

Lesson 9 – Fire Behavior Analysis

Estimated time to complete: 30 minutes

This lesson introduces the WFDSS fire behavior analysis models. The exercises in this lesson focus on creating an analysis using the Automated Basic Fire Behavior (BFB) and Automated Short-Term Fire Behavior (STFB) models. Dispatchers, incident owners, and editors can quickly run these models to determine the potential for fire behavior and growth of an emerging incident. Incident owners and editors can request trained fire behavior analysts to run other fire behavior models when automated BFB and STFB data are insufficient to support decisions. Outputs for analysis created in this lesson are discussed in greater detail in Lesson 10, *Gathering Information to Support Relative Risk and Decisions*.

Fire Behavior Analysis Overview

A key component of any decision is fire behavior analysis. WFDSS provides two types of automated and four types of analyst-assisted fire behavior models.

- Automated BFB and STFB applications rely heavily on computer-generated inputs and can be generated by any WFDSS user.
- Analyst-Assisted BFB and STFB, Near Term Fire Behavior (NTFB), and FSPro models require detailed inputs that are developed by a trained fire behavior analyst.

The following Spatial Fire Behavior Tools graphic briefly describes the models in WFDSS and how each compares to stand alone desk top models FlamMap and FARSITE.

Spatial Fire Behavior Tools						
Tools	Basic Fire Behavior (BFB)	FlamMap	Short-Term Fire Behavior (STFB)	FARSITE	Near-Term Fire Behavior (NTFB)	Fire Spread Probability (FSPro)
"Spread Model"	FlamMap Grid	Minimum Travel Time (MTT) (Finney 2002)	Minimum Travel Time (MTT) (Finney 2012) STFB and FSPro are being continually updated to match FlamMap 5 beta	FARSITE (Finney 1998)	FARSITE (Finney 1998) NTFB is slowly becoming its own unique thing. It has evolved considerably from FARSITE	Minimum Travel Time (MTT) (Finney 2012) STFB and FSPro are being continually updated to match FlamMap 5 beta
Duration	"Snapshot in time"	1 to 3 days	1 to 3 days	1 to 7 days	1 to 7 days	7 to 30 days
Weather	Daily, constant weather, wind, & fuel moisture	Daily, constant weather, wind, & fuel moisture	Daily, constant weather, wind, & fuel moisture	Hourly, variable weather, wind, & fuel moisture	Hourly, variable weather, wind, & fuel moisture	Hourly, variable weather, wind, & fuel moisture-plus ERC seasonal trend, auto-correlation, standard deviations & artificial time series
Type of Tool	Only in WFDSS	PC desktop	Only in WFDSS	PC desktop	Only in WFDSS	Only in WFDSS
Data Source	Automatic upload/editable LANDFIRE and NDFD	Manual Creation of LCP, Fuel Moisture & Weather files	Automatic upload/editable LANDFIRE and NDFD	Manual Creation of LCP, Fuel Moisture & Weather files	Automatic upload/editable LANDFIRE and NDFD	Automatic upload/editable LANDFIRE and NDFD
Output	Raster display of fire behavior	Major flow paths; arrival times	Major flow paths; arrival times	Perimeter; fire behavior grids	Perimeter; fire behavior grids	Probability surface

Automated Fire Behavior Models in WFDSS

The automated BFB and STFB applications are run from the Situation map in WFDSS. These modeling tools are designed to be run by non-fire behavior specialists to quickly obtain fire behavior outputs for a fire area using historic or forecast weather at a given wind speed and direction.

- BFB calculates and maps “snapshot in time” fire behavior outputs for every cell on a user-defined landscape extent.
- STFB calculates the “snapshot in time” fire behavior and the fire spread (arrival time) results, as well as the fire’s major paths from a single ignition point.

The Automated fire behavior outputs provide insight into potential fire spread and fire behavior; however, because they are computer generated without analyst involvement, the output data provides a broad general overview. Default settings for weather and landscape might not be representative of actual conditions, so before using automated BFB and STFB outputs to support decision-making, critique and assess the results to decide how well they represent reality. Users can modify general input parameters and change the landscape data source (the default landscape data source for an incident can be changed on the Incident Information page), but users cannot change the weather station auto-selected for an automated BFB or STFB run. For better model output, request an analyst-assisted BFB and STFB run. As with all models, the quality of the outputs is relative to the quality of the inputs.

The automated BFB and STFB models are both implementations of FlamMap, but the differences between these models and the desktop version of FlamMap are numerous and significant.

Automated Basic Fire Behavior (BFB)

WFDSS Automated Basic Fire Behavior can be used by an Incident Owner or Editor, or by any user assigned the WFDSS role of Dispatcher or Geographic Area Editor (both must be assigned to same geographic area the incident is in). The model, initiated from the Situation map, provides a very simple way to get “snapshot in time” fire behavior outputs for every cell on a user-defined landscape extent that include:

- Flame length
- Rate of Spread
- Fireline Intensity
- Heat per Unit Area
- Crown Fire Activity
- Solar Radiation
- 1 Hr Fuel Moisture
- 10 Hr Fuel Moisture
- Max Spread Direction
- Wind Direction
- Wind Speed

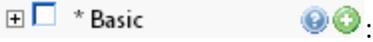
Model inputs, although few, have a significant impact on the gridded fire behavior outputs. The current Automated BFB model requires the following information from the user:

- Defined analysis area / landscape extent (normally no larger than about 5-6 miles per side),
- Name for the analysis,
- A Burn Date and Time.

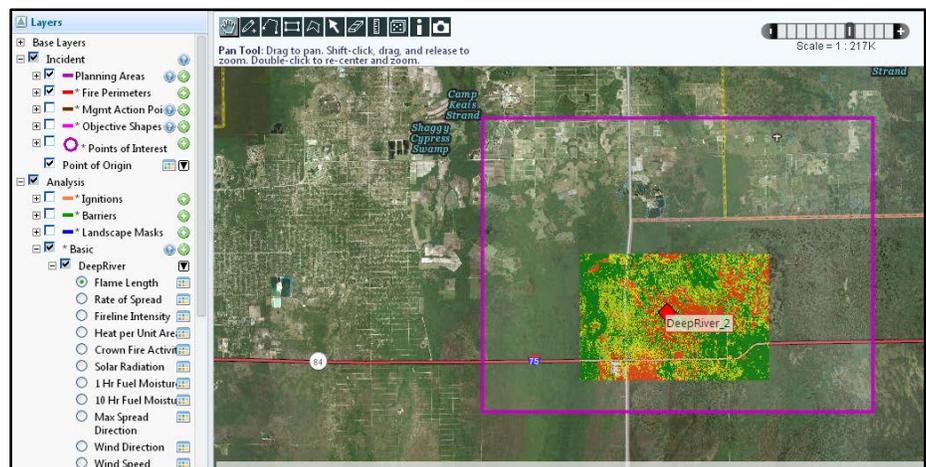
The model retrieves forecasted weather and winds data from the National Digital Forecast Database (NDFD) for current simulations. For past dates or times, the model uses historic weather from a nearby RAWS at similar elevation. You can accept the wind speed and direction that is provided, or you can replace those input values with ones you choose. Within a short time (usually within a minute or so), fire behavior results are ready for viewing.

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.

To run an Automated BFB Analysis:

1. From the Incident List page, select the incident for which you want to run the Automated BFB.
2. Click **Assess Situation**. The Situation page appears showing the map of the incident area.
3. Select  from the Map Tools.
4. Draw a landscape extent on your map around the incident. This is the analysis area.
5. From the **Map** tab, click + next to Analyses. The list expands.
6. These icons appear to the right of the **Basic** layer :
 -  - Accesses the on-line help for the selection item.
 -  - Creates a new BFB analysis.
7. Click the green  icon to begin the BFB request. A list of Automated BFB input fields opens in the Layers section.
8. Enter the **Name** of the BFB run you are creating.
9. Enter the Burn Date. If you're using a date in the past, the model uses historic weather from a nearby RAWS at similar elevation. For current simulations, the model retrieves forecasted weather and wind data from the NDFD.
10. Enter the Burn Time in a 24-hour format excluding the minutes (hh). The model captures "snapshot in time" fire behavior outputs for the burn time you specify.
11. For example, enter 13 for 1300 or something similar.
12. The analysis uses this time to determine what the fire is likely to be doing (e.g., a burn time in the morning will give different results than one during the heat of the day).

13. Click **Next**. WFDSS displays the wind data for the selected date and time. You can edit these data if necessary.
14. Click **Run Model**. A message appears stating that the model was successfully sent for processing. Depending on the system load, it could take several minutes for the run to complete.
15. Click the **Situation** tab to refresh the screen. The results are available in the Basic subfolder.
16. Click + beside the run you would like to view outputs for and then 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.
17. You can also view the run status on the **My Home** tab. Under **My Activities**, you will see the BFB run you just submitted and its status. To refresh the screen click the **My Home** tab again until you see  **Complete** in the status column. When you do, click the  icon to view your BFB results. The Analysis map opens and the analysis results will be displayed.
18. After clicking , you should see something similar to this:



Automated Short Term Fire Behavior (STFB)

WFDSS Automated Short-Term Fire Behavior (STFB) can be used by an Incident Owner, Editor, or by any user assigned the WFDSS role of Dispatcher or Geographic Area Editor (both must be assigned to the same geographic area the incident is in). The model, which can be initiated from the Situation map, provides a quick way to determine the potential for fire spread from a point location starting with a single fuel moisture input (hidden to user) and a static wind speed and direction (set by user and gridded by the model) for a user-defined burn period(s). WFDSS Automated STFB outputs include:

- The same gridded fire behavior outputs as WFDSS Automated Basic Fire Behavior (BFB),
- An Arrival Time Grid, and
- Major Travel Paths.

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

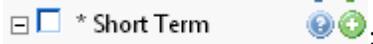
- Defined analysis area/landscape extent (normally no larger than 5 -6 miles per side)
- Name for the analysis
- Analysis Date and Time
- Fire start location (click a point on the map or enter latitude/longitude information)
- Length of the burn period
- Number of burn periods for the analysis
- Corrected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

The model retrieves forecasted weather and winds for the selected time, using NDFD for current simulations. For historic fires, the model uses historic weather from a nearby RAWS station at similar elevation. You can accept the displayed wind speed and direction, or you can replace those input values with ones you choose.

The initial fuel moistures are conditioned prior to ignition and gridded winds are generated from the inputs; the outputs, however, still represent just a single 'snapshot in time'. Within a short period of time (usually within a couple of minutes), WFDSS Automated STFB outputs are ready for viewing.

To run an Automated STFB Analysis

1. From the Incident List page, select the incident for which you want to run Automated STFB.
2. Click **Assess Situation**. The Situation page appears showing the map of the incident area.
3. Select  from the Map Tools.
4. Draw a landscape extent on your map around the incident. This is the analysis area.
5. From the Map tab, click + next to Analyses. The list expands.
6. These icons appear to the right of the Short Term layer

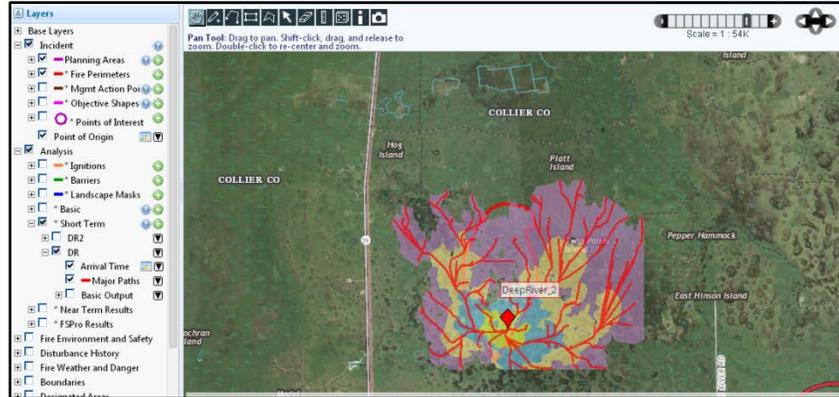


-  - Accesses the on-line help for the selection item.
 -  - Creates a new STFB analysis.
7. Click the green  icon to begin the STFB request. A list of Automated STFB inputs opens in the layers section.
 8. Enter the Name for the STFB run you are creating.
 9. Enter the Burn Date. If you are using a date in the past, the model uses historic weather from a nearby RAWS at similar elevation. For current simulations, the model retrieves forecasted weather and wind data from the NDFD.

10. Enter the Burn Time in a 24-hour format excluding the minutes (hh). Although the analysis runs from this time on a specific day, the burn time is actually the hour that fuel conditioning ends. Fuels conditioned to a morning hour such as 0900 may not result in much fire growth and the model may under predict. Fuels conditioned to an afternoon hour when fuels are warm and dry will provide more aggressive results.
11. Enter 14 for 1400, or something similar.
12. Use the default Latitude and Longitude for this analysis or enter other latitude and longitude values. Remember to enter a positive number for Longitude.

Note: To select a different latitude and longitude, click  and then click a new ignition point on the map. The **Info** tab displays the latitude and longitude that you selected. When you return to the **Map** tab, the STFB latitude and longitude fields are auto-filled with your selection.

13. Enter the hours in a Burn Period and the number of Burn Periods to use in the analysis.
14. The hours in the burn period start with the burn time. For example, when you start the burn time at 1400 and select a burn period of 4 hours, the model uses 1400-1800 as the burn period.
15. When you choose more than one burn period, the model uses that number to determine how many days/burn periods it will model. For example, when you set the burn time and period as above and then select 3 for the number of burn periods, the model looks at 3 days during 1400-1800 to determine the output.
16. Click **Next**. WFDSS displays the wind data for the selected date and time. You can edit these data if necessary.
17. Click **Run Model**. A message appears stating that the model was successfully sent for processing.
18. Depending on the system load, it could take several minutes for the run to complete. Click the Situation tab to refresh the screen. The results will become available in the Short Term subfolder.
19. Click **+** beside the run you would like to view outputs for and then 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.
20. You can also view the status of a run on the **My Home** tab. Under My Activities, you will see the STFB run you just submitted and its status. To refresh the screen click the **My Home** tab again until you see  Complete in the status column. When you do, click  to view your STFB results. The Analysis map opens and the analysis results are displayed.
21. After clicking , you should see something similar to this:



22. To view the legend, click  to the right of Arrival Time under  Layers.

Short Term Fire Behavior Legend

Arrival Time Legend

Ignition	
03/06/2014	13:00-15:00
	15:00-17:00
03/07/2014	13:00-15:00
	15:00-17:00

Constant weather and wind are used in a short term analysis. The weather and wind are based upon the analysis start time.

Acceptance comment:
N/A

Short Term Fire Behavior Analysis Information

NAME	VALUE
Analysis Name	DR
Requestor	Rawling, Jhen
Ignition	DR
Ignition Latitude	26.1769 N
Ignition Longitude	81.3139 W
Barrier	No barrier specified
Burn Period	4 hours
Number of Burn Periods	2
Analysis Date/Time	03/06/2014 13:00 CDT
Conditioning Days	7
Foliar Moisture Content	100%
Crown Fire Method	Finney (1998)
Spotting Probability	0.10
Direction from Max	0
Wind Type	Generate Gridded Wind
Wind Speed	9 mph
Wind Direction	197° azimuth
Landscape Resolution	30 meters

Search for these related topics in the Help

- Running an Automated Basic Fire Behavior (BFB) Analysis
- Running an Automated Short-Term Fire Behavior (STFB) Analysis