

## Lesson 10 – Gathering Information to Support Relative Risk and Decisions

*Estimated time to complete: 45 minutes*

In this Lesson, you will gather information in WFDSS that will be used to inform and support a relative risk assessment and decision content.

In [Lesson 8](#), you learned how to view values in the area of a fire and information about map features. In [Lesson 9](#), you learned how to run automated Basic and Short Term Fire Behavior models. In this Lesson, you will:

- Obtain a values inventory.
- View a current weather forecast.
- View a fire danger rating graph for the nearest reporting weather station.
- Glean information from map layers.
- Query the Landscape to better understand what types of fuels are in the fire area.
- Interpret the results of the automated BFB & STFB analysis you completed Lesson 9.

The list of methods above, as well as those explored in Lessons 8 and 9, are not all inclusive. Additional information about the fire area can be gleaned from WFDSS, and more importantly, from field experience and visits with local fire managers. The exercises in this Lesson will familiarize you with some of the tools and map displays available in WFDSS that can help you gather information to support decision content and incident management.

This lesson contains 10 exercises.

### Gathering Information to Support Relative Risk and Decisions

To calculate relative risk and develop decision content, you need to gather information about your incident that includes:

- Values at risk in the area affected by the fire.
- Weather, size, and other data about the fire.
- Seasonal conditions and an understanding of historic fire activity in the area.

The following exercises will help you accomplish this.

#### Obtaining a Spatial Inventory

Spatial Inventory information is generated automatically when a planning area is saved or when STFB or NTFB fire behavior analyses are processed. WFDSS uses the STFB Arrival Time footprint or the NTFB perimeter projection to determine which values fall within the model outputs.

- A Spatial Inventory generated by a planning area is visible on the Situation map only to users with incident editing privileges, until a decision is published that includes the planning area.
- A Spatial Inventory generated by an automated STFB or an accepted-as-complete analysis-assisted STFB or NTFB analysis is available for viewing on the Situation or Results map by all users, regardless of role or privilege.

The spatial inventory displays the following information:

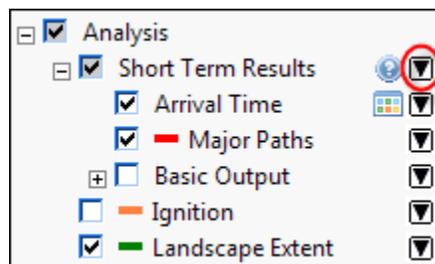
- Basic planning area or analysis information such as name and acreage,
- Values Inventory for known values found within the planning area, STFB Arrival Time Grid or the NTFB projected perimeter,
- Value layers that were queried but contained no results for the area in question.

**Caution:** DO NOT assume that the value layers are complete or all-inclusive! These layers are updated frequently as new information becomes available. Check local data sources and consult with local contacts regarding additional values. Your unit may have important information that is not available to WFDSS at a national level.

In Lesson 8, you created a planning area. In Lesson 9, you created an automated STFB run. Now you will practice viewing the spatial inventory for each in the following exercises.

**To obtain a values inventory for an analysis output:**

1. Navigate to the Analysis list for your training incident, or the incident you’ve chosen to work with, by doing one of the following:
  - Select the incident from the Incident List, and then click **View Analyses**.
  - From the Situation Map, select the **Menu** tab > Incident Analyses.
2. From the Analysis List, select the accepted-as-complete STFB or NTFB analysis for which you would like to view the values inventory.
3. Click **View Results**. The Results map appears with the results for that run displayed in the LayerSwitcher (the list of map layers on the left side of the screen) and the map view.
4. Click the  arrow beside the run you are viewing results for.



5. Click **Spatial Inventory**. A window appears with the Analysis Spatial Inventory. If the inventory doesn’t display after a few moments, right-click on the message page and select Refresh from the menu. The values inventory appears.

**To obtain a values inventory for a planning area:**

1. From the Incident List, select the incident for which you would like to view the values inventory.
2. Click **Situation Assessment**. The Situation map appears.
3. From the **Map** tab, open the **Incident** layers by clicking the + sign beside it, and then open **Planning Areas**.
4. Click the  next to the planning area you would like to view the spatial inventory for.
5. Click **Spatial Inventory**. The Planning Area Spatial Inventory appears. If instead you see a message that says the values inventory request was submitted, right-click on the message page and select **Refresh** from the menu. The Values Inventory appears.

## Viewing the Weather Forecast

The National Weather Service automatically generates the weather forecast for the selected incident or area on a WFDSS map display. Any WFDSS user can view the current, forecasted conditions for any point on the map. The current forecast for an incident's coordinates can be easily viewed from the Situation map and is automatically included in the decision content when a decision is published. WFDSS is designed to assist decision makers by providing the best and most timely information available and, for this reason; the forecast in the decision cannot be 'back dated'. If you would like to include a past forecast in your decision content, you can upload it as an image.

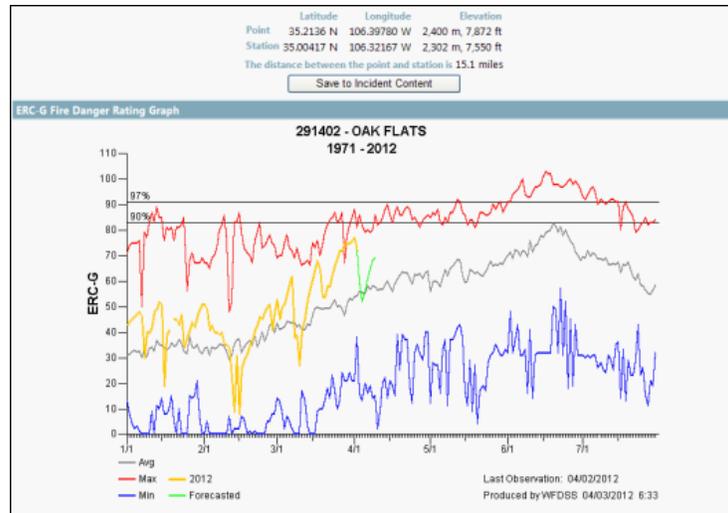
### To view the weather forecast:

1. From the Incident List, select the incident for which you would like to view the weather forecast.
2. Click **Situation Assessment**. The Situation map appears.
3. Select the **Fire Weather and Danger Layers**, and then turn on the **Fire Wx Zones** layer. The fire weather zones display and you can determine in what zone the incident is located (WFDSS already knows which zone the incident is located in, this is just helpful for you to know).
4. Select the **Info** tab. The Information page appears in the left pane with the coordinates of the incident displayed.
5. You can generate a weather forecast for these coordinates or select a different set of coordinates. To select new coordinates; select the  tool, place your cursor on the map where you want to know the forecast, and left click.
6. Click the **Weather Forecast** link in the left pane. The current fire weather planning forecast for the incident or selected point appears. The current forecast is for the fire weather zone that contains the incident or selected point.
7. Review the information in light of current and expected fire conditions.

## Viewing the Fire Danger Rating Graph

The Fire Danger Rating Graph displays the Energy Release Component (ERC) for the Remote Area Weather Station (RAWS) that is closest to the latitude and longitude recorded on the **Info** tab in the left pane and is currently reporting observations. The coordinates on the **Info** tab are usually those recorded for the incident, but you can use the Identify tool to identify a different set of coordinates on the map if you choose.

The Fire Danger Rating Graph (Figure 1) provides a graphical representation of the current and forecasted daily ERC values in relation to past history for the station. This graph is frequently used to assess fire danger and severity and it uses NFDRS fuel model G. Fuel Model G is widely used to display ERC values because it contains all of the dead fuel size classes and both herbaceous and woody live fuels.



**Figure 1 - Example of Fire Danger Rating Graph as seen in WFDSS**

The RAWS identification number, name, and years of data used in the graph are provided in the graph title. The current year's daily ERC values (yellow) and 6 days of NDFD forecast for the station location (green) are displayed with the average (gray), maximum (red), and minimum (blue) values. The 90th and 97th percentile levels are indicated on the graph with horizontal lines. The station location and the incident/point location, as well as the distance between the station and incident/point, are provided above the graph title.

The last observation date recorded for the station is available in the lower right corner of the graph, with the date the image was created by WFDSS. Incident Owners and Editors can save the Fire Danger Rating Graph to an incident's content so it can be easily included in a decision. This content is helpful if you need to relay seasonal severity, or compare current conditions to the historical minimum, maximum and average for a given weather station.

### To view the fire danger rating graph:

1. From the Incident List, select the incident for which you would like to view the fire danger rating graph.
2. Click **Situation Assessment**. The Situation map appears.
3. Choose the **Info** sub-tab.
4. Click the **Fire Danger Rating Graph** link. An ERC Fire Danger Rating Graph from the reporting RAWS closest to the incident appears in a separate browser window.

### Gleaning Information from Map Layers

A variety of information can be gleaned from the many map layers available in WFDSS. As you learned in Lesson 6, you can manage your map layers in System Preferences (My Home > System Preference). For the following lesson, ensure all map layers are available for viewing.

You explored the Situation map and available map layers at an introductory level in Lesson 8. In the following exercises, you will explore the map layers in greater depth.

## Viewing Fire Environment and Safety Layers

The **Fire Environment and Safety** layers can supply very useful information regarding the fire area. These layers currently provide:

- The locations of nearby incidents that are not out, as well as their associated planning areas if a decision has been published.
- The active MODIS that displays satellite infrared heat signature for active fires.
- A spatial Estimated Ground Medevac Time layer that estimates ground transport time in hours from every point within the continental US to a hospital (to be used strategically and not tactically.)
- An Aerial Retardant Avoidance layer that shows areas where the aerial application of fire retardant should be avoided to prevent potential impacts to federally-listed threatened or endangered species.

### To view Fire Environment and Safety Layers:

1. From the Incident List, select the incident for which you would like to view historical fires.
2. Click **Situation Assessment**. The Situation map appears.
3. Select the **Fire Environment and Safety** Layers, and then select the **Incidents** layer. Are there any fires (that are not out) in the area of your training incident?
4. Select the **Active Planning Areas** layer. Do the incidents you located in the previous step have active planning areas? Do the active planning areas intersect the planning area for your training incident?
5. Select the **MODIS** layer. The MODIS layer shows heat signatures for active fires and is available in Training and Production. Your training incident is most likely not an actual fire, so MODIS will not display heat for it. If you'd like, use the pan and zoom tools to navigate to an area with an active fire to view MODIS heat signatures. They appear as orange circles and show which flanks of a fire are active. MODIS updates in WFDSS twice a day, in the morning and again in the afternoon.
6. Select the **Est Ground Evac Time** layer, and then select the legend icon beside it. What is the estimated ground evacuation time in the area of your fire? This information is not intended to automatically deter resource deployment to any location, but to encourage thoughtful decisions about the risks being transferred to firefighters and how to mitigate those risks.
7. Select the **Retardant Avoidance** layer. Are there any Retardant Avoidance areas in your training incident's planning area? Would this affect your suppression strategy?

For additional information about the MODIS, Estimated Ground Medevac Time, or Retardant Avoidance layers, click the  icon beside the layer name in the LayerSwitcher. Appropriate help content for each layer will appear in a pop-up box.

## Viewing Disturbance History Layers

Historical wildfire spatial data, if they exist, can provide valuable situational awareness. If you know the primary direction of fire growth and potential effects of current and forecasted winds, you can determine if recent fire scars are available to act as barriers or slow fire spread.

Analysis assisted BFB, STFB, NTFB, and FSPro fire behavior models can utilize landscape data modified to account for fire scars to determine the likely impacts of associated changes in fuel type on fire spread. The automated versions of BFB and STFB cannot and do not use modified landscape data.

Fuel Treatments were incorporated in WFDSS Training in 2012 using a limited sample of data from selected units. These data were intended for testing and research purposes only, and should not be used for "real-world" applications. Fuel Treatments are not available in WFDSS Production.

### To view historical wildfires:

1. From the Incident List, select the incident for which you would like to view historical fires.
2. Click **Situation Assessment**. The Situation map appears.
3. Select the **Disturbance History** Layers, and then select the **Historical Wildfires** layer.
4. Are there any historical wildfires in the area of your training incident?
5. If so, how far away from the incident are the historical wildfires? To determine this, select  from the toolbar. Left click once on the incident and hold, drag the cursor to the historical fire's edge and double left click to complete. The line turns blue and the distance is recorded in both kilometers and miles in the left pane.
6. Practice measuring distance with other historical fires in the area. In the next exercise, you will learn to query fuel types in the area of the fire and in the fire scars.

### Viewing Fire Weather and Danger Layers

In the **Fire Weather and Danger** Layers, you can view Significant Fire Potential, Fire Weather Zones and RAWS stations for your fire area.

In Lesson 8, you viewed the 7-day Predictive Services Significant Fire Potential forecast from the **Info** tab, for the location of your incident. Earlier in this lesson you viewed the Fire Weather Zones and determined which zone your training incident is located in. In the following exercise you will view daily Significant Fire Potential forecasts for the area of your training incident, and determine if there are RAWs nearby.

### To view Fire Weather and Danger Layers:

1. From the Incident List, select the incident for which you would like to view historical fires.
2. Click **Situation Assessment**. The Situation map appears.
3. Select the **Fire Weather and Danger** Layers, and then open the **Significant Fire Potential** layer. You will see a list of 7 dates, beginning with today.
4. Click the legend icon, and then click today's forecast. Is your training incident located in an area determined to be a Critical Burn Environment? Is Lightning forecasted?
5. Click through each day's forecast and make note of conditions in the area of the fire.
6. Turn off the Significant Fire Potential layer, and then select the **RAWS stations** layer. Are there RAWS in the area of your training incident?
7. Click the name of the RAWS closest to your training incident. A window appears that displays station information.

NAME	VALUE
Station	MAGDALENA (2.8 miles)
Green Up Date	05/01
Grass Type	P : Perennial
Climate Class	2 : Subhumid
Avg. Precip	20.0 inches
Elevation	8600 feet
Aspect/Slope	Southwest / 1 : 0 - 25%
Pos on Slope	Ridge / Peak Top
Station Type	4 - NFDRS Satellite
WFDSS Use	FSPRO ERC-Winds / Other FB

- Click the station name (circled in the graphic above) and a second window pops-up that displays the last 24 hours of hourly observations for the station. This information is sourced from MesoWest and can help you evaluate conditions in a fire area if conditions at the RAWs are similar. If you are not familiar with the RAWs in a particular area; talk to local fire managers, IMETS (if available) or GACC meteorologists. Close the second window.
- Click **Fire Danger Graph** (circled in the graph above) to view the Fire Danger Rating Graph for the selected weather station. If you selected the RAWs closest to your training incident, this should be the same Fire Danger Rating Graph you viewed earlier in the lesson (accessible from the **Info** tab).

## Querying the Landscape Data

Knowing what types of fuels are in a fire area helps you determine fire behavior potential for an incident. From the Situation map, you can query the fire area to determine elevation, aspect, slope, fuel model, and canopy characteristics for a selected point. The Landscape Data Source selected as the default on the Incident Information page is the source of the landscape data provided by the query.

### To query the landscape data

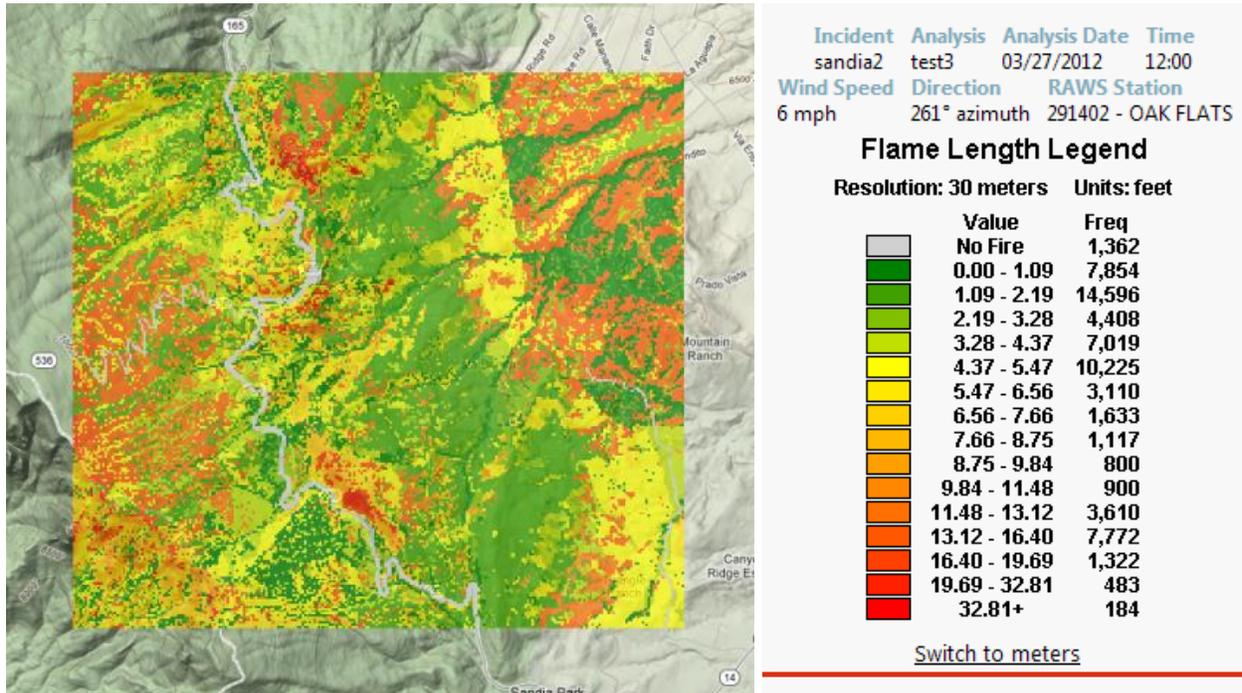
- From the Incident List, select the incident for which you would like to query the landscape data.
- Click **Situation Assessment**. The Situation map appears.
- Click the **Info** tab, and the Information pane appears.
- Select the **i** tool, and then left click in the fire area. A small yellow circle appears where you clicked, and landscape data for that point appears in the information pane on the left.
- Click around the immediate fire area to determine in what fuel models the fire is currently burning.
- Click inside of fire scars to determine if fuel models inside the scars are drastically different than fuel models outside the scars. Will the fuel models inside of fire scars carry fire?

## Interpreting Analysis Results

### Interpreting Basic Fire Behavior (BFB) Analysis Results

If you completed Lesson 9 in the WFDSS 101 series, you created an automated BFB analysis for your training incident. WFDSS Basic Fire Behavior (BFB) output results are fairly straightforward to interpret.

The output shows fire behavior as if the entire landscape burned at one instant in time, under the wind conditions displayed in the wind grids. Though only a single-wind speed and direction were input, the model adjusts these values according to the underlying terrain. When you choose a specific fire behavior output, BFB displays the calculated fire behavior characteristics for every cell of the landscape extent, based on the analysis start date and conditioning end time (start time). The image below shows an example of Automated BFB analysis with the Flame Length output displayed. Note that you can switch the output units from feet to meters by clicking the link near the bottom of the legend.



**To view automated BFB outputs:**

1. From the Incident List, select the incident for which you would like to view automated BFB outputs.
2. Click **Situation Assessment**. The Situation map appears.
3. Click the + beside Analysis layers > Basic layers > the run you would like to view outputs for.
4. Select the radio button beside the output you would like to view in the map display. To view the legend for an output, click  to the right of the output.

When viewing your BFB outputs, ask yourself the following questions:

- Are flame lengths conducive to direct attack by hand crews?
- Is there potential for passive or active crown fire?
- Are rates of spread higher or lower than what you’d expect? How about in the area around homes or private property?
- How dry are the 1 Hr and 10 Hr fuels and how will the dead fuel moisture values affect fire spread?
- What affect does topography have on wind direction and wind speed?

## Automated BFB Assumptions and Limitations

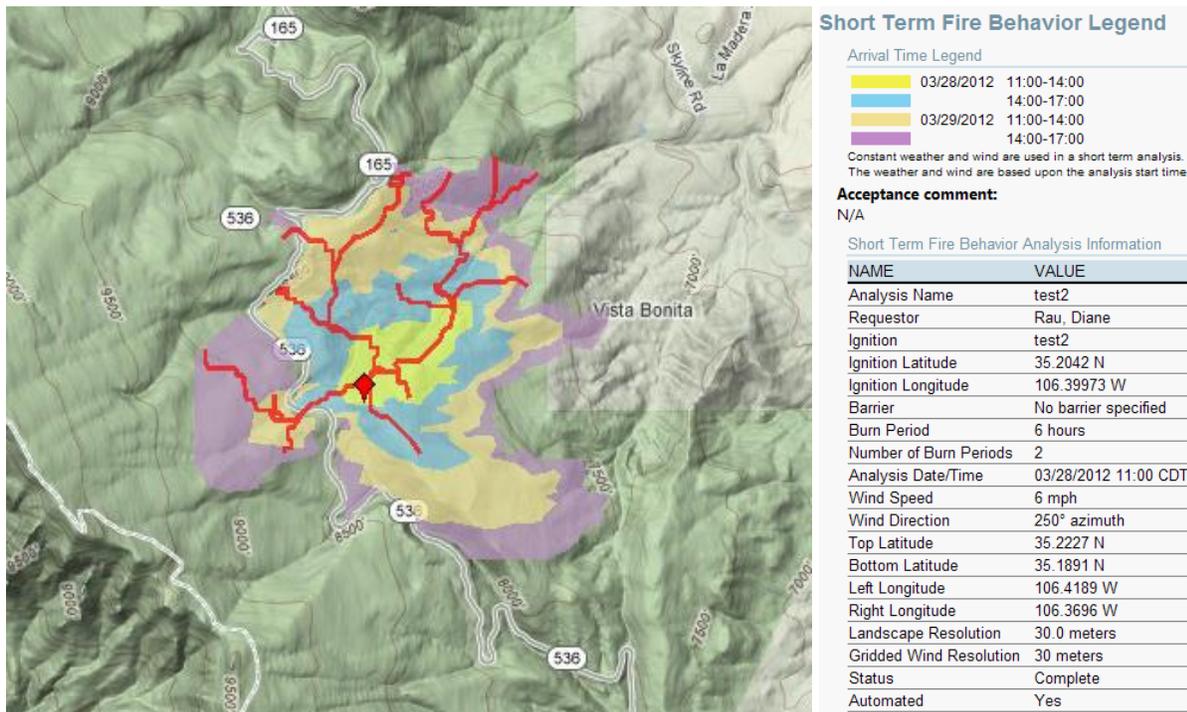
- WFDSS Automated Basic Fire Behavior (BFB) calculates fire behavior outputs using fuel moistures based on topographic information, forest canopy cover, and the previous seven days of weather data (for fuel moisture conditioning) from the WFDSS-selected RAWS. However, the RAWS selected by WFDSS cannot be changed by the user. In addition, RAWS observations cannot be edited.
- The wind speed and direction (from historic observations, NDFD, or supplied by the user) are used as inputs into WindNinja to create gridded winds at 200-meter resolution. Though the wind inputs are populated for the forecast start time, users of Automated BFB should review these default values and adjust them based on the best available local information or when attempting to answer a scenario based question ('will there be active crown fire with 20mph southerly winds?'). Additionally, it is important to check the output wind speed and direction grids because a 20mph inputs could result in 50mph winds at the ridgetop and 4mph winds in the valley bottom. Users may have to make a few runs and work the analysis 'backwards' to get the windspeed they want in a specific area (especially if the terrain is highly contoured).
- Fire behavior calculations are performed independently for each cell on the landscape
- WFDSS BFB uses the same underlying fire models (Rothermel's 1972 surface fire model, Van Wagner's 1977 crown fire initiation model, Rothermel's 1991 crown fire spread model, and Nelson's 2000 dead fuel moisture model) used in other fire behavior applications; thus the assumptions and limitations of those underlying fire models are inherent within WFDSS BFB.
- As with all models, the quality of the outputs from WFDSS Automated BFB depends on the quality of the inputs. Once the run is complete, experienced users can examine the RAWS data and landscape that were used for the analysis, but cannot adjust those inputs for automated runs. If the input data are suspect, then consider the output results suspect as well. When the weather or landscape needs significant adjustment, consider finding a qualified analyst that can make those changes through an analyst assisted model.
- WFDSS Automated BFB does not allow the user to save the outputs, they can only be displayed within WFDSS. **In addition, after 20 days, the analysis is automatically deleted by WFDSS.**

**Note:** It is important to remember that the more automated the model, the less ability you have to refine the inputs. WFDSS Automated BFB is highly automated and requires very few user inputs, so *carefully critique the results* before using them to support wildland fire decisions.

## Interpreting Short Term Fire Behavior (STFB) Analysis Results

If you completed Lesson 9 in the WFDSS 101 series, you created an automated STFB analysis for your training incident. WFDSS Short-Term Fire Behavior (STFB) output results are fairly straightforward to interpret. The following image shows an Automated STFB analysis with both Arrival Time and Major Paths displayed. The legend provides the inputs used for the analysis and describes the hours used for the Arrival Time output. In this example, the legend displays the date and hours for the Arrival Time, as

well as the Short-Term Fire Behavior Analysis Information. The dark red lines depict the simulated fire's Major Paths from the point of ignition, indicated by a red marker.



Although initial fuel moistures are conditioned prior to ignition and gridded winds are generated from the inputs, the outputs still represent just a single 'snapshot in time'. Weather conditions (wind, temperature, humidity, precipitation etc.) do not change throughout the scenario and, though the fuels are conditioned to the start time, fuel moistures do not change over the course of the analysis, either. The MTT flow path results of an Automated STFB run represent only the influence of topography combined with the static (but gridded) wind speed and direction used in the inputs. If the influence of changing weather conditions over time is important for answering the question being asked, then consider locating an analyst to complete a Near Term Fire Behavior (NTFB) run.

### To view automated STFB outputs:

1. From the Incident List, select the incident for which you would like to view automated BFB outputs.
2. Click **Situation Assessment**. The Situation map appears.
3. Click the + beside Analysis layers > Short Term layers > the run you would like to view outputs for.
4. Select the box beside the output you would like to view in the map display. To view the legend for an output, click  to the right of the output.

When viewing your STFB outputs, ask yourself the following questions:

- Is the fire projected to grow in the direction of values such as homes or private property?
- Is fire growth projected in an area that maybe you didn't think possible?

- Is the projected fire growth greater than you thought it would be given the current and forecasted wind and weather?
- Are there areas where major flow paths branch out because of receptive fuel conditions and could the fire be safely controlled before reaching these areas?

The output results from an Automated STFB analysis cannot be saved or downloaded for use in a GIS, they can only be displayed within WFDSS. **In addition, after 20 days the analysis is automatically deleted by WFDSS.**

### Automated STFB Assumptions and Limitations

- WFDSS Automated Short-Term Fire Behavior (STFB) calculates fire behavior outputs using fuel moistures based on topographic information, forest canopy cover, and the previous seven days of weather data (for fuel moisture conditioning) from the WFDSS-selected RAWS. However, the RAWS selected by WFDSS cannot be changed by the user. In addition, the RAWS data cannot be edited by the user.
- The wind speed and direction (from historic observations, NDFD or supplied by the user) are used as inputs into WindNinja to create gridded winds at 200-meter resolution. The input winds are considered to be an average across the entire landscape and will be stronger at ridgetops and lighter in valley bottoms.
- Though forward fire spread over time is displayed, the weather conditions (except gridded winds) do not change throughout the duration of the analysis. Outputs are weather dependent more than time dependent. Though hours are displayed in the outputs, they should be interpreted to match weather conditions and not clock hours. “Under these static conditions, the fire could move this far in six hours”, not “the fire will reach this road at 1900 hours”.
- Fuel moisture values (as calculated at the analysis start date and time) are held constant for the duration of the STFB simulation.
- WFDSS STFB uses most of the same underlying fire models (Rothermel's 1972 surface fire model, Van Wagner's 1977 crown fire initiation model, Rothermel's 1991 crown fire spread model, Albini's 1979 spotting from torching trees, and Nelson's 2000 dead fuel moisture model) used in other fire behavior applications; thus, the assumptions and limitations of those underlying fire models are inherent within WFDSS STFB.
- Fire growth calculations for STFB across the landscape extent are performed assuming independence of fire behavior between neighboring cells. In other words, the travel time across a cell does not depend on the behavior in adjacent cells.
- This automated version of STFB only allows for a single-point ignition (1/10<sup>th</sup> acre fires).
- As with all models, the quality of the outputs from WFDSS Automated STFB depends on the quality of the inputs used. If the landscape data or RAWS data used are inadequate, the resulting fire behavior outputs will be questionable. It is important to be familiar with and assess the fuels data, as well as the RAWS data before using WFDSS Automated STFB in support of wildland fire decision-making. If the input data is suspect, then consider the output results suspect as well.

In the next Lesson, you will use all of the information you’ve gathered to calculate relative risk.

**Search for these related topics in the Help:**

- [Obtaining a Values Inventory](#)
- [Viewing the Weather Forecast](#)
- [Viewing the Fire Danger Rating Graph](#)
- [Viewing Fire-Related Layers](#)
- [Querying the Landscape Data](#)
- [Automated BFB – What it Means \(interpretation\)](#)
- [Automated BFB – Assumptions and Limitations](#)
- [Automated STFB – What it Means \(interpretation\)](#)
- [Automated STFB – Assumptions and Limitations](#)