Reference Guide

Automated Basic and Short-Term Fire Behavior

2.0

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WFDSS Basic Fire Behavior

WFDSS Automated Basic Fire Behavior can be used by the Incident Author, Owner, or anyone granted incident privileges. These analyses are conducted from the Incident's Assess Situation perspective.

The automated version of Basic Fire Behavior (BFB) is a very simple way to get "snapshot in time" fire behavior outputs for every cell on the user-defined landscape extent.

To run the analysis, you need only the following information:

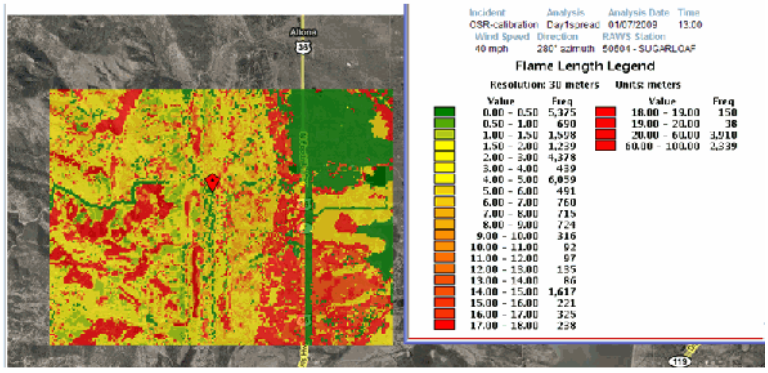
- Defined analysis area / landscape extent (normally no larger than about 5-6 miles per side)
- Start date and time for the analysis

The model retrieves historic or forecasted weather and winds for the analysis date and time. You can choose to accept the wind speed and direction provided or replace those input values with ones you choose. Within a short time (usually within a minute or so), fire behavior results will be ready for viewing.

Note: It is important to remember that the more automated the model, the less ability you have to refine the inputs. Because WFDSS Automated BFB is highly automated (providing fuels, weather, and topography data, and requiring very few inputs from the user), *carefully critique the results* before using them for supporting wildland fire decision making.

WFDSS Basic - What it is

WFDSS Automated Basic Fire Behavior (BFB) is a web-based fire behavior application. It gives "snapshot in time" fire behavior outputs (flame lengths, rates of spread, fireline intensities, etc.) for an entire user-defined landscape extent using one set (per cell) of wind and fuel moisture conditions. WFDSS BFB can be thought of as a "spatial BEHAVE or BehavePlus". Using fuels, topography, and weather data, fire behavior characteristics are calculated and displayed for every cell of the landscape extent.



Flame Length Example

WFDSS Automated BFB - What it needs (inputs)

Like BEHAVE and BehavePlus, WFDSS Basic Fire Behavior (BFB) requires the following information to perform fire behavior calculations:

- fuels
- weather (winds and fuel moisture values)
- topography

WFDSS BFB automatically provides nearly all of the necessary information to perform fire behavior calculations.

Caution: The quality of the output from the analysis is only as good as the data input into the model. Before using the output results to support wildland fire decision-making, be sure that you understand the inputs: fuels data being used, the appropriateness of the RAWS from which fuel moistures are calculated, and the validity of the weather forecast data.

The following table lists the inputs required for the automated WFDSS Basic Fire Behavior model:

Input	Source	Editable Value
Landscape data	WFDSS	Can choose one of the following from the Incident Information page (HOWEVER you may NOT edit): - AK Tanana Zone - AK Yukon-Charley - Alaska - 2009 - CA Landscape - LANDFIRE National - LANDFIRE Rapid Refresh - Western Northern Rockies
Foliar Moisture Content	WFDSS default (100%)	Not Editable
Live fuel moistures	From the WFDSS-selected RAWS and based on the standard NFDRS algorithms	Not Editable
Weather observations (for 7-day fuel moisture conditioning of dead fuels)	Nearby RAWS*	Not Editable
Weather forecast information for fire behavior predictions	National Digital Forecast Data (NDFD) based on the RAWS location	Not Editable
Wind speed and direction	National Digital Forecast	Can change:

Input	Source	Editable Value
forecast information for fire behavior predictions (wind speed and direction values are used as inputs to generate gridded winds)	Data (NDFD) based on the center of the user-defined landscape extent	▸ wind speed ▸ wind direction
Landscape extent (extent of analysis area)	User-defined	Draw the landscape extent (normally no more than 5-6 miles per side)
Name of analysis	User-defined	Name the analysis
Analysis Date and Time	User-defined	Enter the analysis date and time

** WFDSS chooses the nearby RAWS in the following way: The center of the analysis area is used as a starting point. Then, a horizontal/vertical distance algorithm sorts the RAWS stations within a given area. Next, WFDSS iterates through the list until the first station is found with the requisite fuel moisture / weather information (continuous hourly observations).*

WFDSS Basic - What it does (outputs)

Using the analysis date, WFDSS retrieves the previous seven days of RAWS data to do fuel moisture conditioning (of dead fuels) for each cell of the landscape extent. The dead fuel moistures that have been calculated by the analysis start date and time are used by WFDSS Automated Basic Fire Behavior (BFB) to provide fire behavior outputs for each cell. Wind direction and speed is provided from NDFD and, if desired, you can change those values or accept them. The wind values are then used by WindNinja to create gridded winds for the landscape extent. Using the fuel moistures and gridded winds, Automated BFB calculates fire behavior characteristics. Automated BFB provides many of the same fire behavior outputs as BEHAVE (and BehavePlus). Below are the outputs available in WFDSS Automated BFB and their units:

Output	Display Units
Flame Length	meters
Fireline Intensity	kilowatts per meter (kW/m)
Rate of Spread	meters per minute (m/min)
Heat per Unit Area	kilojoules per meter squared (kJ/m^2)
Crown Fire Activity	0 (no fire), 1 (surface fire), 2 (torching), 3 (active crown fire)
Maximum Spread Direction	radians

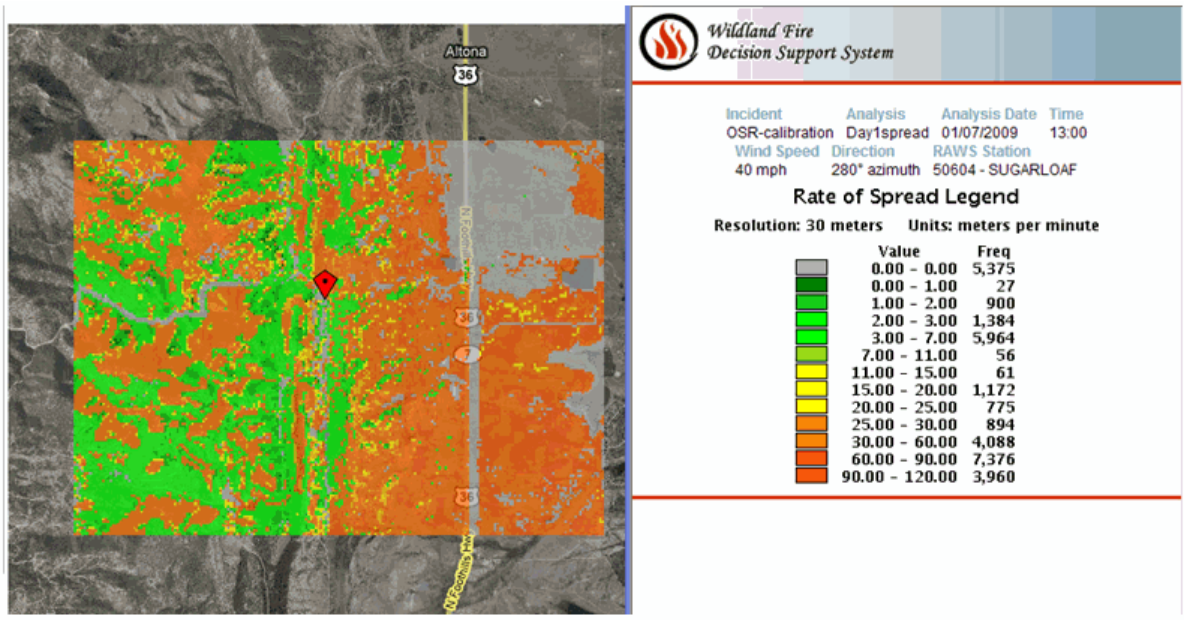
WFDSS Automated BFB also calculates the following environmental outputs:

Output	Display Units
1 hour fuel moisture	fraction (e.g., 0.06 = 6%)
10 hour fuel moisture	fraction (e.g., 0.18 = 18%)
Solar radiation	watts per meter squared (W/m^2)

Because it is geospatial, WFDSS BFB calculates and maps the outputs for every cell on a landscape for an instant in time. In the current automated version, WFDSS BFB does not allow the user to change the units, legend, or save the outputs. Currently, the outputs can only be displayed within WFDSS; however, you can save screen captures. BFB analysis results will automatically be deleted after 20 days.

WFDSS Basic - What it means (interpretation)

WFDSS Basic Fire Behavior (BFB) output results are fairly straightforward to interpret. 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 time. The image below shows an example of Automated BFB analysis with the Rate of Spread output displayed.



Rate of Spread Example

The legend provides the following information:

- inputs used for the analysis, such as the Analysis Date and Time, Wind Speed and Direction, and RAWS Station used
- resolution (in this case, 30 meters)
- units (in this case, meters per minute)
- rate of spread value class that corresponds with each color
- frequency or number of cells in each value class.

When interpreting these output results, it is crucial to remember the numerous WFDSS Automated BFB Assumptions and Limitations.

1) 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 edited.

2) 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.

3) Fire behavior calculations are performed independently for each cell on the landscape

4) 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.

5) As with all models, the quality of the outputs from WFDSS Automated BFB depends on the quality of the inputs. 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 BFB in support of wildland fire decision-making. If the input data are suspect, then consider the output results suspect as well.

6) 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.**

7) It is important to remember that the more automated the model, the less ability the user has to refine the inputs. Because WFDSS Automated BFB is highly automated (providing fuels, weather, and topography data, and requiring very few inputs from the user), carefully critique the results before using them for supporting wildland fire decision-making.

WFDSS Basic - Why use it - (potential uses)

Outputs from WFDSS Automated Basic Fire Behavior (BFB) have a variety of uses, including the following:

- Fire behavior outputs (flame lengths, rates of spread, crown fire activity, etc.) can be calculated using forecasted weather and displayed in WFDSS Automated BFB to provide insight into expected fire behavior across the landscape extent for a chosen time (e.g., the peak of the burning period for the next afternoon).
- Using forecasted weather, landscape-wide 1-hour and 10-hour fuel moistures could be calculated for determining likelihood of successful burnout conditions.
- Using archived (historic) wind and weather observations, WFDSS Automated BFB calculations could be used for critiquing landscape fuels data by choosing a date and time of a 2008 fire that had recorded fire behavior observations. For example, the Automated BFB Crown Fire Activity output could be compared to actual observations of crown fire activity for a given time and location.

WFDSS Basic - Assumptions and Limitations

1) 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 edited.

2) 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.

3) Fire behavior calculations are performed independently for each cell on the landscape

4) 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.

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6) 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.**

7) It is important to remember that the more automated the model, the less ability the user has to refine the inputs. Because WFDSS Automated BFB is highly automated (providing fuels, weather, and topography data, and requiring very few inputs from the user), carefully critique the results before using them for supporting wildland fire decision-making.

WFDSS Short-Term Fire Behavior (STFB)

WFDSS Automated Short-Term Fire Behavior can be used by the Incident Author, Owner, or anyone granted Incident privileges. These analyses are conducted from the Incident's Assess Situation perspective.

The automated version of WFDSS Short-Term Fire Behavior (STFB) is a quick way to get an idea of potential fire spread from a point location using one set of wind and fuel moisture conditions for the user-defined burn period(s).

The current automated version of STFB requires only the following information from the user:

- Name for the analysis
- Analysis Date and Time
- Fire start location (click a point on the map or enter latitude/longitude information)
- Defined analysis area/ landscape extent (normally no larger than 5-6 miles per side)
- Length of the burn period
- Number of burn periods for the analysis

The model retrieves forecasted weather and winds for the selected time, using National Digital Forecast Data (NDFD) for current simulations. For historic fires, the model can use historic weather.

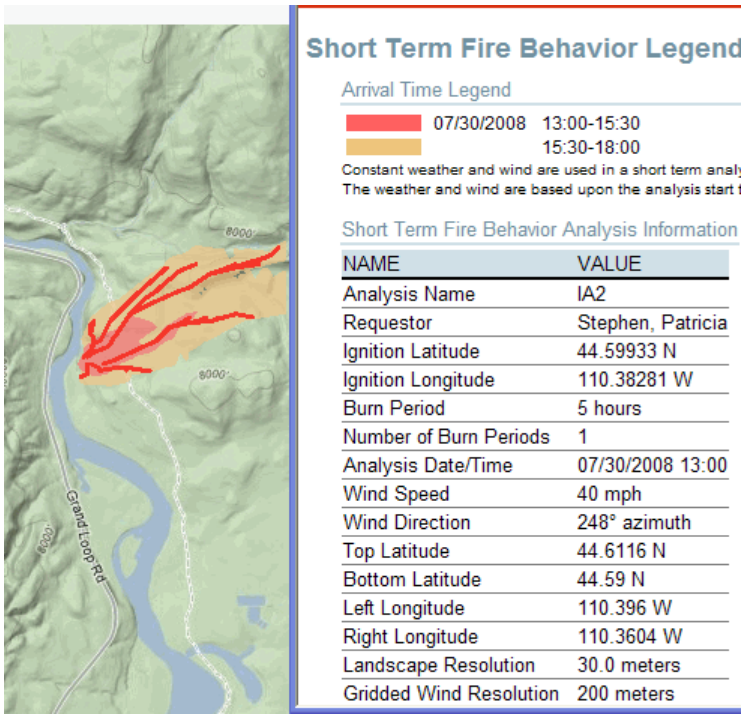
You can accept the wind speed and direction provided, or replace those values with ones you select. Within a short period of time (usually within a couple of minutes), WFDSS Automated STFB fire spread results are ready for viewing.

Note: It is important to remember that the more automated the model, the less ability the user has to refine the inputs. Because WFDSS Automated STFB is highly automated (providing fuels, weather and topography data, and requiring very few inputs from the user), carefully critique the results before using them for supporting wildland fire decision-making.

WFDSS STFB - What it is

WFDSS Short-Term Fire Behavior (STFB) is a two-dimensional fire growth model. This web-based application calculates spread rates and maximum spread direction at each cell. Holding all environmental conditions (wind and fuel moistures) constant for the duration of the simulation, STFB calculates fire growth and behavior by searching for the set of pathways with minimum fire spread times from an ignition (point) source.

Using one set of wind and fuel moisture conditions, STFB provides potential fire spread (arrival times and major paths) for a user-defined length of time.



Automated STFB Potential Fire Spread with Arrival Times and Major Paths

WFDSS Automated STFB - What it needs (inputs)

Like other geospatial fire models, WFDSS Short-Term Fire Behavior (STFB) requires the following data to perform fire behavior calculations:

- fuels
- weather (winds and fuel moisture values)
- topography information

STFB automatically provides (from web-based sources) most of the necessary information to perform fire behavior spread calculations.

Caution: The quality of the output from the analysis is only as good as the data input into the model. Before using the output results to support wildland fire decision-making, be sure that you understand the inputs: fuels data being used, the appropriateness of the RAWS from which fuel moistures are calculated, and the validity of the weather forecast data.

The following table lists the inputs required to make fire behavior and spread predictions in the automated version of WFDSS STFB:

Input	Source	Editable Values
Landscape data	WFDSS	Can choose one of the following from the Incident Information page (HOWEVER, you may NOT edit): - Alaska Tanana Zone - Alaska Yukon-Charley - Alaska - 2009 - California state data - LANDFIRE National - LANDFIRE Rapid Refresh - Western Northern Rockies
Foliar Moisture Content	WFDSS default (100%)	Not Editable
Live fuel moistures	From the WFDSS-selected RAWS and based on the standard NFDRS algorithms	Not Editable

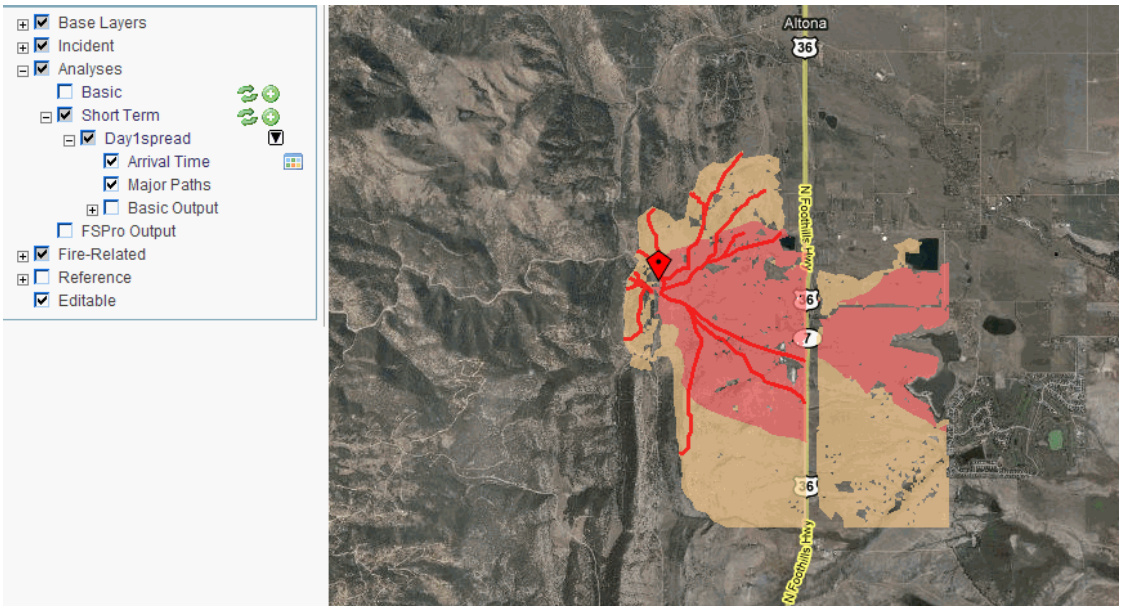
Input	Source	Editable Values
Weather observations (for 7 day fuel moisture conditioning of dead fuels)	Nearby RAWS*	Not Editable
Weather forecast information for fire behavior predictions	National Digital Forecast Data (NDFD) based on the RAWS location	Not Editable
Wind speed and direction forecast information for fire behavior predictions (wind speed and direction values are used as inputs to generate gridded winds)	National Digital Forecast Data (NDFD) based on the center of the user-defined landscape extent	Can change: ▸ wind speed ▸ wind direction
Landscape extent (extent of analysis area)	User - defined	Draw the landscape extent (normally no more than 5-6 miles per side)
Location of fire (point)	User - defined	Enter a Latitude/Longitude or select the fire's location on a map by clicking at a point
Name of analysis	User - defined	Name the analysis
Analysis Start date and time	User - defined	Enter the analysis date and time
Number of hours in the Burn Period	User - defined	Define a burn period
Number of Burn Periods	User - defined	Define the number of burn periods (1-3)

** WFDSS chooses the nearby RAWS in the following way: The ignition location is used as a starting point. Then, a horizontal/vertical distance algorithm sorts the RAWS stations within a given area. Next, WFDSS iterates through the list until the first station is found with the requisite fuel moisture / weather information (continuous hourly observations).*

WFDSS STFB - What it does (outputs)

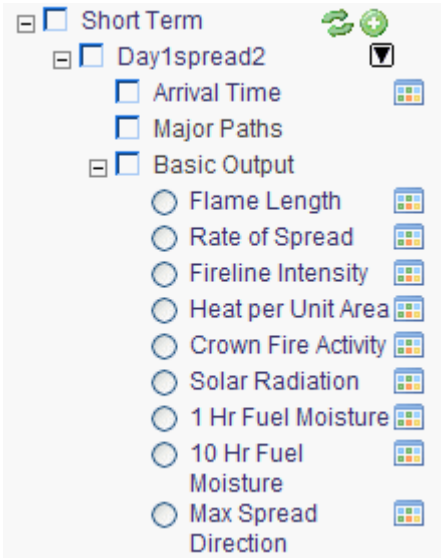
Following 7 days of fuel moisture conditioning, the WFDSS Short-Term Fire Behavior (STFB) model uses one set of gridded wind and fuel moisture conditions (based on the analysis start time) for the simulation duration to calculate and display two fire spread outputs:

- **Arrival Time:** represents the number of hours it takes the fire to reach that location on the landscape from the ignition source
- **Major Paths:** shows only the most significant fire spread pathways



Automated STFB Outputs showing Arrival Time and Major Paths

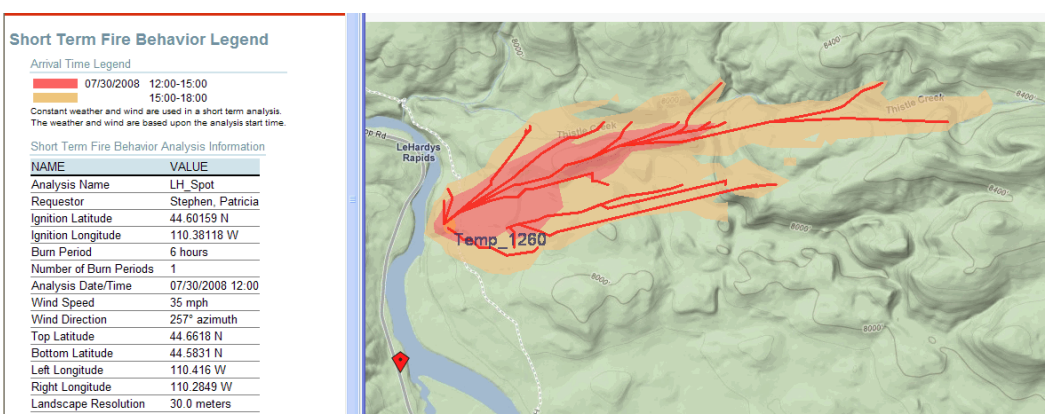
In addition to the fire spread outputs described above, when a STFB analysis is conducted, Basic Fire Behavior (BFB) "snap shot in time" outputs are also calculated for the defined landscape extent using the start date and time, and are available for display.



Automated STFB Outputs showing BFB Calculations

WFDSS STFB - What it means (interpretation)

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.



Automated STFB Outputs with Legend

When interpreting these output results it is crucial to remember the numerous WFDSS Automated STFB Assumptions and Limitations.

1) 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.
2) 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.
3) Even though STFB can simulate many hours of fire spread, wind speed and direction are held constant for the duration of the simulation.
4) Fuel moisture values (as calculated at the analysis start date and time) are held constant for the duration of the STFB simulation.
5) 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.
6) 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.
7) This automated version of STFB only allows for a single-point ignition.
8) 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.

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.**

WFDSS STFB - Why use it - (potential uses)

The automated version of WFDSS Short-Term Fire Behavior (STFB) is a quick way to get an idea of potential fire spread from an ignition point using one set of wind and fuel moisture conditions for the user-defined burn period(s). Some potential uses of Automated STFB (given its many limitations) include the following:

- Obtain insight into potential short-term fire spread times and locations using forecasted weather.
- Get a rough idea of short-term fire spread during a forecasted wind event.
- Run "what-if" scenarios for spot fires.

- Run several days of fire spread to help determine the size and extent needed for the Planning Area for the WFDSS Decision Process.
- Evaluate landscape and weather data using historic weather and fire perimeters.

WFDSS STFB - Assumptions and Limitations

1) 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.
2) 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.
3) Even though STFB can simulate many hours of fire spread, wind speed and direction are held constant for the duration of the simulation.
4) Fuel moisture values (as calculated at the analysis start date and time) are held constant for the duration of the STFB simulation.
5) 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.
6) 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.
7) This automated version of STFB only allows for a single-point ignition.
8) 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.
9) 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.**

NEW! Automated STFB Values Inventory Information

It is now possible to obtain values inventory information associated with a Short-term Fire Behavior (STFB) analysis. When you make a Values Inventory request, WFDSS uses the STFB Arrival Time footprint to query a values inventory database. It then displays the values that are within the STFB Arrival Time grid, as well as what database layers were queried but contained no data within the area affected.

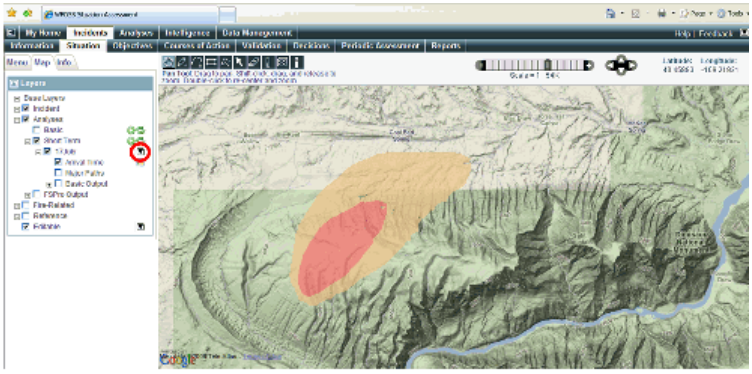
CAUTION: Do NOT assume that the data layers are complete or all-inclusive! The layers available in the values inventory are updated frequently as new information becomes available. In addition, new value layers are periodically being added to the database.

To access the STFB values inventory information:

To access the Values Inventory associated with a Short-Term Fire Behavior (STFB) analysis, follow the steps below:

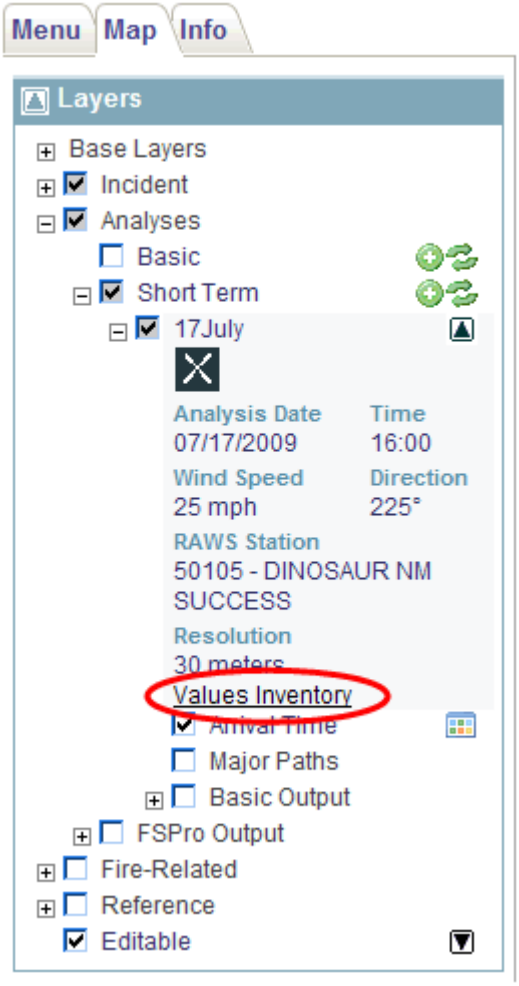
1) On the Incident List page, select the incident you want to view an STFB for.
2) Click **Assess Situation**.
3) On the Incident Situation Assessment page, choose the Map tab.
4) Expand the Analyses Item.
5) Click the black triangle (circled in red in the image below) next to the STFB analysis name.

   Information about the analysis appears.



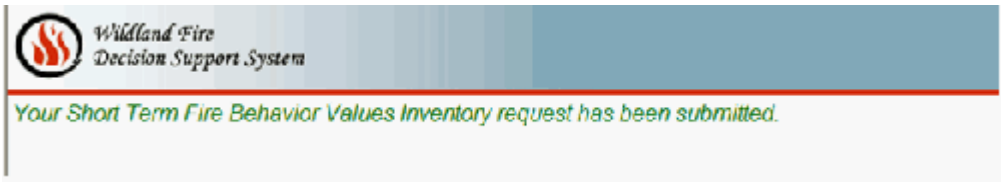
STFB Display Options

6) Click the Values Inventory (circled in red in example below)



STFB Map tab with Values Inventory Highlighted

A window will pop up saying that the values inventory request was submitted.



7) Wait a few moments, then refresh the screen by right-clicking and choosing Refresh from the menu.

Values Inventory Information should then be displayed in the window. Three tables are included on this page:

- Basic information about the analysis
- A table showing values found within the area covered by the STFB Arrival Time Grid (category, value, data source, as well as currency and coverage of the layers)

- A table showing the currency and coverage of values layers that were queried but no results were found within the STFB footprint.

Wildland Fire Decision Support System

Short Term Analysis Values Inventory Information

NAME	VALUE
Incident Name	Split Top
Analysis Name	17July
Analyst	Stephen, Patricia
Short Term Size	2,297 acres

Category	Value	Data Source	Currency	Coverage
Building Clusters: Uintah	0	US Counties / FGDC Cadastral Subcomm.		Available counties in AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
Census Housing Values	$0	U.S. Census Bureau	01/01/2000	National
County: Uintah	2,297 acres	Tele Atlas North America, Inc., ESRI	4/1/2008	National
Jurisdiction: BLM	631 acres	Primarily BLM Land Status	01/01/2007	AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
Jurisdiction: NPS	1,651 acres	Primarily BLM Land Status	01/01/2007	AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
Jurisdiction: State	15 acres	Primarily BLM Land Status	01/01/2007	AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY

Currency/Coverage of Values Queried that Produced No Results

Category	Data Source	Currency	Coverage
Habitat: Sage Grouse	BLM	07/15/2008	National
Habitat: Mexican Spotted Owl	Gila National Forest	03/01/2008	Habitat restricted to Gila National Forest
Habitat: Southwestern Willow Flycatcher	Gila National Forest	03/01/2008	Habitat restricted to Gila National Forest
Communication Towers	FCC	03/11/2008	National
Electric Transmission Lines	HSIP	03/01/2008	National
Electric Power Plants	HSIP	03/01/2008	National
Electric Sub Stations	HSIP	03/01/2008	National
Class 1 Airsheds	NPS Air Resources Division	Various	National
Ozone Non-Attainment	EPA	Unknown	National
Particulates Non-Attainment	EPA	2008	National
Major Roads	Tele Atlas North America, Inc., ESRI	11/01/2006	National
Oil and Gas Pipelines	HSIP-PennWell MAPSearch	03/01/2007	National
NPS Buildings	NPS		Participating NPS units

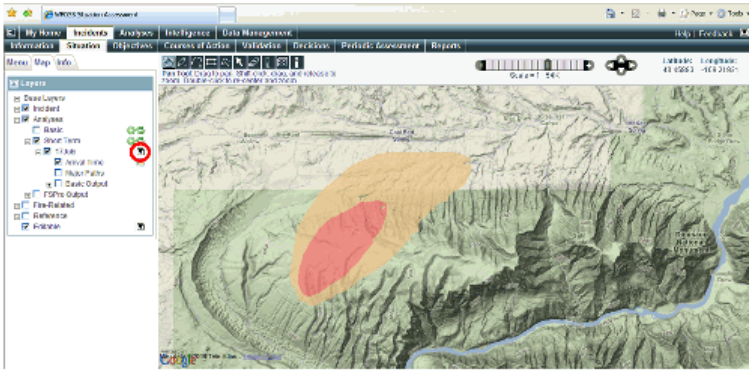
Even though this Values Inventory information is not totally complete and is still a work in progress, it will evolve and improve over time. In the interim, it can provide some useful information for wildland fire decision support.

To access the STFB Values Inventory Information:

To access the Values Inventory associated with a Short-Term Fire Behavior (STFB) analysis, follow the steps below:

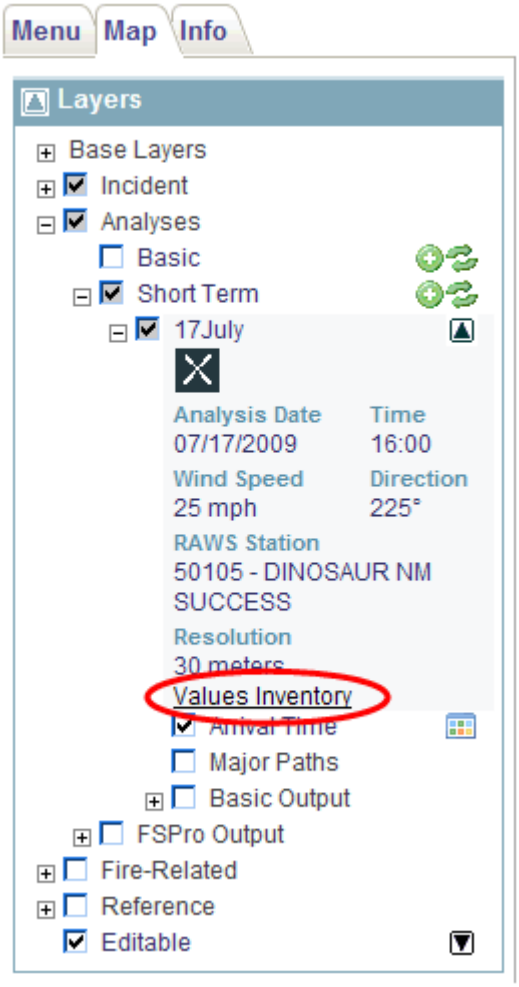
1) On the Incident List page, select the incident you want to view an STFB for.
2) Click **Assess Situation**.
3) On the Incident Situation Assessment page, choose the Map tab.
4) Expand the Analyses Item.

5) Click the black triangle (circled in red in the image below) next to the STFB analysis name. Information about the analysis appears.



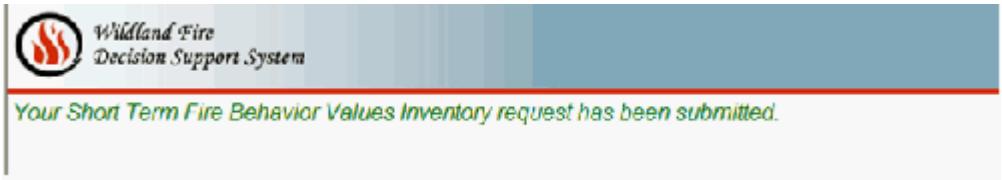
STFB Display Options

6) Click the Values Inventory (circled in red in example below)



STFB Map tab with Values Inventory Highlighted

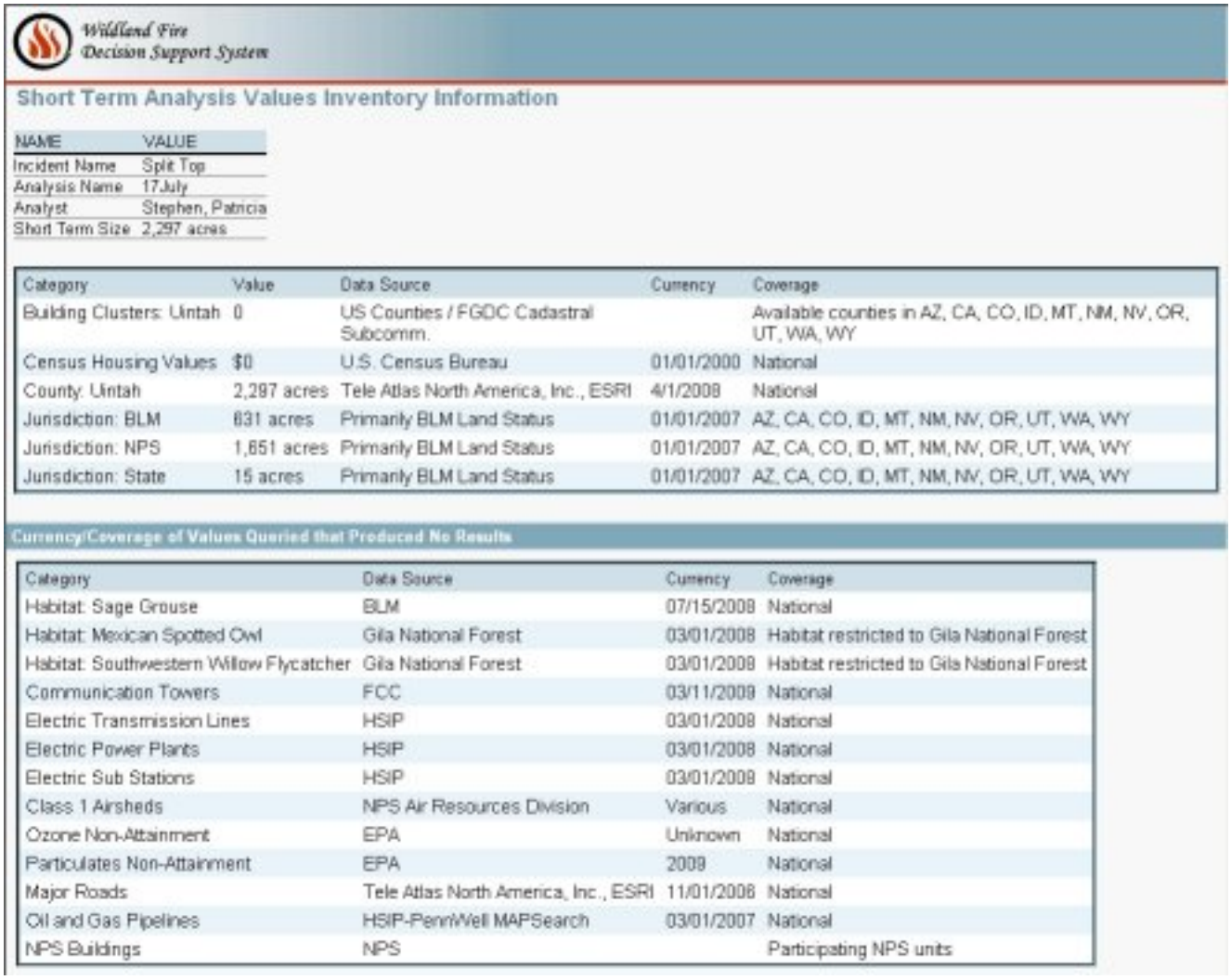
A window will pop up saying that the values inventory request was submitted.



7) Wait a few moments, then refresh the screen by right-clicking and choosing Refresh from the menu.

Values Inventory Information should then be displayed in the window. Three tables are included on this page:

- Basic information about the analysis
- A table showing values found within the area covered by the STFB Arrival Time Grid (category, value, data source, as well as currency and coverage of the layers)
- A table showing the currency and coverage of values layers that were queried but no results were found within the STFB footprint.



NAME	VALUE
Incident Name	Split Top
Analysis Name	17July
Analyst	Stephen, Patricia
Short Term Size	2,297 acres

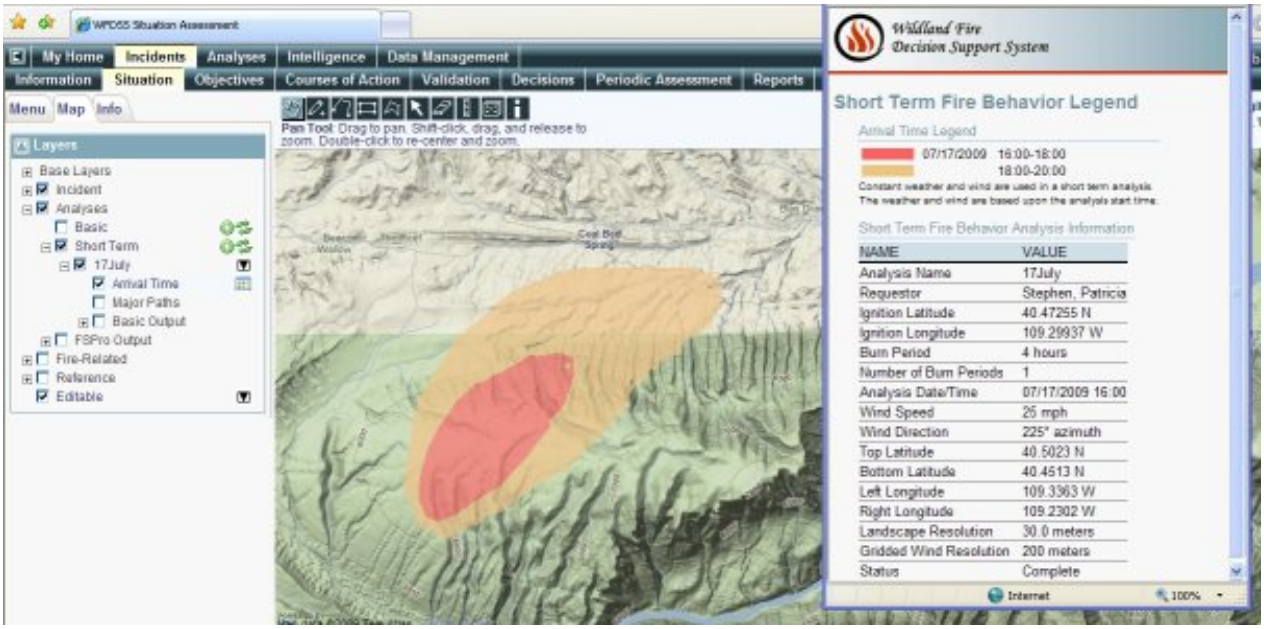
Category	Value	Data Source	Currency	Coverage
Building Clusters: Uintah	0	US Counties / FGDC Cadastral Subcomm.		Available counties in AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
Census Housing Values	$0	U.S. Census Bureau	01/01/2000	National
County: Uintah	2,297 acres	Tele Atlas North America, Inc., ESRI	4/1/2009	National
Jurisdiction: BLM	631 acres	Primarily BLM Land Status	01/01/2007	AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
Jurisdiction: NPS	1,651 acres	Primarily BLM Land Status	01/01/2007	AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY
Jurisdiction: State	15 acres	Primarily BLM Land Status	01/01/2007	AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY

Category	Data Source	Currency	Coverage
Habitat: Sage Grouse	BLM	07/15/2008	National
Habitat: Mexican Spotted Owl	Gila National Forest	03/01/2008	Habitat restricted to Gila National Forest
Habitat: Southwestern Willow Flycatcher	Gila National Forest	03/01/2008	Habitat restricted to Gila National Forest
Communication Towers	FCC	03/11/2009	National
Electric Transmission Lines	HSIP	03/01/2008	National
Electric Power Plants	HSIP	03/01/2008	National
Electric Sub Stations	HSIP	03/01/2008	National
Class 1 Airsheds	NPS Air Resources Division	Various	National
Ozone Non-Attainment	EPA	Unknown	National
Particulates Non-Attainment	EPA	2009	National
Major Roads	Tele Atlas North America, Inc., ESRI	11/01/2008	National
Oil and Gas Pipelines	HSIP-PennWell MAPSearch	03/01/2007	National
NPS Buildings	NPS		Participating NPS units

Even though this Values Inventory information is not totally complete and is still a work in progress, it will evolve and improve over time. In the interim, it can provide some useful information for wildland fire decision support.

How to View WFDSS Automated Fire Behavior Inputs

Prior to the the WFDSS 3.4 release in July 2009, the only analysis information available for Basic Fire Behavior (BFB) and Short-term Fire Behavior (STFB) analyses was the information displayed in the analysis legend. See the STFB example below.



If you have completed an analysis and want to see what inputs were used to calculate the fire behavior outputs, you can now view them. However, they are View ONLY and will not be available for editing until the Analyst-Assisted version is released in fall 2009.

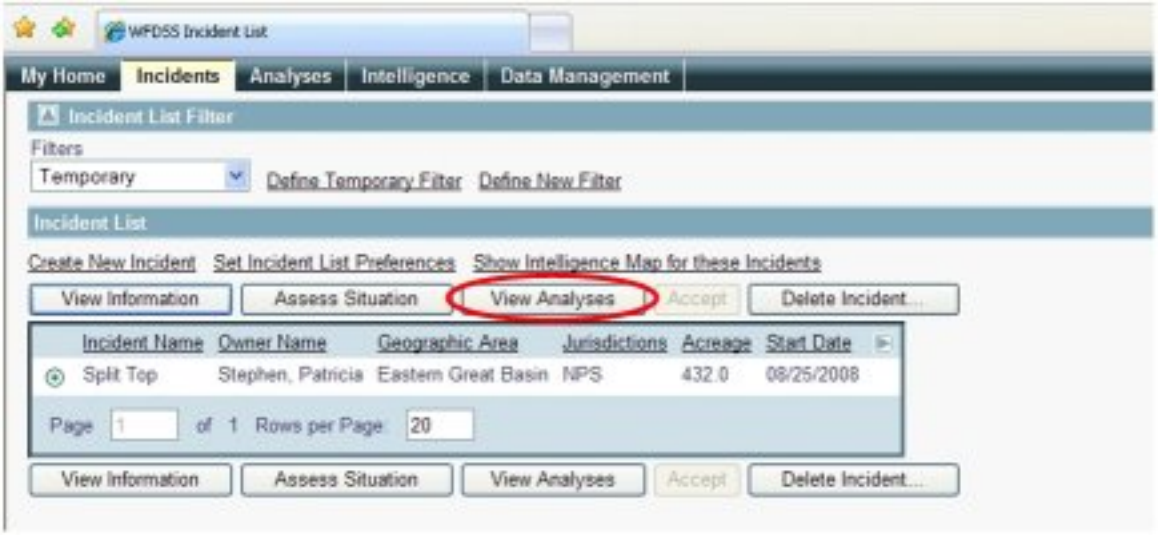
The View ONLY input information available for automated BFB and STFB analyses include:

- General Parameters (analysis name, date and time, foliar moisture, crown fire method and RAWS information)
- Winds (speed, direction, type, and gridded wind resolution)
- Weather Stream (RAWS observations for the 7 days prior to analysis start date - used for dead fuel moisture conditioning)
- Wind Stream (hourly RAWS winds and cloud cover information for the 7 days prior to analysis start date - used for dead fuel moisture conditioning)
- Fuel Moistures (Initial fuel moisture values at the start of the 7 day dead fuel moisture conditioning period as calculated at the RAWS location)

To view the automated BFB and STFB inputs:

To see the View ONLY input information for a completed Basic Fire Behavior (BFB) or Short-term Fire Behavior (STFB) analysis follow the steps below (these are specifically for STFB, but are nearly identical for a BFB analysis):

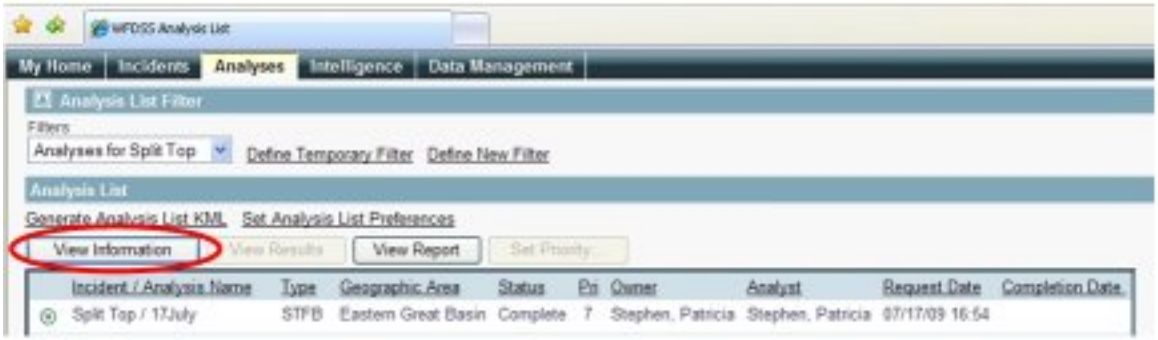
1) On the Incident List page, select the incident, then click **View Analyses**. See example below:



Incident List example to view analyses

This lists all the fire behavior analyses available for the chosen incident.

2) Click the radio button next to the BFB or STFB analysis of interest, then click **View Information**. See example below:



Analysis selected to view information

3) Click the blue arrow next to the section heading for the type of data you want to view. The selected section expands.

The following options are available (click the link to find out more about each type of data):

- ***General Information*** (on page 26)
- ***Winds*** (on page 27)

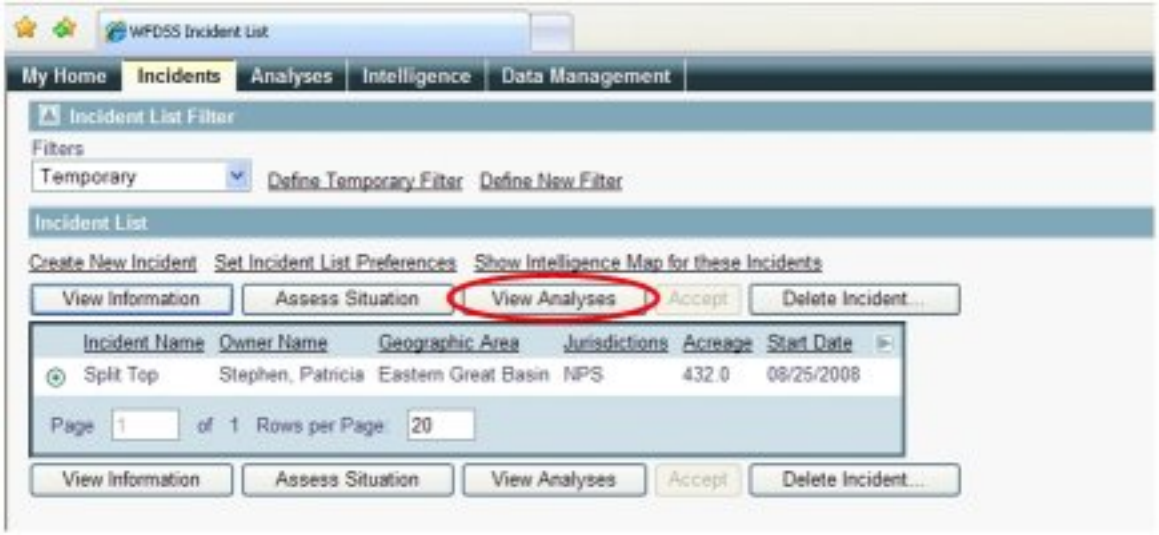
- ***Weather Stream*** (on page 28)
- ***Wind Stream*** (on page 29)
- ***Fuel Moistures*** (see "Fuel Moistures (initial fuel moistures)" on page 30)

4) To close the section, click the blue arrow again.

Automated BFB and STFB View ONLY Inputs

To see the View ONLY input information for a completed Basic Fire Behavior (BFB) or Short-term Fire Behavior (STFB) analysis follow the steps below (these are specifically for STFB, but are nearly identical for a BFB analysis):

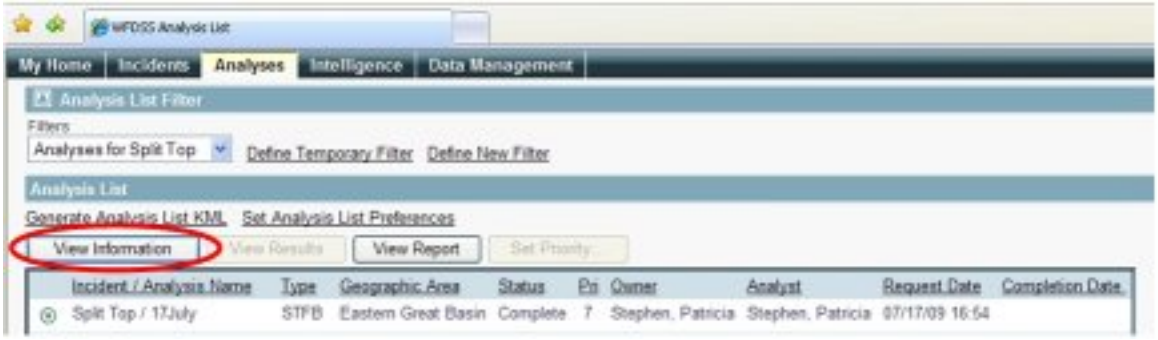
1) On the Incident List page, select the incident, then click **View Analyses**. See example below:



Incident List example to view analyses

This lists all the fire behavior analyses available for the chosen incident.

2) Click the radio button next to the BFB or STFB analysis of interest, then click **View Information**. See example below:



Analysis selected to view information

3) Clcik the blue arrow next to the section heading for the type of data you want to view. The selected section expands.

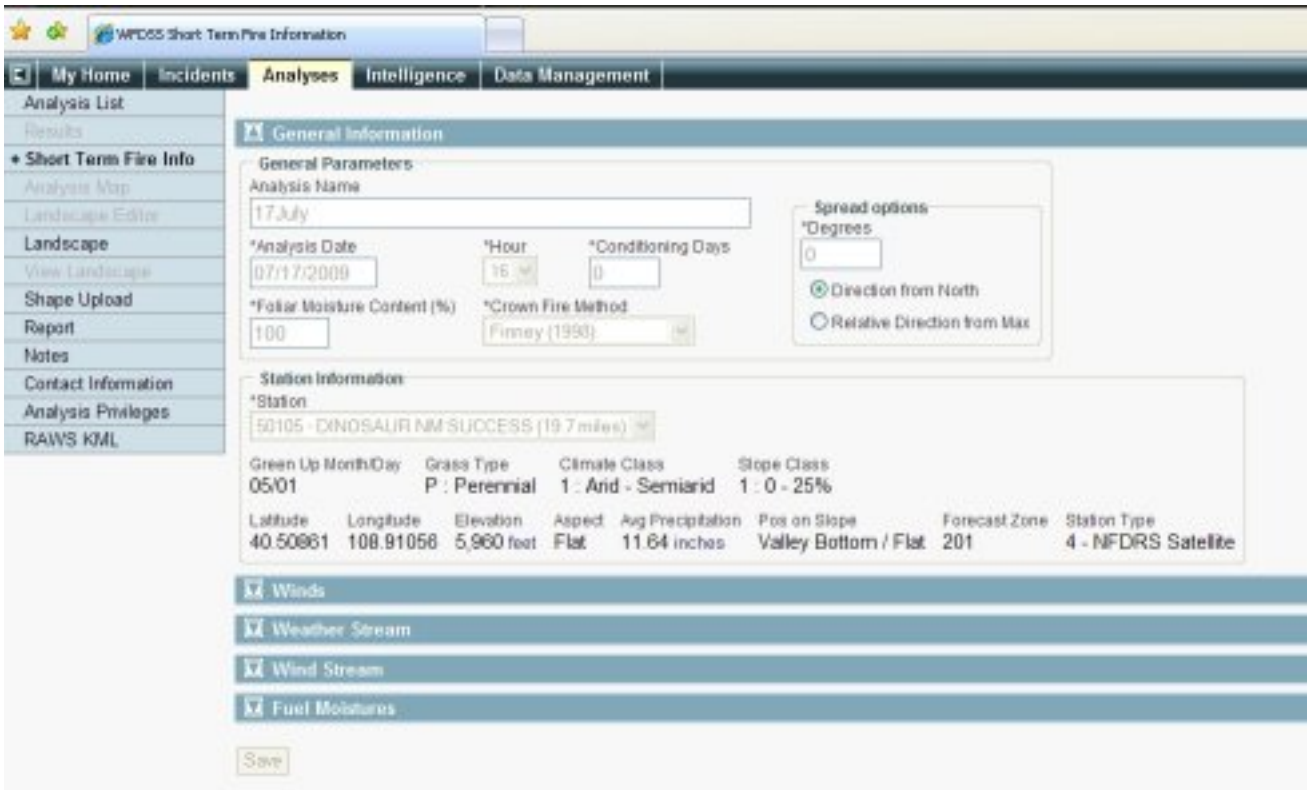
The following options are available (click the link to find out more about each type of data):

- ***General Information*** (on page 26)
- ***Winds*** (on page 27)
- ***Weather Stream*** (on page 28)
- ***Wind Stream*** (on page 29)
- ***Fuel Moistures*** (see "Fuel Moistures (initial fuel moistures)" on page 30)

4) To close the section, click the blue arrow again.

General Information

This section provides information about the general parameters used in the analysis as well as the RAWS Station Information. See example below.



STFB General Information from Analysis

This information is View only, however, in the near future, the Analyst-Assisted version will allow Fire Behavior Specialists to make changes to the many inputs needed for a Basic Fire Behavior (BFB) or Short-Term Fire Behavior (STFB) analysis.

Winds

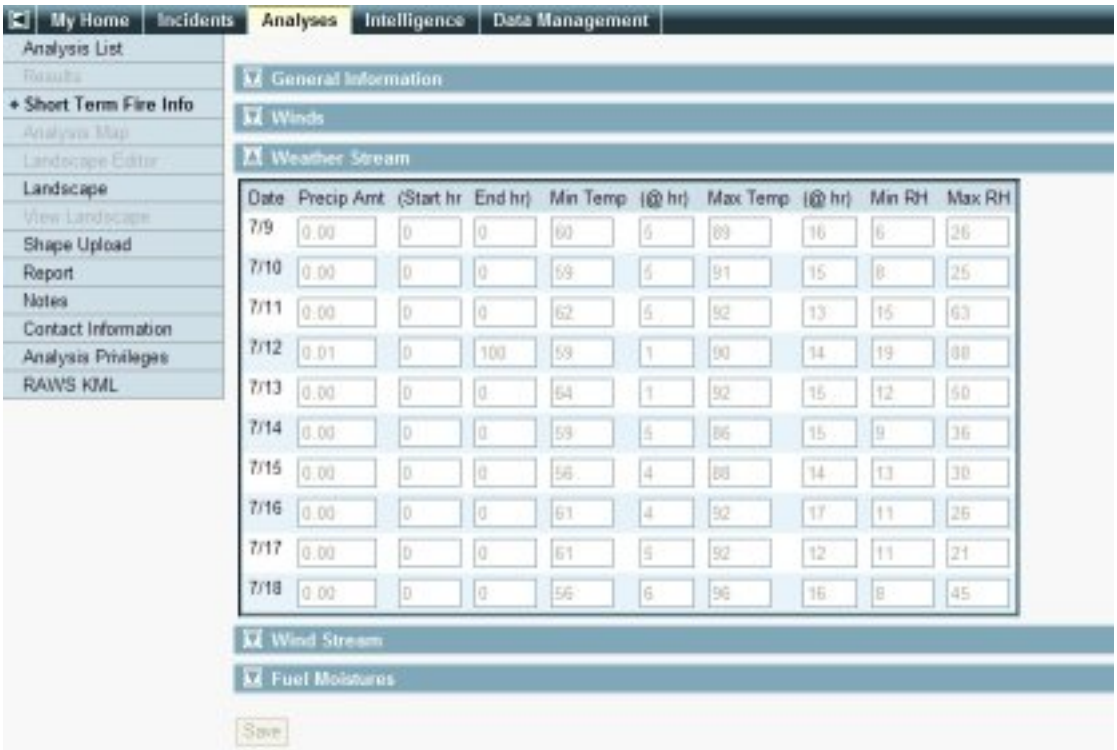
This section shows you the windspeed, wind direction, wind type, and gridded wind resolution used in the analysis.

View the Winds section

Weather Stream

- The Weather Stream section gives you 10 days of weather observations from the WFDSS-selected RAWS. The second to the last row of observations (July 17 in the example below) is the analysis start date and observations. The previous 7 days' (to the start date) observations were used for dead fuel moisture conditioning. The last date is the day after the analysis start date, as required by the model.
- If you have chosen a date in the past for which to run your analysis, archived weather is used. However, the more likely scenario is starting your analysis for a future date. When that is the case, National Digital Forecast Database (NDFD) values are used to calculate fuel moistures and fire behavior outputs.

Note: If you are in Alaska where NDFD data is not yet available, BFB and STFB analyses can only be run for dates in the past.



Weather Stream data

Wind Stream

- Wind Stream information provides 10 days of hourly observations, with the first 7 days used for dead fuel moisture conditioning. Only the percent cloud cover information (for shading) is used in fuel conditioning. Percent cloud cover is not a value collected by RAWS. Therefore, this percentage displays as zeroes, unless rain occurred that hour,in which case 100% cloud cover is recorded.

Wind Stream Example Using RAWS Data

- However, for any days using forecasted data (NDFD), a percent cloud cover does exist and is used to calculate shading and dead fuel moisture values.

7/17	4	2	76	0
7/17	5	0	236	0
7/17	6	0	324	0
7/17	7	0	198	0
7/17	8	2	167	0
7/17	9	1	218	0
7/17	10	1	196	0
7/17	11	4	297	0
7/17	12	3	252	0
7/17	13	4	283	0
7/17	14	9	106	0
7/17	15	9	320	11
7/17	16	9	320	11
7/17	17	9	320	11
7/17	18	10	310	25
7/17	19	10	310	25
7/17	20	10	310	25
7/17	21	5	330	25
7/17	22	5	330	25

Wind Stream Using NDFD

Fuel Moistures (initial fuel moistures)

The Fuel Moistures section displays the initial fuel moisture values at the RAWS location for the beginning of the dead fuel moisture conditioning period. It is important to remember the following:

- These are the starting moistures to condition dead fuels at every cell on the landscape extent based on the 7 days of weather observations prior to the analysis start date.
- The live herbaceous fuel moisture (Herb FM) and live woody fuel moisture (Woody FM) values will not change. *Only the dead fuel moisture values are affected by fuel moisture conditioning.* Thus, the Herb FM and Woody FM shown in the Fuel Moistures section are exactly what were used in the analysis for all fuel models on every cell of the landscape.

Note: It is worth evaluating and considering the appropriateness of these live fuel moisture values, especially when using the 40 Fuel Model set. These NFDRS calculated live fuel moisture values are notoriously low. During certain times of the year (when herbaceous and woody moistures, in the real world, are considerably higher than the values used for the analysis), your Automated BFB and STFB fire behavior outputs will potentially over-predict reality.

FAQs for Automated BFB and STFB

- Fire Behavior Specialists will be able to change live fuel moistures to more realistic values in the Analyst-Assisted versions of BFB and STFB.

Fuel Moisture Data Example

These Questions and Answers are intended to provide an overview of the automated version of WFDSS Basic Fire Behavior (BFB) and Short-Term Fire Behavior (STFB) applications. For more detailed information about these applications, as well as their assumptions and limitations, please see the following documents on WFDSS HOME PAGE > RELATED RESOURCES > FIRE BEHAVIOR:

- ***Comparison of FLAMMap and WFDSS Basic and Short-term Fire Behavior (PDF)*** pdfs/Comparison_chart_FlamMap3_and_WFDSS_automated_fire_behavior.pdf
- ***Draft Basic and Short-Term Behavior (PDF)*** pdfs/wfdss_auto_bfb_stfb.pdf

What is the procedure for setting up and running Basic Fire Behavior (BFB) and Short Term Fire Behavior (STFB) analyses?

For instructions on how to set up and run BFB and STFB analyses, see "***Basic and Short-Term Fire Behavior*** pdfs/wfdss_auto_bfb_stfb.pdf (PDF - 7.9 MB)", also found on the WFDSS HOME PAGE > TRAINING > WEBINARS AND OTHER ELEARNING.

What is the purpose of the Automated Basic Fire Behavior (BFB) and Short-Term Fire Behavior (STFB), and how can they be used?

The automated BFB and STFB applications within WFDSS are designed for use by non-fire behavior specialists to quickly obtain outputs for a fire area using automatically supplied, forecasted weather. They can be used by the Incident Author, Owner, or anyone granted Incident privleges. The fire behavior outputs from these applications can provide insight into potential fire spread and fire behavior.

How valid are the fire behavior results from Basic Fire Behavior (BFB) and Short-Term Fire Behavior (STFB) and can they be used to support fire management decisions?

As with all models, the quality of the outputs are relative to the quality of the input data. Before using BFB and STFB outputs to support decision-making, critique and assess the results to decide how well they represent reality.

How does the Automated version of WFDSS Basic Fire Behavior (BFB) and Short-Term Fire Behavior (STFB) differ from the desktop version of FlamMap 3.0?

The differences are numerous and significant. Please see "***Comparison of FLAMMap and Automated WFDSS Basic and Short-term Fire Behavior.pdf*** pdfs/Comparison_chart_FlamMap3_and_WFDSS_automated_fire_behavior.pdf", also available on the WFDSS HOME SITE > RELATED RESOURCES > FIRE BEHAVIOR for a comprehensive comparison.

What is the difference between WFDSS Basic Fire Behavior (BFB) and Short-Term Fire Behavior (STFB)?

WFDSS provides most of the inputs (including forecasted weather) for both applications. BFB calculates and maps "snapshot in time" fire behavior outputs for an entire user-defined landscape extent. STFB calculates fire spread (arrival time) results, as well as the fire's major paths from a single ignition point.

Can local landscape data be uploaded into WFDSS for use in Basic Fire Behavior (BFB) and Short-Term Fire Behavior (STFB)?

The short answer at this time is NO. It is possible that will be an option in the future, but definitely not for the 2009 fire season.

What are the available landscapes that can be used for Basic Fire Behavior (BFB) and Short-Term Fire Behavior (STFB) and how do you choose the one you want?

As of August 2009, there are 7 landscapes that can be used for WFDSS fire behavior applications. You can choose which landscape you want to use by selecting it on the Incident Information page.

- LANDFIRE National landscape covers the entire conterminous United States.
- LANDFIRE Rapid Refresh is available for most of the western US.
- LANDFIRE National (Western Northern Rockies) is available.
- California has a state-wide landscape available in WFDSS.
- 3 Alaska landscapes (AK Tanana Zone, AK Yukon-Charley, AK - 2009) are available.

How do you define your landscape analysis area (landscape extent), and how large should it be when doing Basic Fire Behavior (BFB) and Short-Term Fire Behavior (STFB) analyses?

You draw a rectangle on the map using the Landscape Extent icon on the Situation Assessment map. Since you should only be concerned with fire behavior characteristics or fire spread for a short time, you do not need to draw a large analysis area. Typically, an extent of 5-6 miles per side should suffice. If you run your STFB analysis and it seems too small, you can always re-draw the landscape extent.

What resolution is used for the landscape data in Basic Fire Behavior (BFB) and Short-Term Fire Behavior (STFB) analyses?

The resolution of the landscape used for BFB and STFB analyses depends on the landscape extent drawn by the user. For extents that are 10 miles by 10 miles (100 square miles) or smaller, 30-meter resolution is used. For landscapes that are larger than 100 square miles and smaller than 400 square miles, the resolution is generally 60 meters. For extents that are 20 miles by 20 miles, the resolution is 90 meters. The maximum landscape extent allowed is 900 square miles (30 miles by 30 miles), and the resolution is automatically scaled to 120 meters.

Can the landscape data be modified for Basic Fire Behavior (BFB) and Short-Term Fire Behavior (STFB) analyses?

In the current automated version of BFB and STFB, you cannot modify the landscape data. When the Analyst-assisted versions of BFB and STFB are available, you will be able to use a Landscape Editor (similar to that used in FSPro) to make modifications to the landscape data.

Can the user choose which RAWS to use for weather and wind data for Basic Fire Behavior (BFB) and Short-Term Fire Behavior (STFB) analyses?

In the current automated version of BFB and STFB, you cannot choose which RAWS to use. You can only use the WFDSS-selected RAWS. When the Analyst-assisted versions of BFB and STFB are available, the fire behavior specialist will be able to select the RAWS from a list, as long as it has the requisite observations.

How does WFDSS select the RAWS for Basic Fire Behavior (BFB) and Short-Term Fire Behavior (STFB) analyses?

WFDSS selects the RAWS by doing the following:

1) Identifying the center of the landscape extent
2) Calculating the distance from the center to the nearest RAWS using a horizontal/vertical (elevation) algorithm
3) Ranking the stations
4) Selecting the station that is the "closest" and has weather data requisite for conditioning (7 days of hourly weather observations)

What are the RAWS data used for in Basic Fire Behavior (BFB) and Short-Term Fire Behavior (STFB) analyses?

WFDSS BFB and STFB *automatically* conditions fuels by using the previous 7 days of weather observations from the RAWS. Dead fuel moistures are calculated for every cell in the analysis area using these RAWS data; however, in the Automated versions, the user cannot modify the observations to better reflect the weather in the area of the fire.

How does fuel moisture conditioning work in Basic Fire Behavior (BFB) and Short-Term Fire Behavior (STFB)?

The user chooses a date and time for which they want the analysis to start. WFDSS looks back for the last 7 + days (up to 14 days) to obtain the necessary RAWS observations for automatically conditioning the dead fuels and determining dead fuel moisture values as of the analysis date and time. (The moisture values are based on the weather, as well as the cell's aspect, elevation, and canopy cover.) Those fuel moistures are then used to calculate fire behavior characteristics. To see how to view the observations used in fuel conditioning, refer to How to View WFDSS Automated Fire Behavior Inputs.

How does Basic Fire Behavior (BFB) and Short-Term Fire Behavior (STFB) get forecasted weather and can these data be changed?

In WFDSS BFB and STFB, forecasted weather is obtained from the National Digital Forecast Data (NDFD). NDFD uses RAWS location to derive forecasted weather data. These data can not be modified by the user in the automated version.

How does Basic Fire Behavior (BFB) and Short-Term Fire Behavior (STFB) get forecasted winds, and can these data be changed?

In WFDSS BFB and STFB, forecasted wind speed and direction values are obtained from the National Digital Forecast Data (NDFD). NDFD uses the center of the landscape extent to derive the forecasted winds. Both the wind speed and wind direction values **CAN** be modified by the user.

Do the Basic Fire Behavior (BFB) and Short-Term Fire Behavior (STFB) applications use gridded winds?

Yes. The wind speed and direction values (from NDFD or user determined) are used as inputs for WindNinja to create gridded winds at 200-meter resolution. NDFD wind speed and direction or values supplied by the fire behavior specialist are used as inputs to generate gridded winds.

What fuel moisture values are used in the Basic Fire Behavior (BFB) and Short-Term Fire Behavior (STFB) applications?

Dead fuel moisture values are calculated using fuel moisture conditioning, which is based on each cell's aspect, elevation, and canopy cover, as well as the previous 7 days of RAWS weather data.

BFB and STFB obtain live fuel moisture values from daily WFDSS ERC-G calculations via the WFDSS-selected RAWS. These values cannot be modified. However, they can be viewed (see ***Viewing WFDSS Automated Fire Behavor Inputs*** (see "How to View WFDSS Automated Fire Behavior Inputs" on page 23)). Foliar moisture content is set to a default value of 100%, and this cannot be changed. Modifying live herbaceous, live woody, and foliar moisture content will likely be available in the future within the Analyst-Assisted versions of BFB and STFB.

How do you locate the fire ignition to do a Short-Term Fire Behavior (STFB) analysis?

In the automated version of WFDSS STFB, the user can input a latitude/longitude for the ignition, or zoom to a location and create an ignition point by clicking the location on the WFDSS map. Only point locations can be used. When the Analyst-Assisted version is available, the fire behavior specialist will be able to upload shapefiles of the point fire location or fire perimeters.

Is spread by spotting incorporated in WFDSS Short-Term Fire Behavior (STFB)?

Yes, spread by spotting has been incorporated in STFB.

What crown fire calculation method is used in Short-Term Fire Behavior (STFB)?

WFDSS uses the Finney (1998) crown fire calculation method for all fire behavior modeling.

What is the Date and Time used for in Basic Fire Behavior (BFB) and Short-Term Fire Behavior (STFB) analyses?

BFB uses the start date and time (and the previous 7 days of weather) to determine dead fuel moisture values and calculate fire behavior characteristics for that "snapshot in time".

STFB uses the start date and time in the same way, but in addition, it uses that data as the beginning of the fire spread simulation.

What is a burn period in Short-Term Fire Behavior (STFB) and why do you need it?

In STFB, the burn period is the number of hours, per operational period, that will be used for the fire spread simulation. Because the STFB model uses only one set of fuel moisture and wind (speed and direction) conditions for the entire simulation, it is important to choose the burn period carefully.

How many burn periods can be selected when running Short-Term Fire Behavior (STFB)?

The model allows up to 3 burn periods; however, it is crucial to keep in mind that all environmental conditions (fuel moistures, wind speed, and wind direction) are held constant for the duration of the simulation. Therefore, the user should carefully consider how many hours should be used per burn period and how many burn periods are appropriate. You might want to choose to simulate only one or two burn periods because, in reality, fuel moistures, wind directions, and wind speeds would not be expected to remain constant for very long.

What output results are available when Basic Fire Behavior (BFB) is run and what are the units for each output?

BFB provides many of the same fire behavior outputs as BEHAVE (and BehavePlus). Below are the outputs available in WFDSS BFB and their units:

Output	Display Units
Flame Length	meters
Fireline Intensity	kilowatts per meter (kW/m)
Rate of Spread	meters per minute (m/min)
Heat per Unit Area	kilojoules per meter squared (kJ/m2)
Crown Fire Activity	0 (no fire), 1 (surface fire), 2 (torching), 3 (active crown fire)
Maximum Spread Direction	radians

WFDSS BFB also calculates the following environmental outputs:

Output	Display Units
1-hour fuel moisture	fraction (e.g., 0.06 = 6%)
10-hour fuel moisture	fraction (e.g., 0.18 = 18%)
Solar radiation	watts per meter squared (W/m2)

Can the Basic Fire Behavior (BFB) or Short-Term Fire Behavior (STFB) output legends be changed; for instance, can the units or colors be changed by the user?

No. In the automated version of WFDSS BFB and STFB, neither the units nor the color choices can be changed. The fire behavior specialist will have the option to change the legend when the Analyst-Assisted version of BFB is available.

Can Basic Fire Behavior (BFB) and Short-Term Fire Behavior (STFB) analyses results be saved and downloaded to GIS?

No. In the automated version of BFB and STFB, the results cannot be saved or downloaded; they can only be displayed within WFDSS. However, the user could save screen captures to be used in the Decision Document.

Can the Basic Fire Behavior (BFB) and Short-Term Fire Behavior (STFB) analyses be saved?

No, analyses will be available for an incident for 20 days, and then they are automatically deleted.

When will the Analyst-Assisted version of WFDSS Basic Fire Behavior (BFB) and Short-Term Fire Behavior (STFB) be available?

Good question. It is likely that the Analysist-Assisted version will not be available until late August, 009.

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