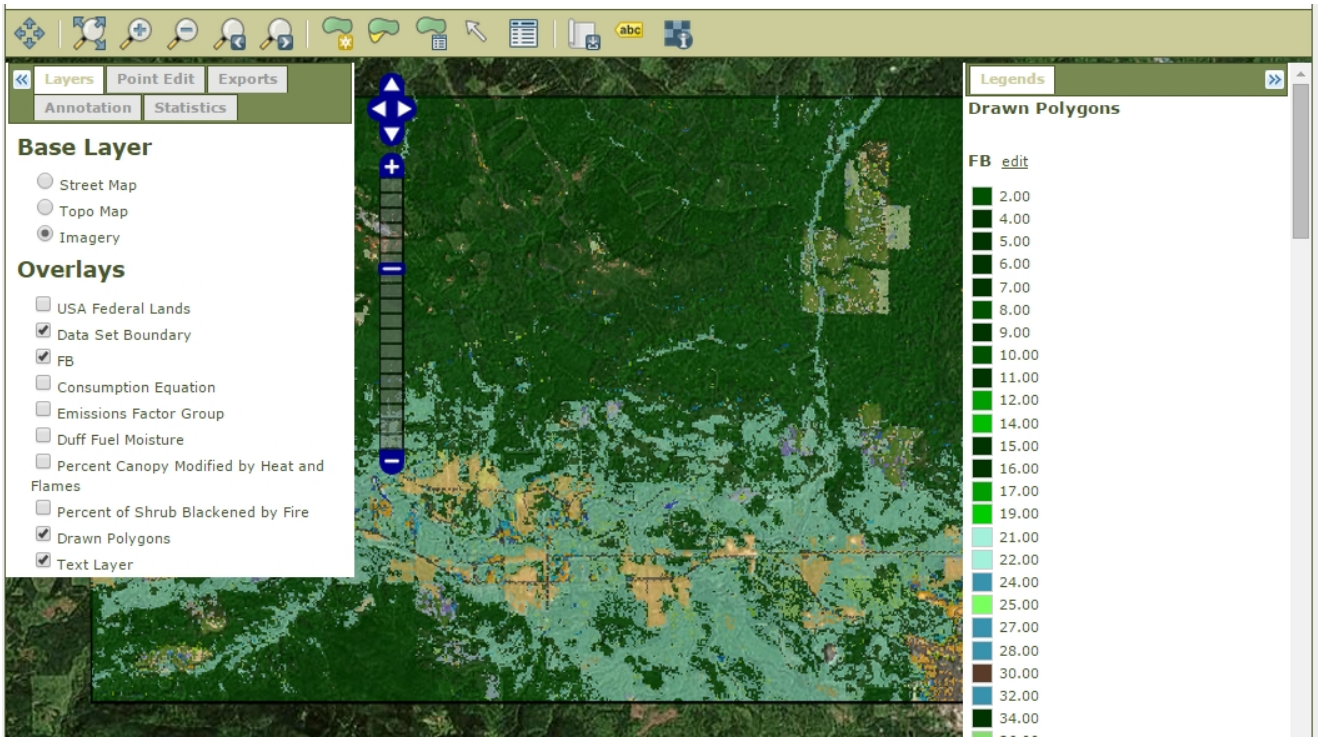
For this tutorial, we will use the inputs displayed below. We'll select dry conditions, including a **1000-hr woody fuel moisture** of **16**, and a **Duff fuel moisture** of **5**. We'll assume a scenario in which **50%** of the canopy is consumed, and **90%** of shrubs are blackened. For the **consumption equation** options (Boreal, Southern, or Western) we will choose **Western**, as it best represents the area of the burn. We will leave the **Emission Factor Group** set to its default setting.

> **Note**
> There are several Emission Factor Groups available. For more information on the Emission Factor groups, visit the **Emission Factor Groups by Cover Type** and the **Emission Factors by Emission Factor Groups**pages.



Once these inputs are done, click **Next**

Before the Consume model runs you will have a chance to review the fuel bed (FB) data



On this page you may use the data as is, or make edits to it using the mapping toolbar. In this example we will leave the data as-is, scroll to the bottom of the page, and click **next**.

If you choose to edit the data within the map interface during a run, the changes will take effect during the run. However, the original data file will remain unchanged. To make permanent changes to a dataset, use the **Data Studio** feature under the **Data** tab of IFTDSS.

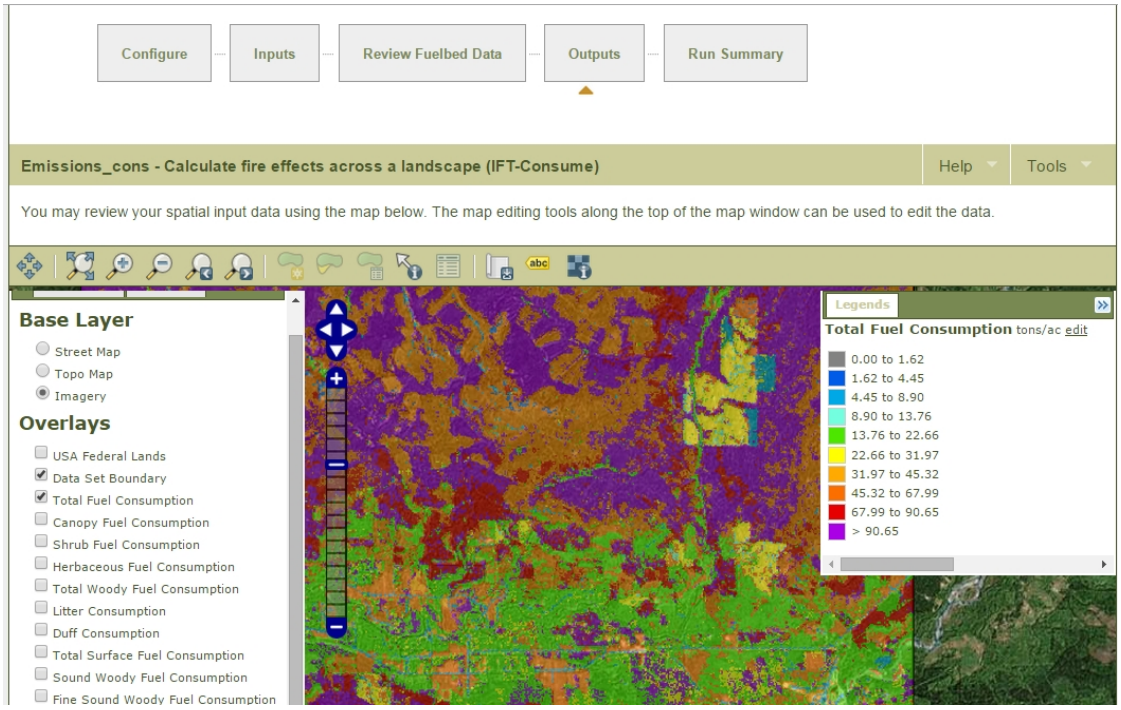
Note
Visit the **FCCS Fuelbed Overview** Page if you would like further information on fuelbeds.

Viewing output data

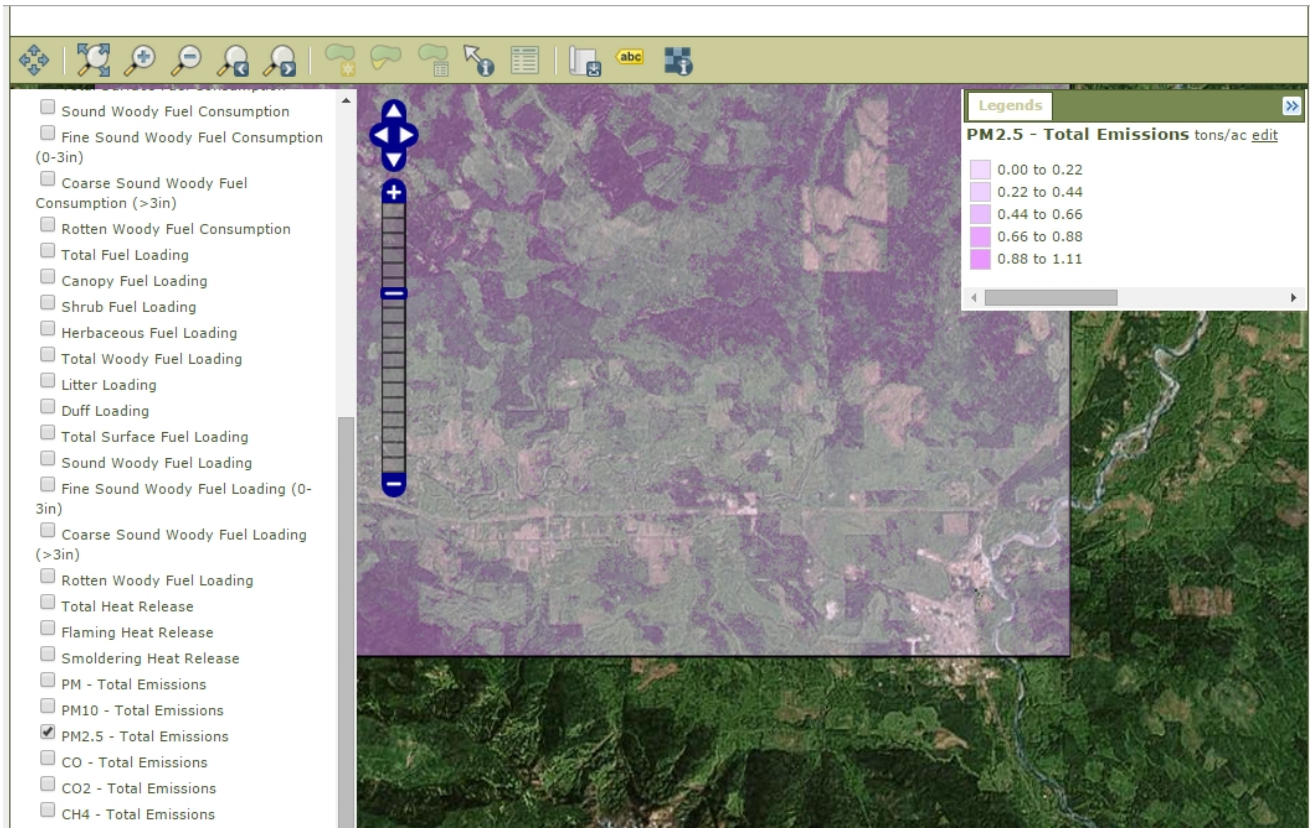
IFT-Consume will list several emissions:

Name	Units	Brief Description
Carbon monoxide (CO)	Tons per acre, kg per meter squared	Total carbon monoxide emitted.
Carbon dioxide (CO_2)	Tons per acre, kg per meter squared	Total carbon dioxide emitted.
Methane (CH_4)	Tons per acre, kg per meter squared	Total methane emitted.
Non-methane hydrocarbon (NMHC)	Tons per acre, kg per meter squared	Total non-methane hydrocarbons emitted.
Particulate matter (PM)	Tons per acre, kg per meter squared	Total particulate matter emitted.
Particulate matter 2.5 ($PM_{2.5}$)	Tons per acre, kg per meter squared	Total particulate matter 2.5 emitted.
Particulate matter 10 (PM_{10})	Tons per acre, kg per meter squared	Total particulate matter 10 emitted.

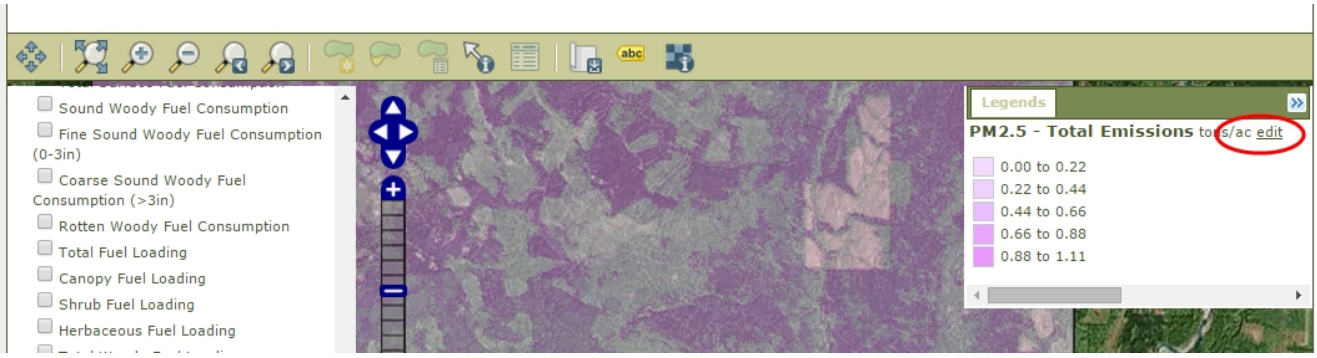
When the model is finished running, you can view the outputs spatially. We'll focus on the emissions outputs for most of this tutorial.

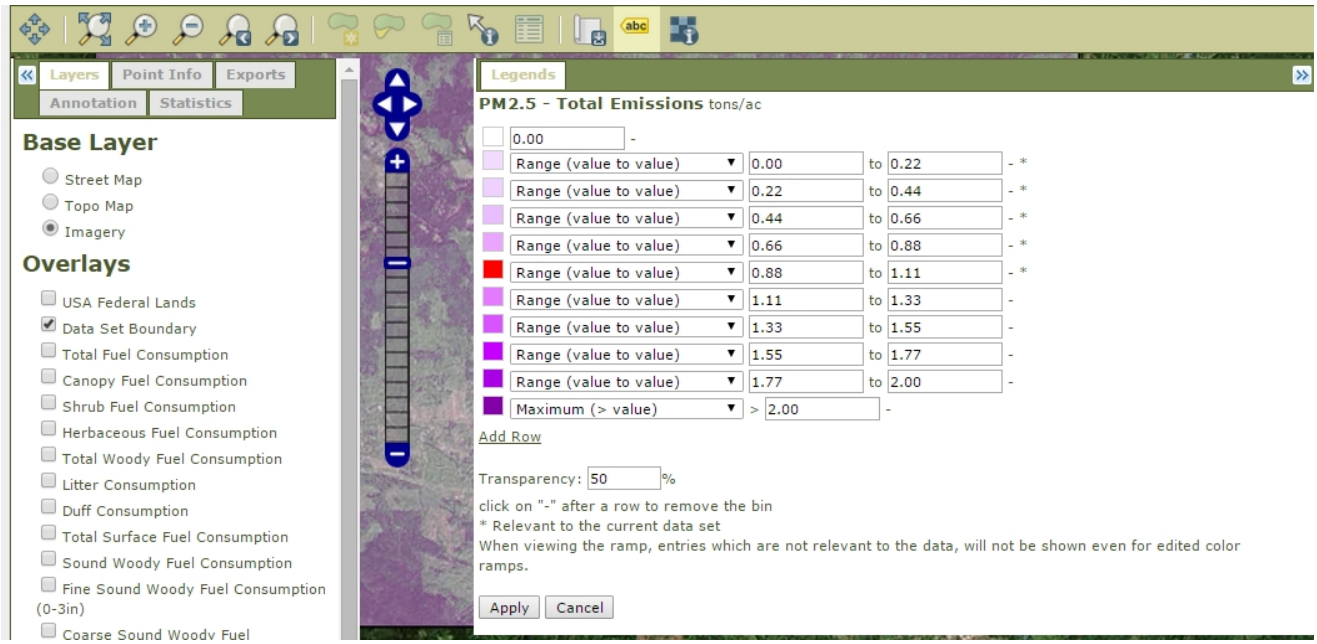


On the dropdown list to the left, we have the option of viewing total particulate matter, coarse particulates (PM_{10}), fine particulates ($PM_{2.5}$), carbon monoxide (CO), carbon dioxide (CO_2), methane (CH_4), and non-methane hydrocarbons (NMHC). PM 2.5 is displayed below.



To change the display color, or adjust the range of values displayed, select the **edit** option in the legend.





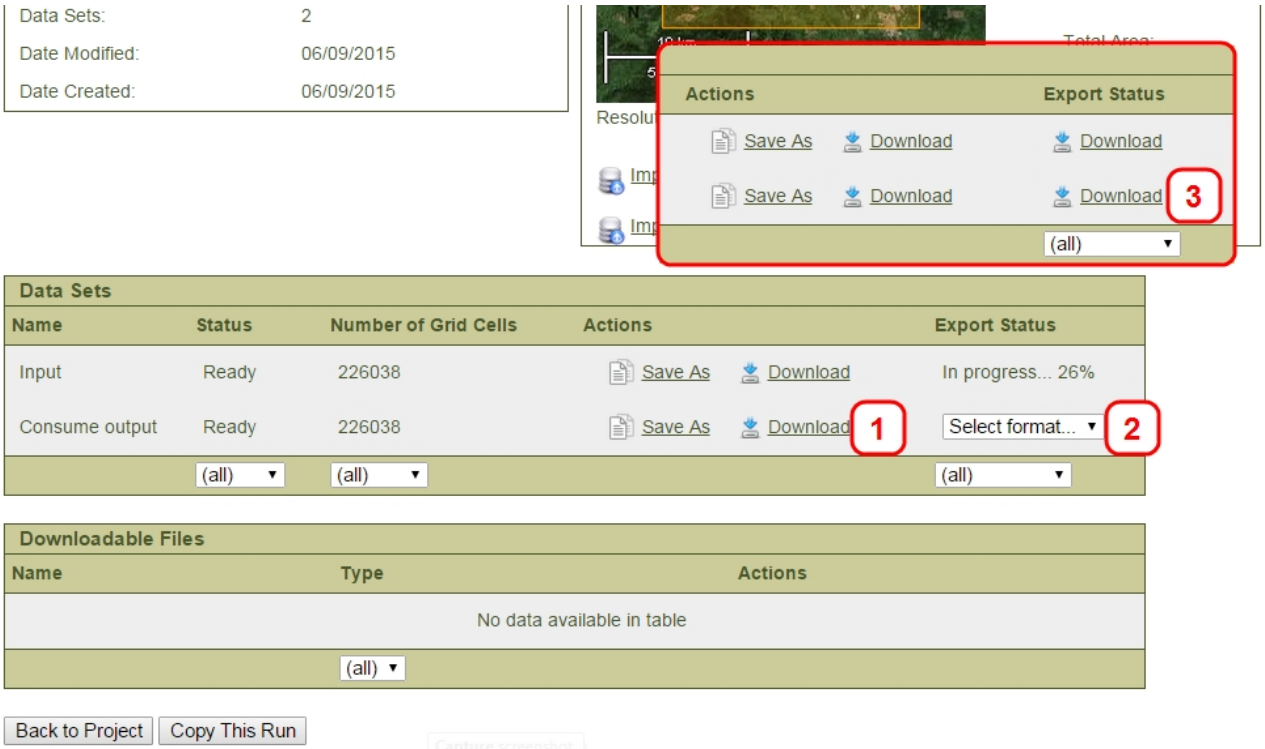
To prepare for the next step, click **Finish** at the bottom of the page, this will take you to the **Run Summary** page.

Exporting data as raster layers to ArcMap for analysis

To download raster versions of the consume inputs and outputs, scroll down to the **Data Sets** box of the **Run Summary** page

Download the raster datasets of the consume inputs and outputs:

1. Select **Download** under Actions
2. Select your desired format (**raster** for this example). You will see the export progress indicated as a percent
3. Once the export process has completed, the percent progress will be replaced by a **Download** icon. Click the download icon to download a zip-file.



Evaluating results in ArcMap

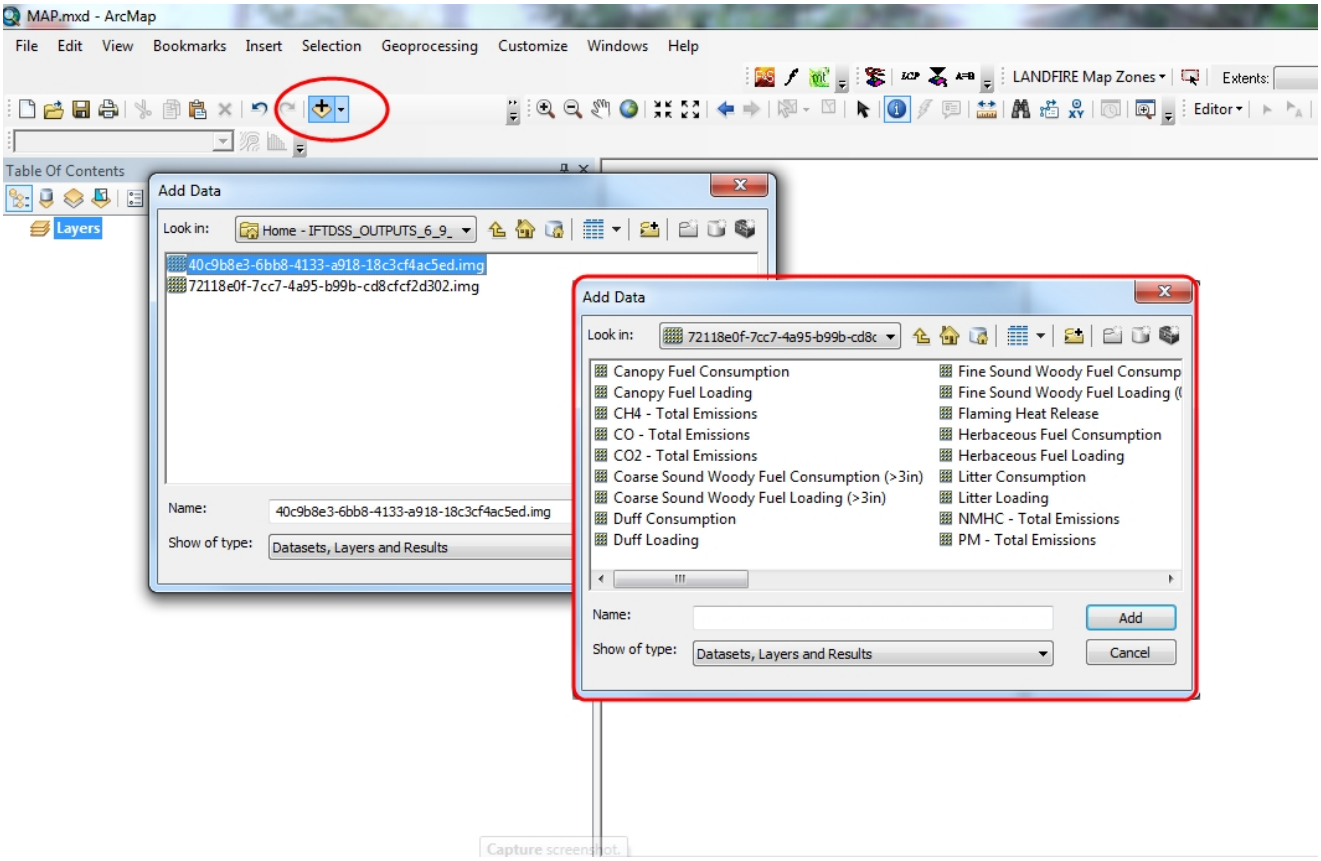
For this next section, we will evaluate results in ArcMap.

Place your saved input and output zip files in a folder of your choosing, and unzip the datasets

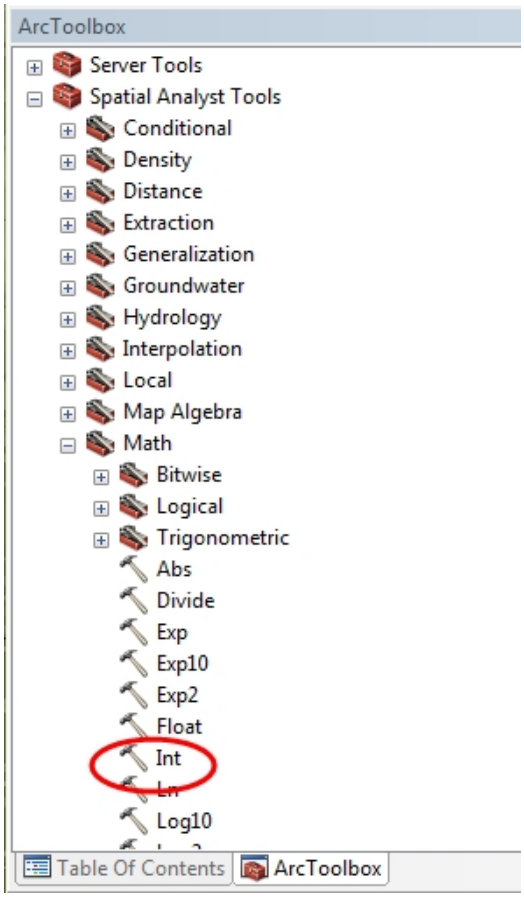
Open Arcmap

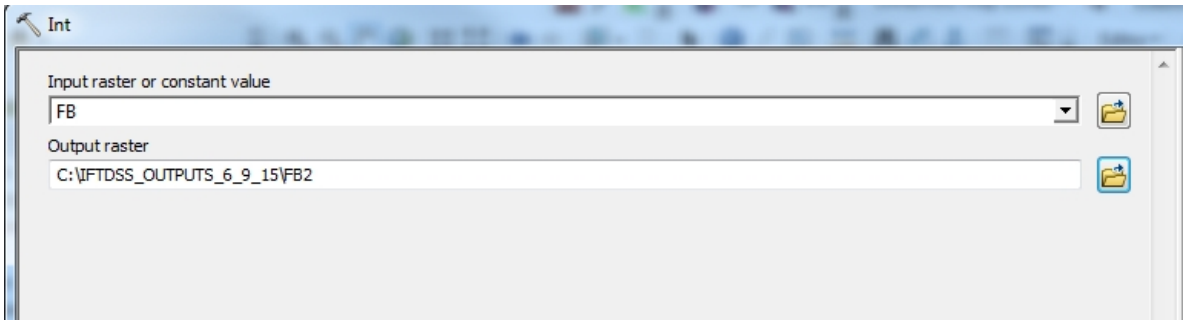
> **Note**
> Your Arcmap menus may look different than those depicted in this tutorial, depending upon the version of Arcmap you are using.

Use the **Add data** tool (circled in red) to find the folder with the exported Consume inputs and outputs. For this example we will download the **FB (Fuelbed) layer** from inputs. From outputs we'll download consumption layers for **duff, litter, woody fuel, sound woody fuel, rotten woody fuel, and canopy**, as well as the **total particulate matter** layer. This process is displayed in the images below:



Note
These layers are saved as IMAGINE files. To generate an attribute table, or perform quantitative analysis, you will have to convert them to integer format by opening **Geoprocessing>ArcToolbox >Spatial Analyst> Math>Int.**





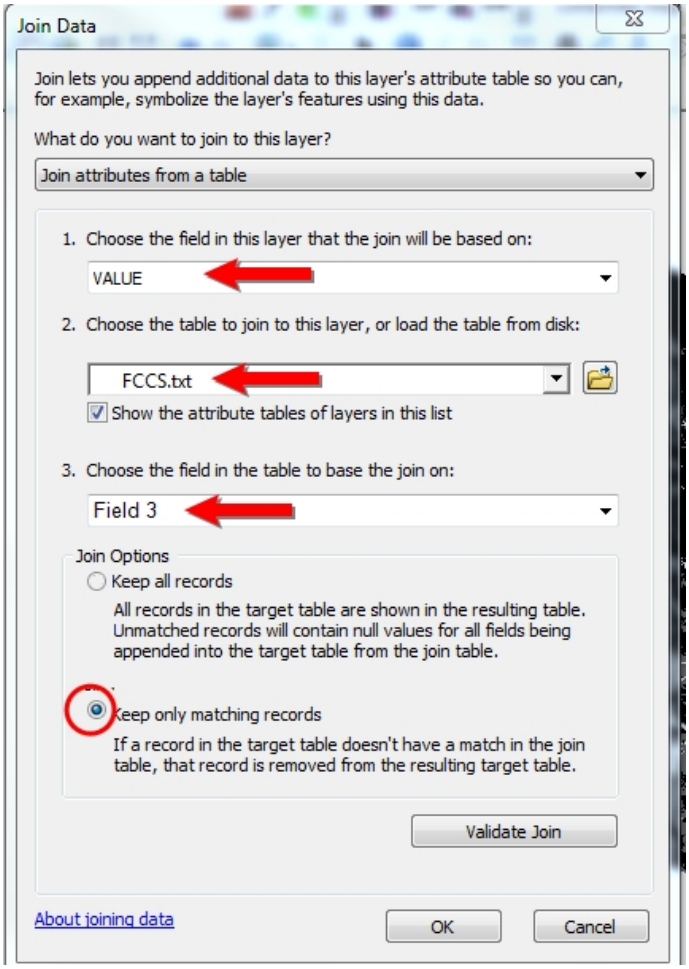
Note
The fuel bed layer, as imported from IFTDSS, will list fuelbeds by their FCCS number only. However, if you have a corresponding database file of FCCS fuelbeds in your area, their numbers, and names, it can be joined to the IFTDSS fuelbed layer and exported as new

layer; this will allow you to identify fuelbeds by name across your landscape.

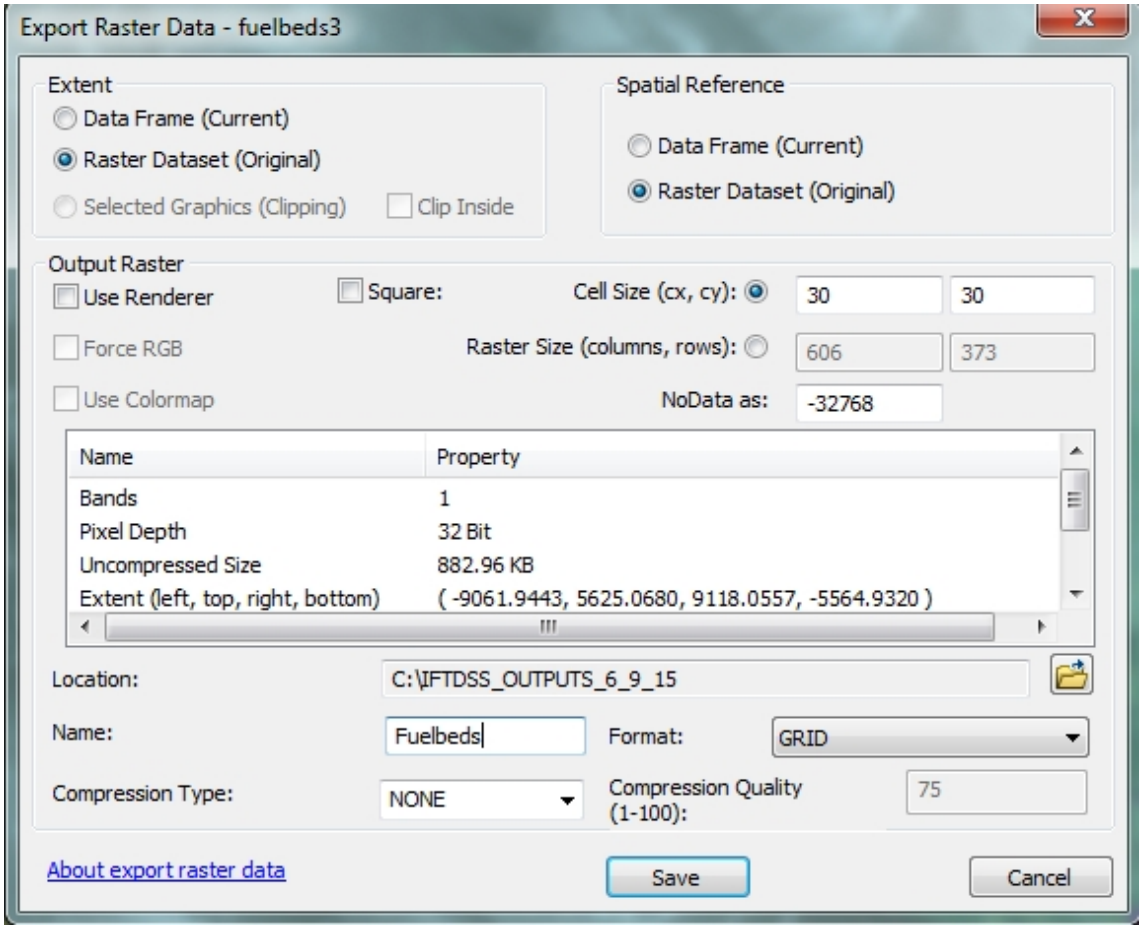
Joining a database to layer

Right click on fuelbed layer and select **join**.

Specify which fields to join, in the example below the **VALUE** field of the imported IFTDSS fuelbed layer corresponds to the FCCS number (Field 3) of an FCCS text file that was available for the area in this example. If you are using a table that has more FCCS fuelbeds than your imported IFTDSS fuelbeds layer, make sure to select the join option **Keep only matching matching records** is selected. **Select OK**.



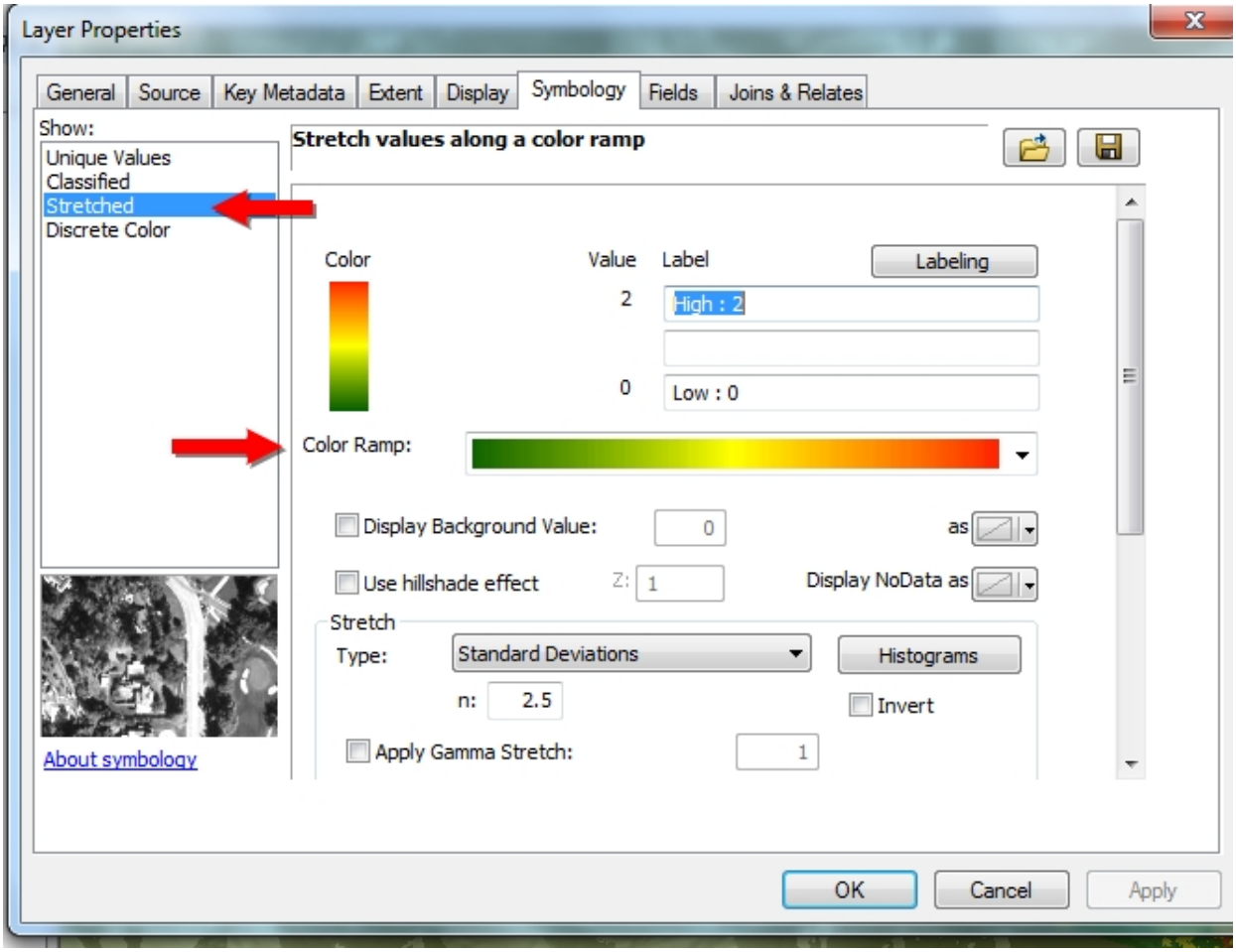
To make the join permanent, export the joined fuelbed layer by **right clicking**, select **data**, and **export data.** Ensure your extent and spatial references are set to use the original (**Raster Dataset (Original)**), and **Cell Size** is 30 by 30, and the format is set to GRID, as they are in the figure below. Select **Save**.



For this example, we have joined the fuelbed names to the FB data layer, and exported the result as new raster file so that fuelbed names are visible on the landscape.

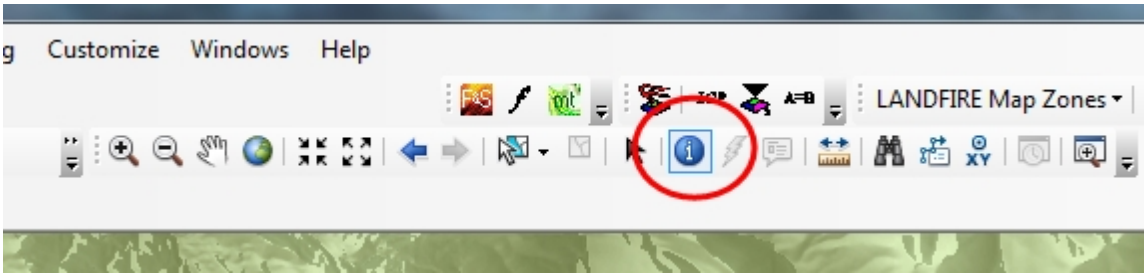
Changing the appearance of a layer

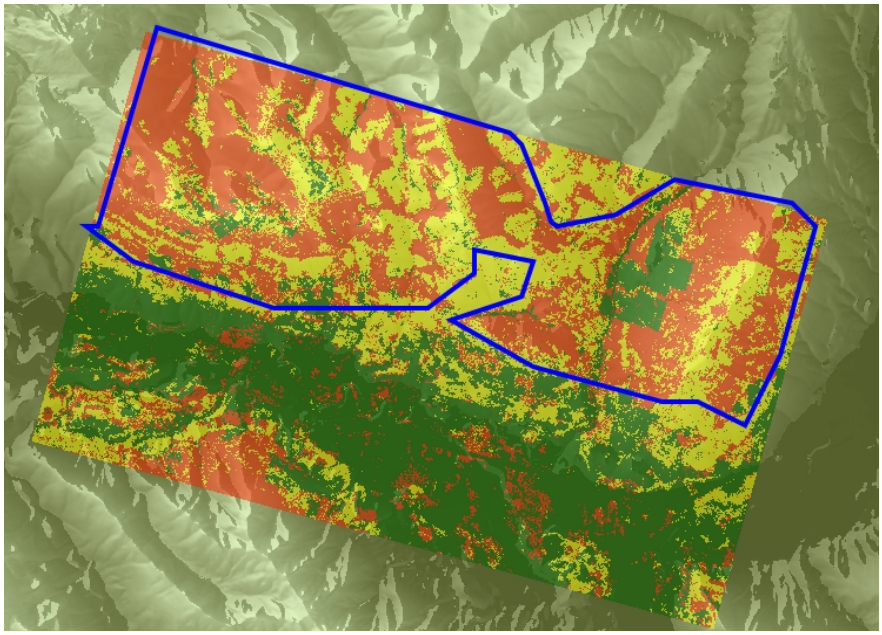
Right click on each layer, select **properties>symbology**, and adjust the color and display to your preference. In this example we selected the total particulate layer, and selected **stretched** and chose a color scheme ranging from green to red as the values increased. This will show where on the landscape the highest particulate matter concentrations would be produced.

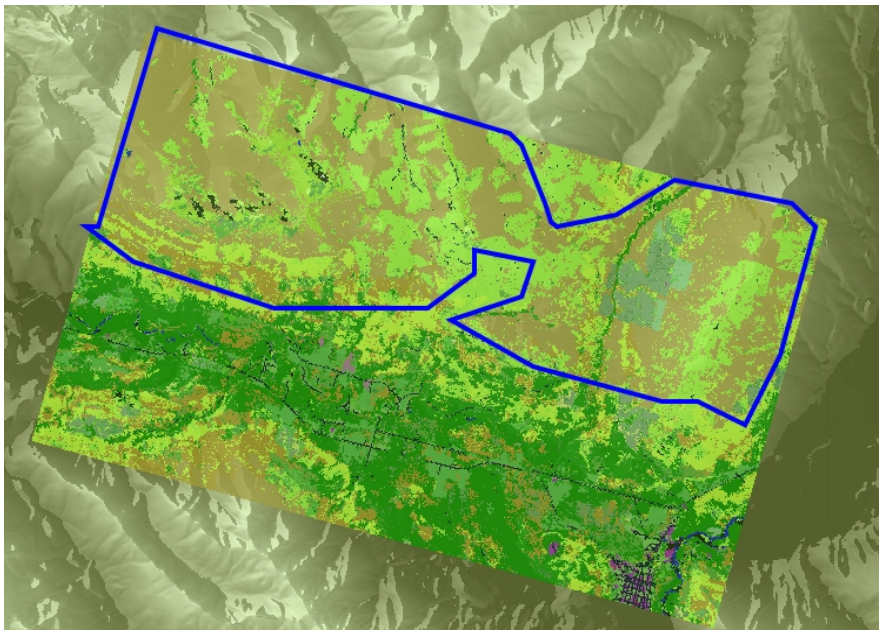


Comparing layers

By toggling back and forth between the fuelbed layer and the particulate matter layer, and using the point info tool. we can see the fuels which are likely to produce the greatest quantities of particulate matter, that could potentially impact human health, or regulatory compliance.

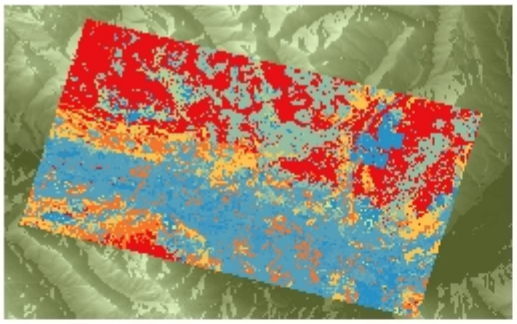




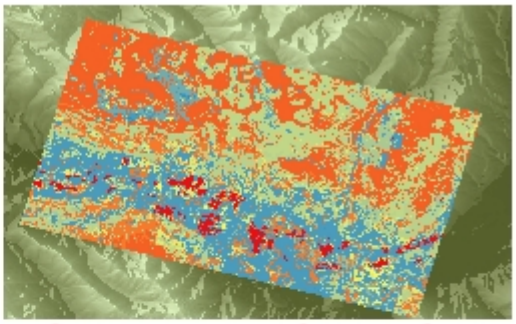


We can see in the mountains to the north of the valley, the fuelbeds and high particulate matter areas match well. Using the identify tool, we can see that the fuelbed predicted to generate these levels of particulate matter is Fuelbed 2, ‘Douglas fir-Western redcedar-Western Hemlock’.

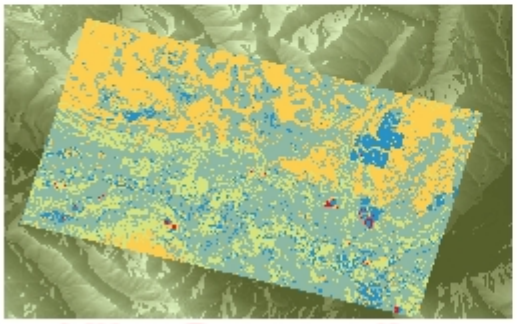
By using the same sliding color scale to see the relative highest amounts of various fuels, we see Fuelbed 2 also corresponds well to high quantities of litter, duff, and sound woody fuel consumed, but not necessarily fine woody fuel consumption. This provides information on the specific fuels in these areas that would contribute to particulate emissions, and may be candidates for treatments.



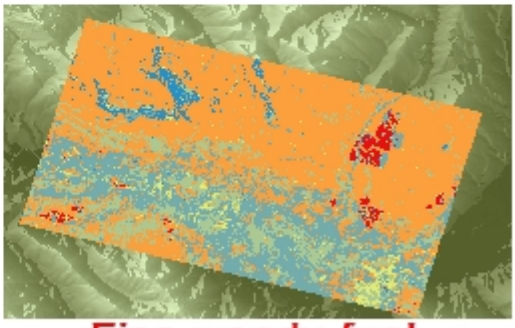
Duff Consumption



Large sound woody fuel consumption



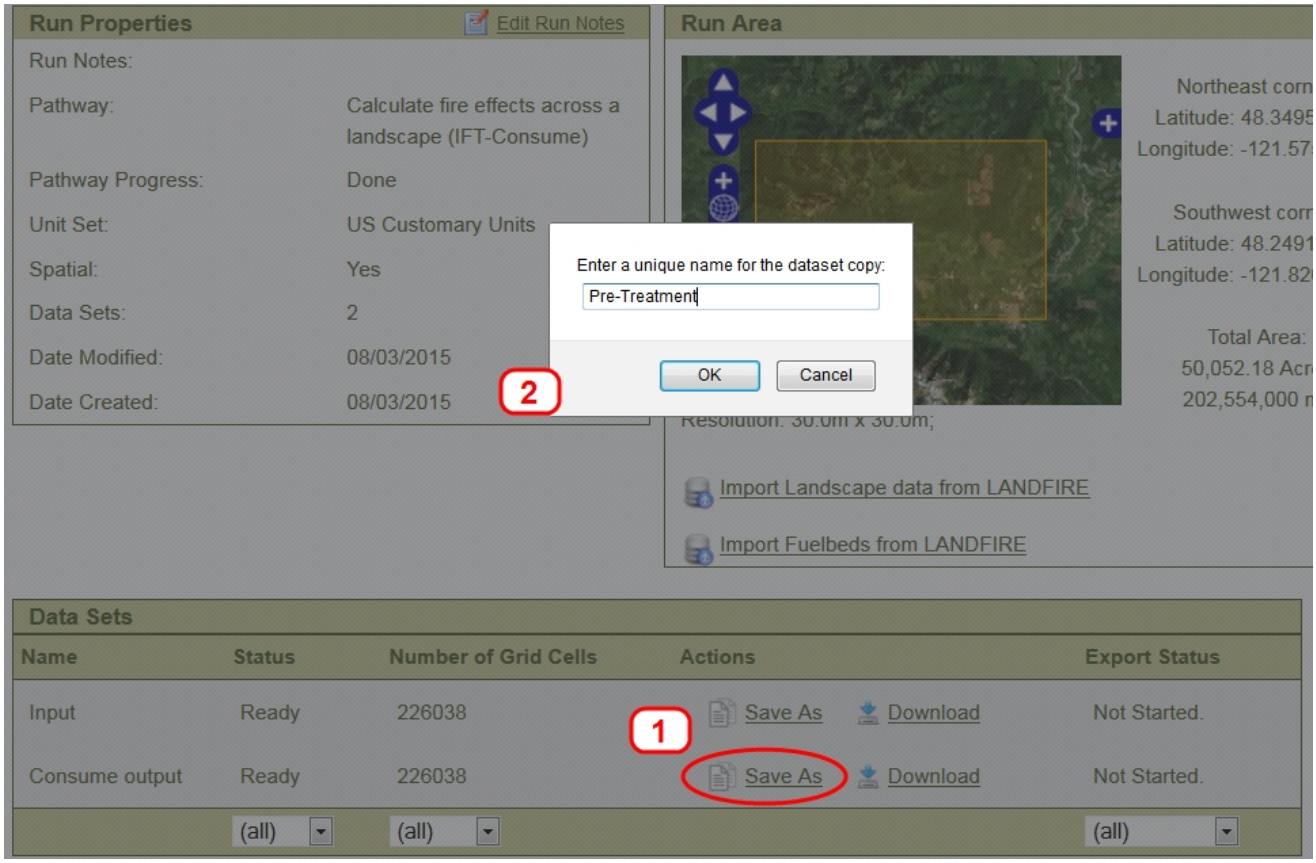
Litter Consumption



Fine woody fuel consumption

These choices are just examples, feel free to explore, using a similar approach for your own area of interest, evaluating different fuels, fuelbeds, and emissions. Doing so will allow you to identify areas of interest, and potential fuel characteristics.

To use this feature to compare emissions from pre and post-treatments, go through the process outlined in this tutorial using your pre-treatment data. When finished, save your outputs ..... Then create a new run using post-treatment data and compare the outputs.



This comparison can be useful in both identifying areas of the landscape that are likely to produce high levels of emissions, and the differences in emissions between treated and untreated areas.

Review

In this tutorial we walked through the steps needed to predict consumption and emissions using Consume. The tutorial provided information and step by step instructions on:

- Setting up a project
- Acquiring FCCS fuelbed data to run IFT-Consume
- Selecting -IFT Consume from the IFTDSS workflows
- Populating and running the IFT-Consume model
- Viewing output data
- Exporting data as raster layers to ArcMap for analysis
- Evaluating results (in ArcMap)

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.

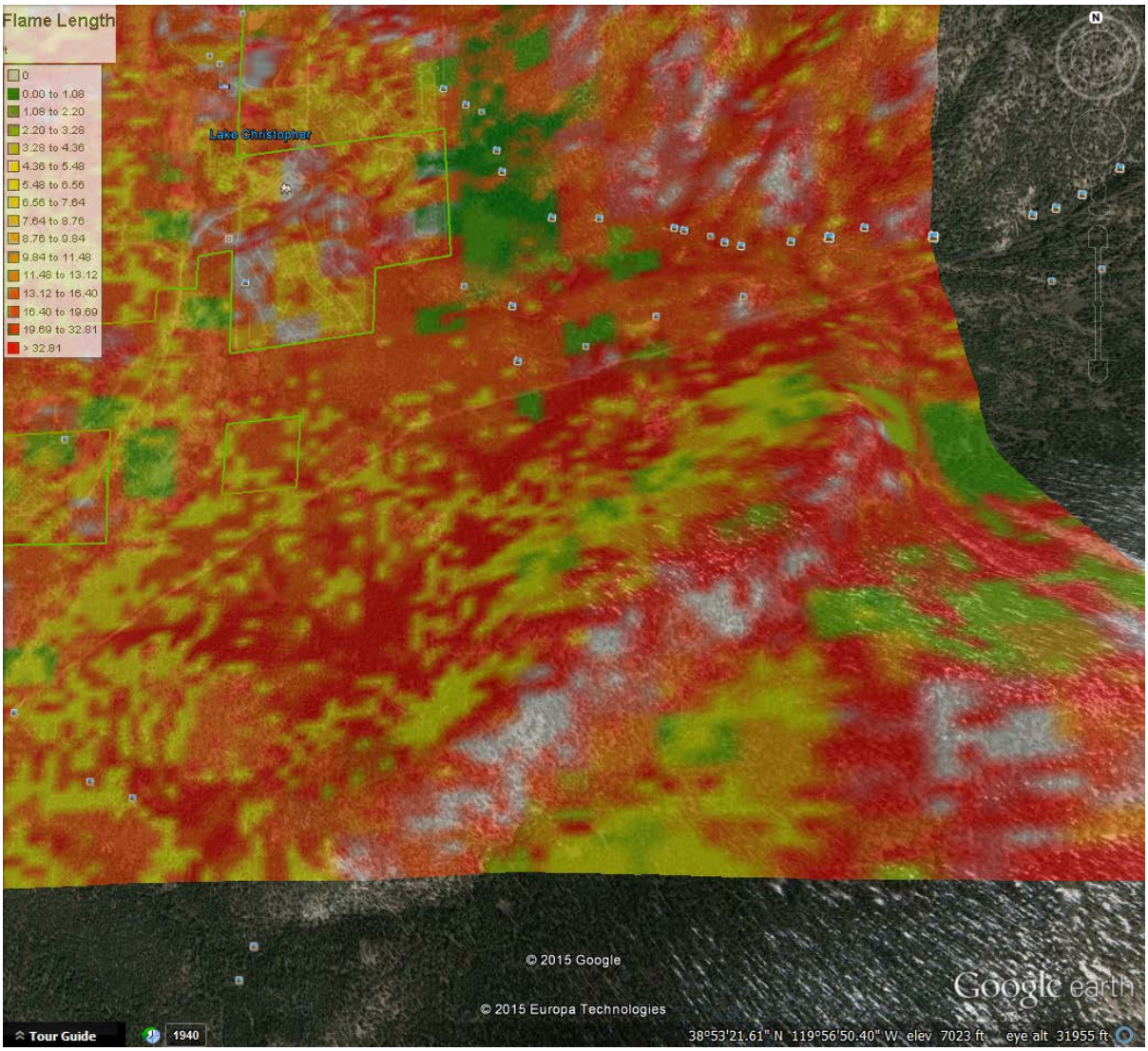
On that page, you'll find links to tutorials and videos on such topics as hazard analysis, prescribed burn planning, fuels treatment, spatial analysis across a landscape, and many more.

Objectives

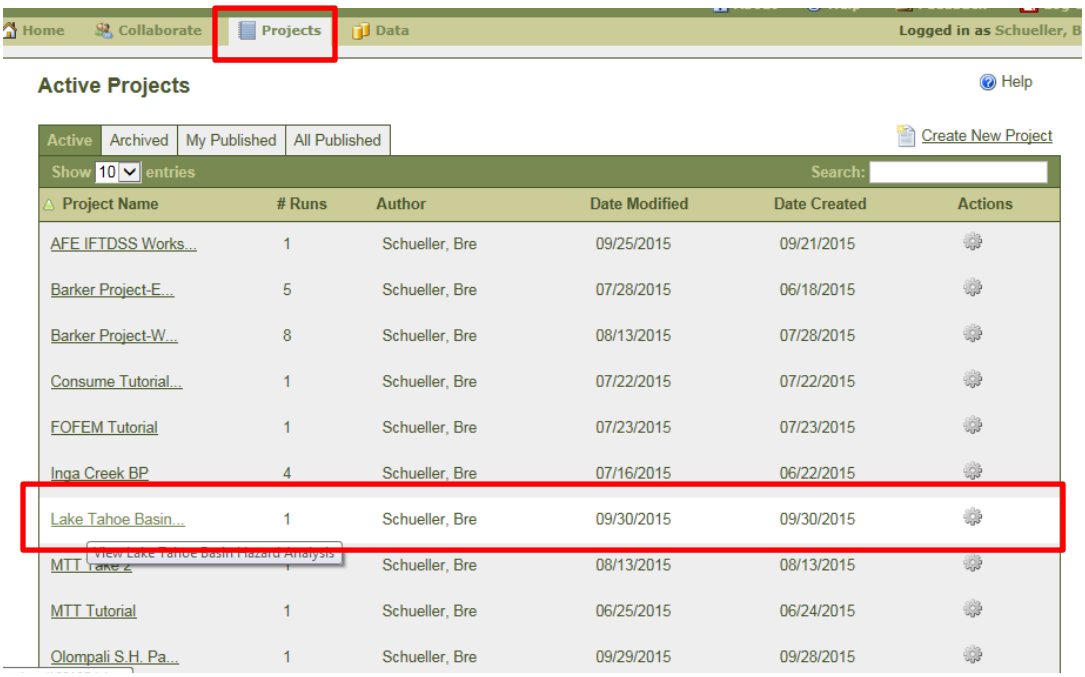
Develop basic skills to analyze IFTDSS landscape data and fire behavior outputs in Google Earth.

Overview

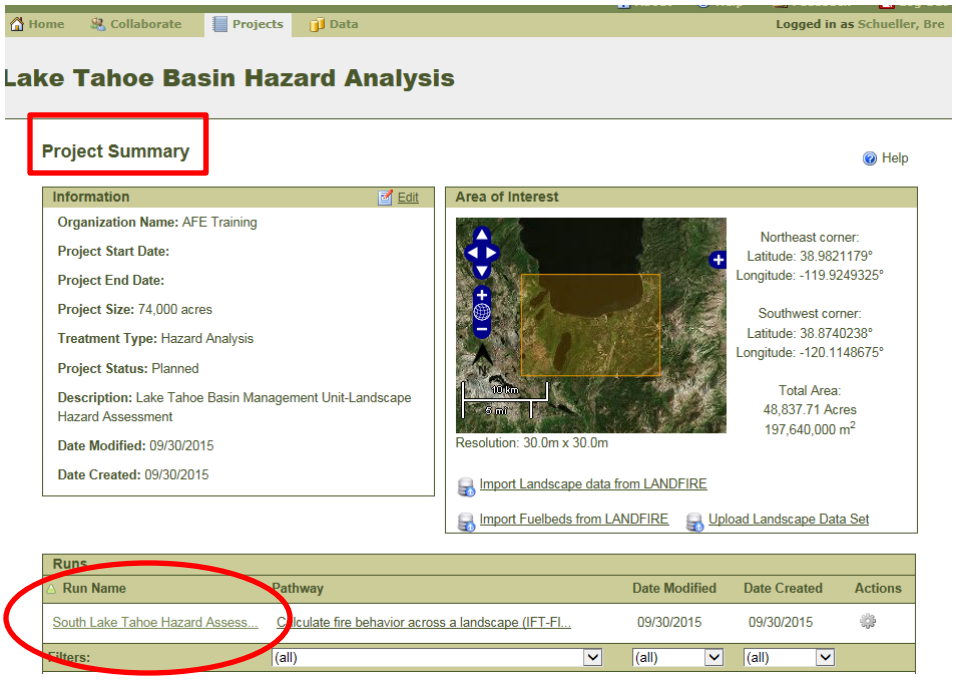
- Export KML data inputs and outputs from IFTDSS to Google Earth
- Assess features in Google Earth with IFTDSS inputs and outputs



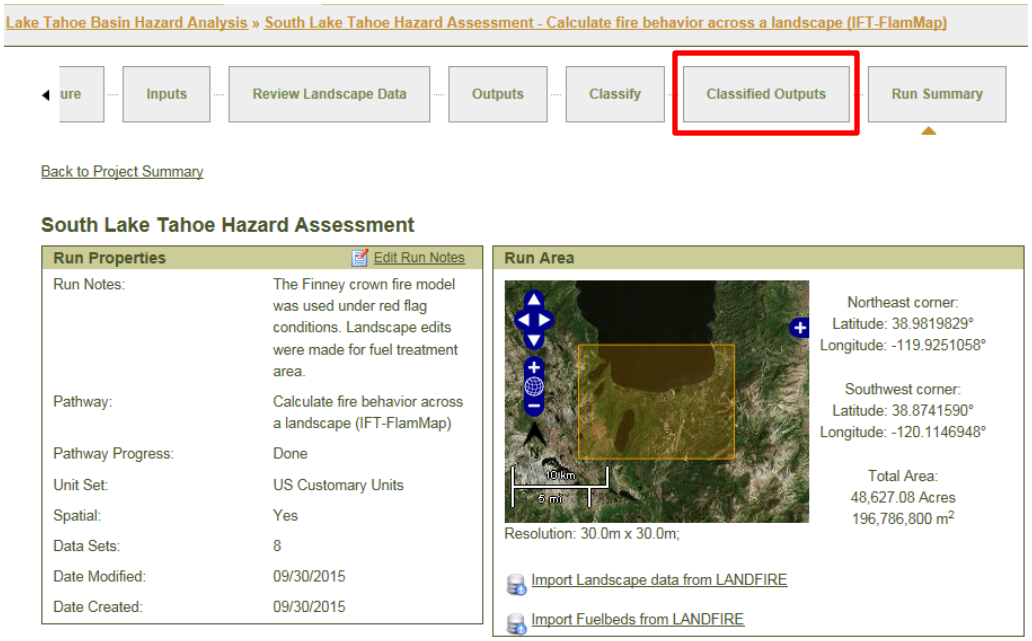
1. If you have not already exported KML files from one of your projects, log in to IFTDSS and go to the **Projects** tab. Select a project of your choosing. For this exercise the **Assess fuel hazard across a landscape IFT-FlamMap** project tutorial is being chosen.



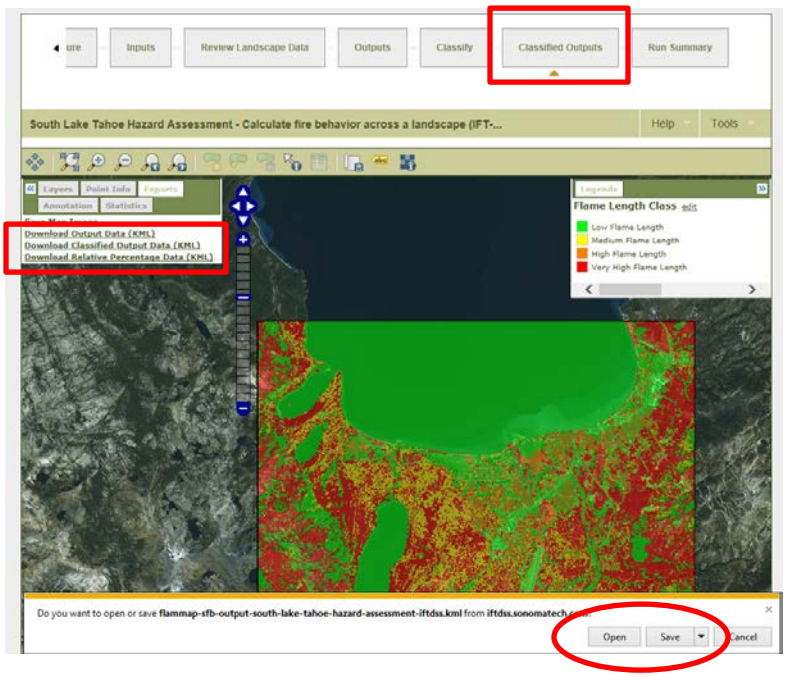
2. From the **Project Summary** page select the run that you would like to export your files from. For this exercise the **Calculate fire behavior across a landscape (IFT-FlamMap)** run is being chosen as it is the only one available within this project.

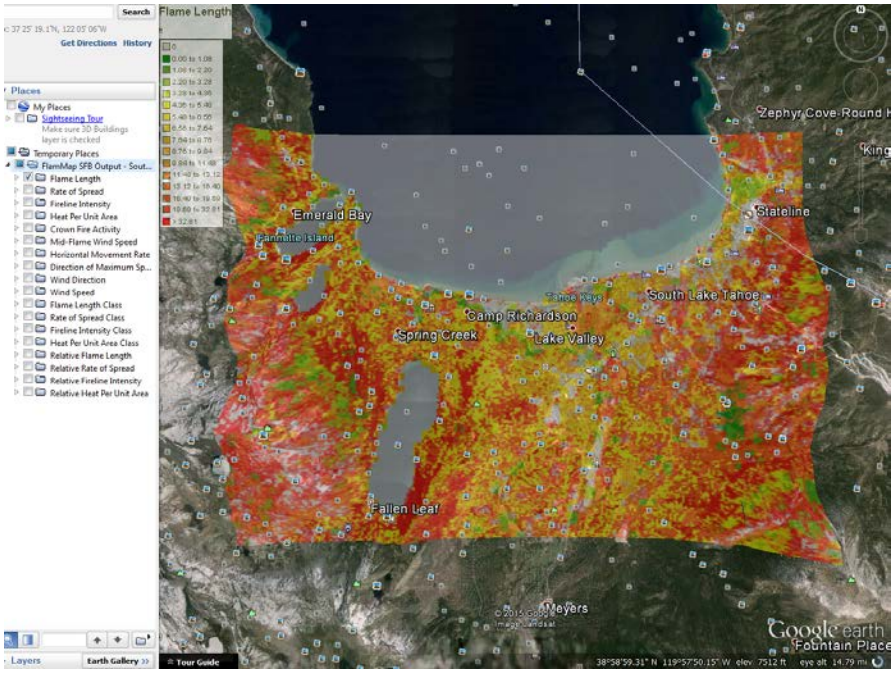


3. You should now be looking at the **Run Summary** step within the **Calculate fire behavior across a landscape (IFT-FlamMap)** workflow for your chosen run. Navigate to the **Classified Outputs** step by clicking on the **Classified Outputs** box in the workflow.



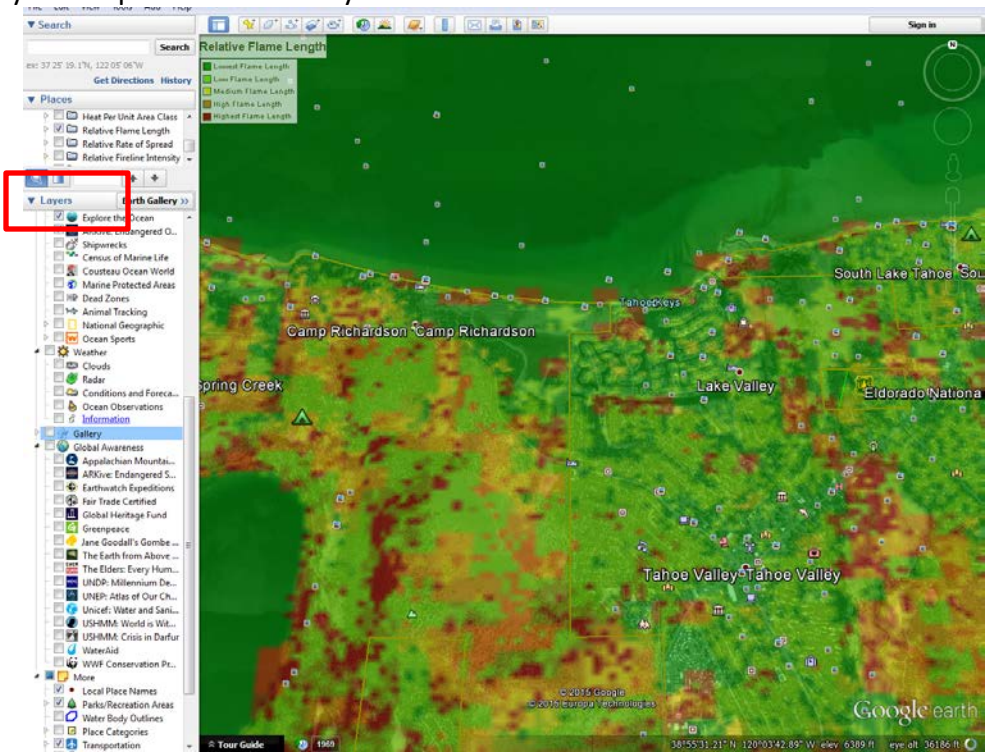
At the **Classified Outputs** map click the **Exports** tab in the map panel and download all three **KML** files. You can save them to your computer to click **Open** to open them up in Google Earth. If you click **Open** you will leave IFTDSS for Google Earth. If you saved the KML files to your computer you will need to navigate to the folder where you saved the files and double click on them to open them in Google Earth.



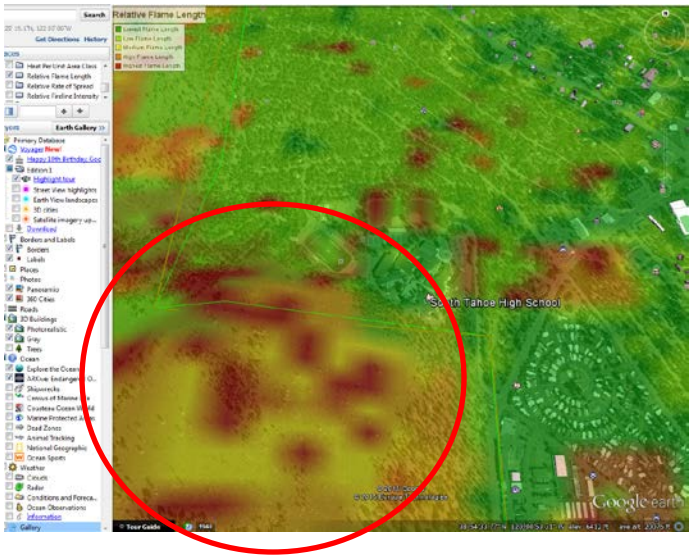


Your run input and output variables are now stored as layers in the Temporary Places folder within Google Earth. Take some time to explore your inputs and outputs in Google Earth.

You can use the Layers tab in Google Earth to add parks, water bodies, schools, airports, etc to your map for further analysis.



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

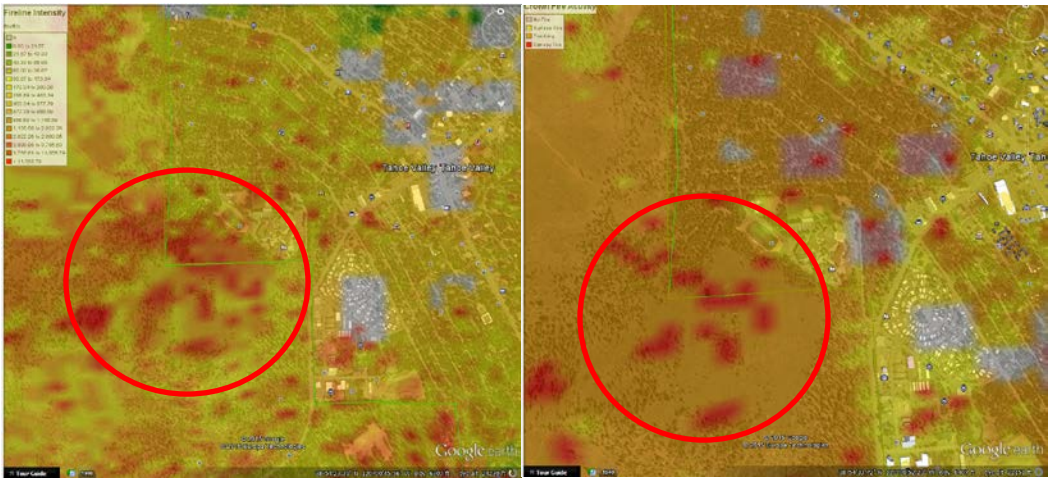


In this example, we focus on a number of fire-related descriptors to identify an area where further fuels treatment analysis may be warranted.

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

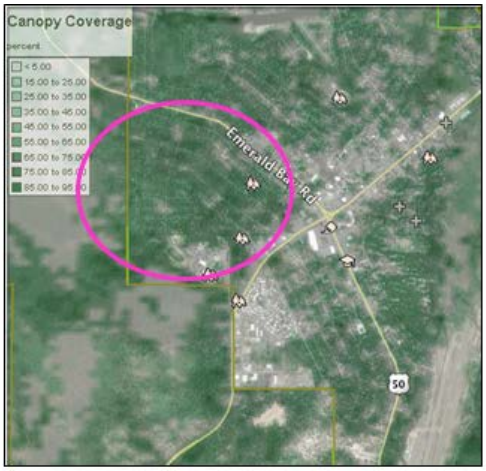
Using multiple fire behavior descriptors, it is clear that this forest is at risk for high flame lengths, high fireline intensity, and canopy fire.

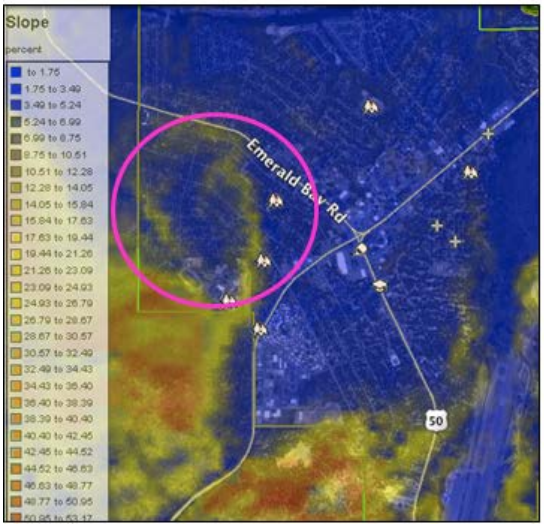
Next, we will review some environmental parameters.



This location also has moderate slopes, high canopy coverage, and low canopy base heights.

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





Feel free to explore other KML files you have created in IFTDSS to evaluate your inputs, outputs and general landscape characteristics.