

BehavePlus fire modeling system, version 4.0



Basic Start Lesson

Introduction Unit

Introduction

The BehavePlus fire modeling system offers many options. You can also use it in a very simple manner. This first lesson gets you started by showing you how to accept defaults, enter values, and get answers.

Objectives

1. Enter values in a Worksheet.
2. View the information available in the help window.
3. Calculate a Run to produce tables and graphs.
4. Change inputs and produce new tables and graphs.
5. Use BehavePlus to examine the effect of fuel model, fuel moisture, wind, and slope on rate of spread and flame length.

Where This Lesson Fits in

This lesson and the other three in the Introduction Unit will teach you basic program operation. These lessons should be completed in order.

1. Basic Start – simple entry of input to get answers in the form of tables and graphs
2. Worksheets – how the worksheet is developed from user selections
3. Input Methods – various ways of entering input values
4. Calculations – table and graph output options

Subsequent lessons cover the many features and fire modeling capabilities offered by BehavePlus.

The Worksheet

In BehavePlus the Worksheet is used to input values. When you start the BehavePlus program, the **BasicStart Worksheet** is loaded automatically. (You have the option of defining a different startup worksheet.)

The worksheet includes not only the input variable list, but also space for a description of the run, notes on run options selected, and a list of selected output variables. A guide button associated with each input variable gives a definition and help on assigning a value to the variable.

BehavePlus 4.0 Page 1

Inputs: SURFACE
Description

Fuel/Vegetation, Surface/Understory
Fuel Model

Fuel Moisture

| | | |
|--------------------------|---|--|
| 1-h Moisture | % | |
| 10-h Moisture | % | |
| 100-h Moisture | % | |
| Live Herbaceous Moisture | % | |
| Live Woody Moisture | % | |

Weather
Midflame Wind Speed (upslope) mi/h

Terrain
Slope Steepness %

Run Option Notes

Maximum reliable effective wind speed limit is imposed [SURFACE].
Calculations are only for the direction of maximum spread [SURFACE].
Fireline intensity, flame length, and spread distance are always for the direction of the spread calculations [SURFACE].
Wind is blowing upslope [SURFACE].

Output Variables

Surface Rate of Spread (maximum) (ch/h) [SURFACE]
Flame Length (ft) [SURFACE]

Notes

Note that the module name at the top of this example is SURFACE. This module is for surface fire spread and intensity calculations. This **BasicStart Worksheet** is set up with options such that the Rate of Spread and Flame Length are calculated for the head fire burning upslope with the wind. Note that these options are listed under the **Run Option Notes** section of the Worksheet.

Look at the sections of the Worksheet:

- Inputs - Lists required input variables
- Run Option Notes – For clarification, lists the relevant run options currently in effect.
- Output Variables – Lists the output variables that will be calculated in this Run.
- Notes – A space where the user can document the Run.

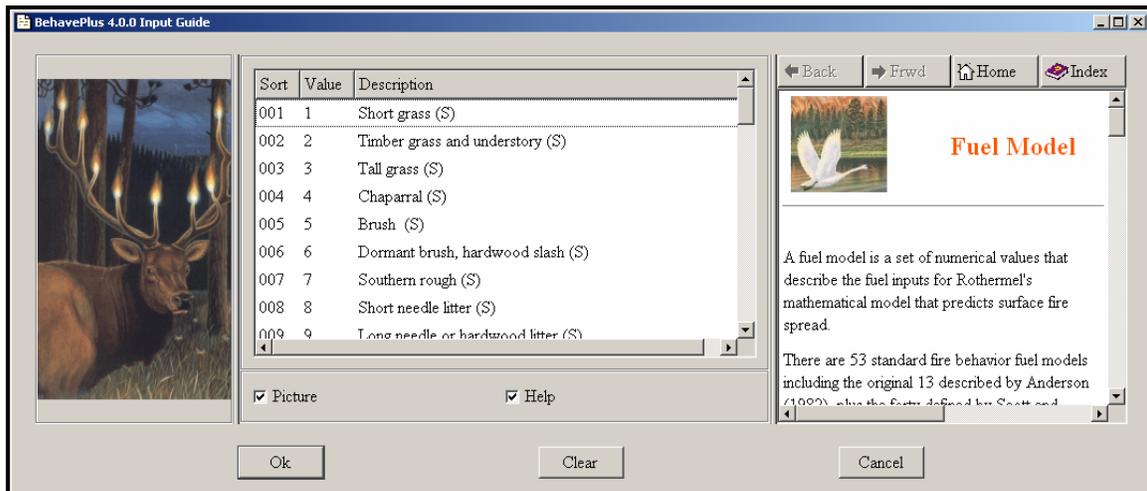
For this example, you will enter values for:

- Fuel model
- Fuel moisture for each size class
- Wind speed
- Slope steepness

From these inputs, Rate of Spread and Flame Length are calculated for a head fire, which is burning upslope with the wind.

Entering Inputs

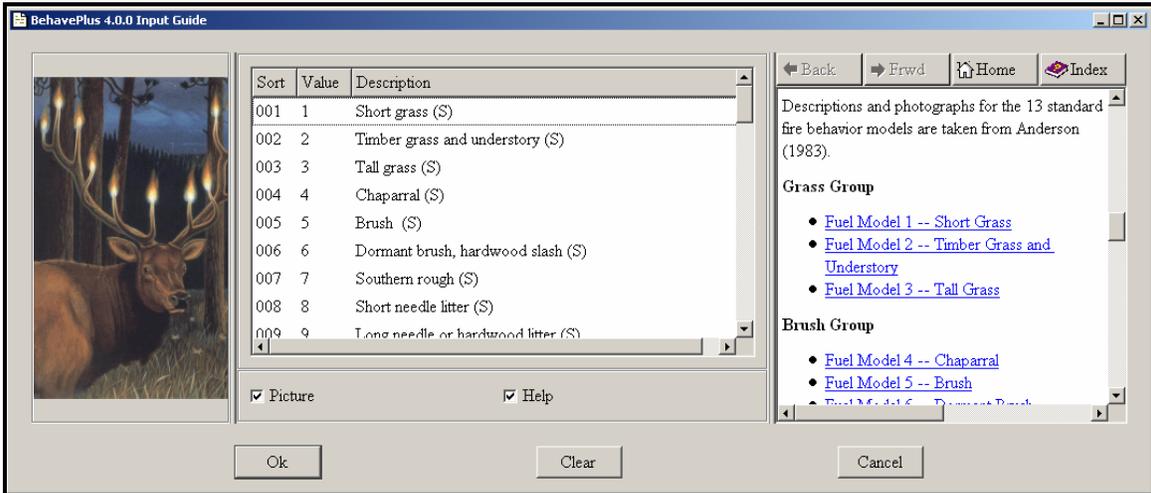
- Place the cursor in the **Description** field.
- Type “Lesson 1 – Basic Start Example”.
- Press the **Enter** or **Tab** key to advance to the next input field.
The cursor should be in the **Fuel Model** field.
- Click the Guide Button to the left of the fuel model input field: .
An **Input Guide** dialog box will open.



The center pane shows a list of the available fuel models: the 53 standard fire behavior fuel models including the original 13 and the 40 added in 2005.

The right pane is a help window which defines the variable (Fuel Model in this case) and provides help with selecting an input value.

- Scroll down in the help window using the right hand slide bar to see the list of the original 13 standard fuel models.



- Click on **Fuel Model 2** in the right-hand help window to see a description and photos. Fuel Model 2 represents a combination of long needle dead fuels, scattered larger fuels, and live grasses. It can represent an open grown Ponderosa Pine stand with a grass understory.



- Select **Fuel Model 2** from the center pane; a click will add a blue highlight.
- Close the **Input Guide** window by clicking the **OK** button. The Fuel model field on the worksheet should display **2**.
- Press the **Enter** or **Tab** key to advance to the **1-h Moisture** field.
- Type “5, 10, 15” (can also be entered as “5 10 15” with spaces instead of commas) in the **1-h Moisture** field and press the **Enter** key.

This run will compare the effect of these three fine dead fuel moisture (1-h) values on calculated fire behavior.

- Enter “5” in the **10-h Moisture** field
- Enter “6” in the **100-h Moisture** field
- Enter “100” in the **Live Herbaceous Moisture** field
- Tab through the **Live Woody Moisture** field, leaving it blank.

The **Live Woody Moisture** field is shaded because Fuel Model 2 does not include a live woody fuel component.

- Enter “6” in the **Midflame Wind Speed** field.
- Enter “30” in the **Slope Steepness** field.
- Enter any comments you want in the **Notes** section.

Your Worksheet should now look like this:

The screenshot shows the BehavePlus 4.0 software interface. The title bar reads "BehavePlus 4.0" and "Page 1". The main window is titled "Inputs: SURFACE" and contains the following sections:

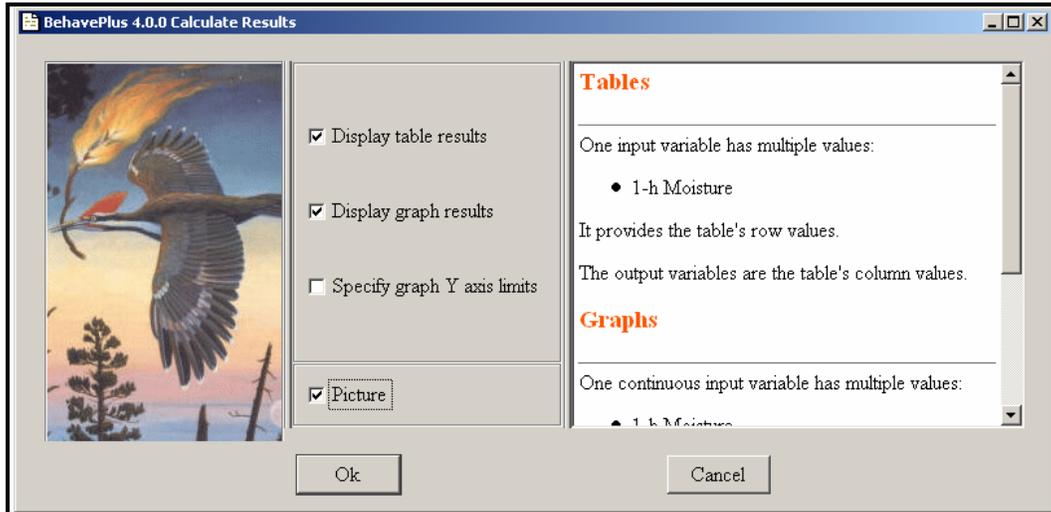
- Description:** Lesson 1 - Basic Start Example
- Fuel/Vegetation, Surface/Understory:** Fuel Model: 2
- Fuel Moisture:**
 - 1-h Moisture: 5, 10, 15
 - 10-h Moisture: 5
 - 100-h Moisture: 6
 - Live Herbaceous Moisture: 100
 - Live Woody Moisture: (shaded field)
- Weather:** Midflame Wind Speed (upslope): 6 mi/h
- Terrain:** Slope Steepness: 30
- Run Option Notes:**
 - Maximum reliable effective wind speed limit is imposed [SURFACE].
 - Calculations are only for the direction of maximum spread [SURFACE].
 - Fireline intensity, flame length, and spread distance are always for the direction of the spread calculations [SURFACE].
 - Wind is blowing upslope [SURFACE].
- Output Variables:**
 - Surface Rate of Spread (maximum) (ch/h) [SURFACE]
 - Flame Length (ft) [SURFACE]
- Notes:** This is an example of a completed Basic Start Worksheet.

Producing Output Tables and Graphs

- From the top toolbar menu select the **Calculate > Calculate** command or click the Calculate toolbar

button: .

The **Calculate Results** dialog box is displayed. Accept the defaults as shown below.



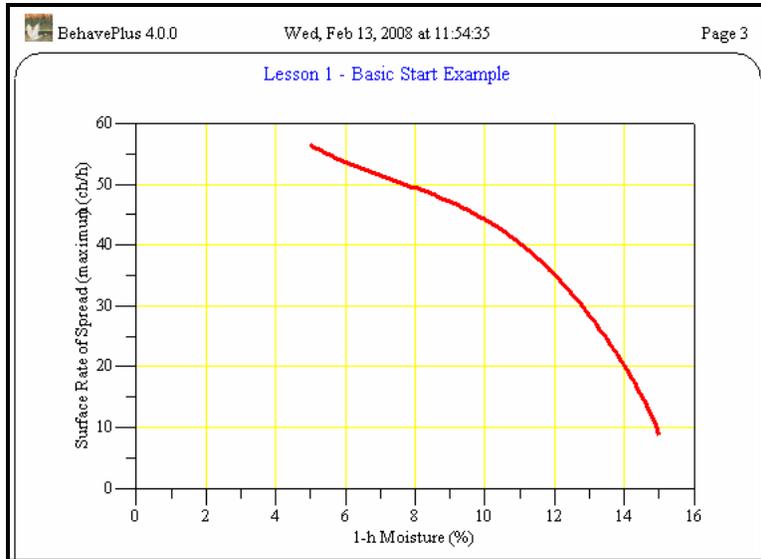
- Make sure the **Display table results** and **Display graph results** check boxes are both selected. Then click the **OK** button.

The following table is displayed. Each output variable (Rate of Spread and Flame Length) is calculated for each of the three 1-h dead fuel moisture values that were input (5, 10, 15). Note the heading for the tables and graphs is what you entered in the **Description** field of the Worksheet.

| 1-h Moisture | ROS (max) | Flame Length |
|--------------|-----------|--------------|
| % | ch/h | ft |
| 5 | 56.4 | 7.9 |
| 10 | 44.3 | 6.7 |
| 15 | 8.7 | 1.6 |

Notice that a 5% increase in 1-h moisture from 5% to 10% reduces the Flame Length by 1.7 ft. ($7.9 - 6.7$) while a 5% increase in 1-h moisture from 10% to 15% reduces the Flame Length by 5.1 ft ($6.7 - 1.6$).

- Click the Next Page  toolbar button to view the next output page. The graph shows the change in Rate of Spread as affected by 1-h moisture.



A graph is produced for each of the two output variables. Use the  toolbar button to go to the next page and see the Flame Length plot.

Changing Input Values

- Now click the First Page  toolbar button to return to the first page of the Worksheet.

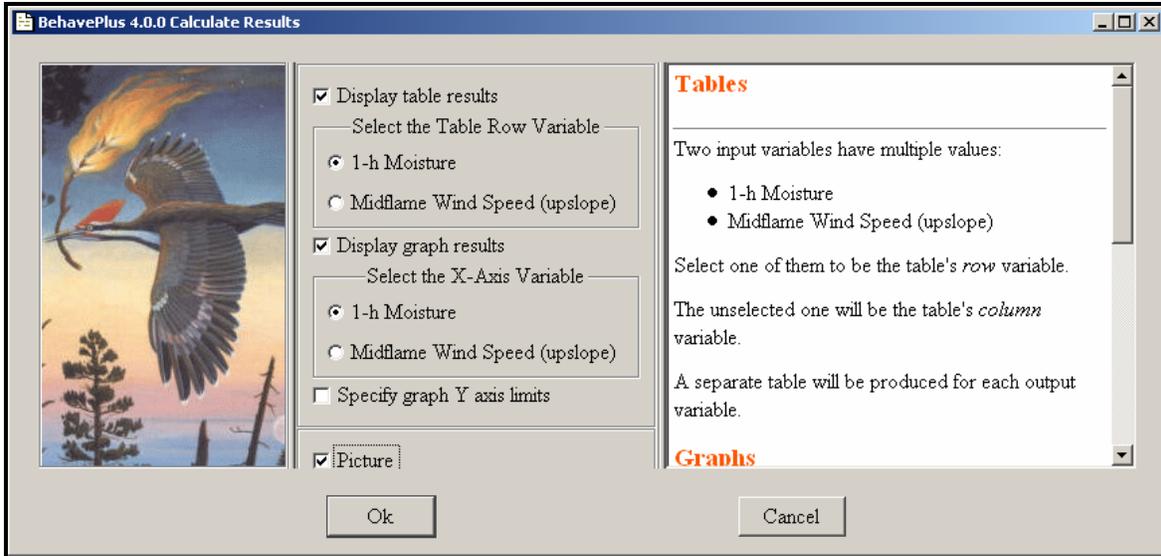
You will now enter a range of wind speeds to see the combined effects of wind and fine dead fuel moisture on the Rate of Spread and Flame Length.

- In the **Midflame Wind Speed** field, replace the current value “6” with “0, 3, 6, 9”.

Producing New Output Tables and Graphs

Click the  toolbar button to do the calculations using the new inputs.

Additional options are available in the **Calculate Results** dialog box since there are now two input variables with ranges of data. Additional display options allow you to choose the orientation of the tables and graphs. Accept the default options for now.

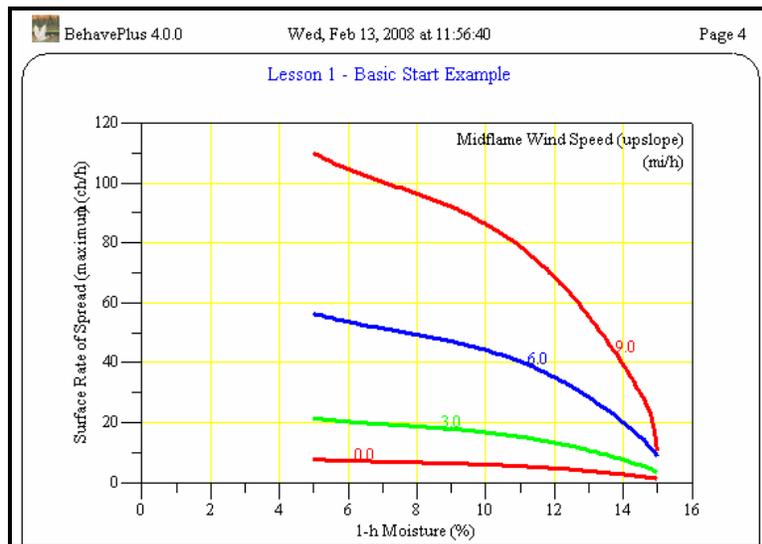


- Click the **OK** button to view the results.

Adding the range of values for a second input variable increases the number of output pages. A separate table is now produced for each of the output variables with the combinations of 1-h moisture and wind speed specified in the Inputs Section of the

Worksheet. Use the  and  toolbar buttons to view each page of this run.

- Look at the Surface Rate of Spread (ROS) graph.

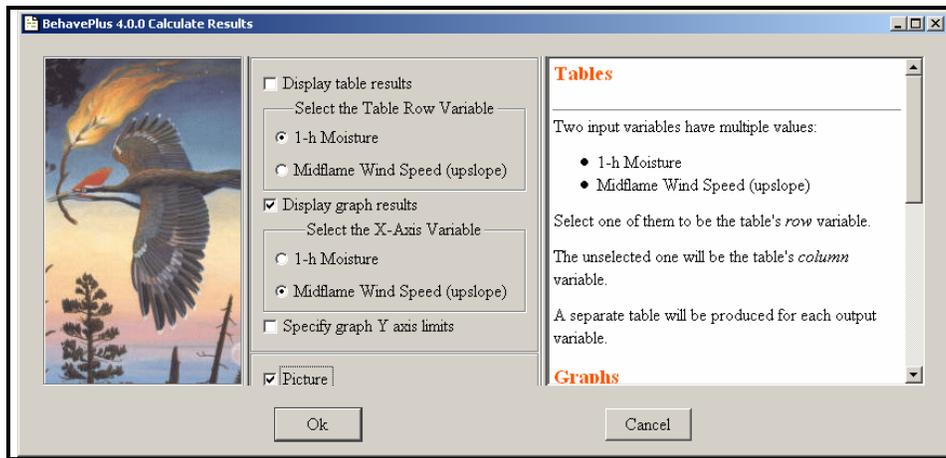


There is a curve for each of the input wind values. Notice the low ROS for moist fine dead fuels (15%) no matter what the wind speed. But when the fine fuels are drier, wind speed has a greater influence on Rate of Spread. (Recall the effect on Flame Length illustrated earlier).

Now view the same results in a different way by changing options in the **Calculate Results** dialog box.

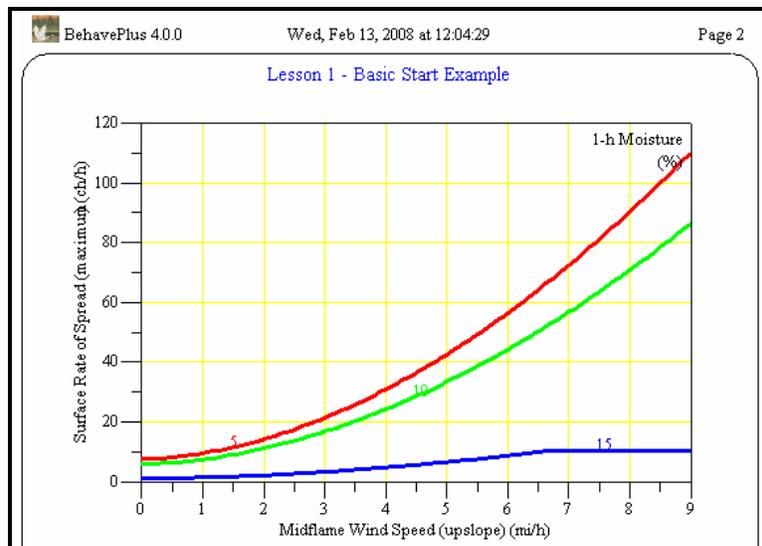
- Click the  toolbar button without changing any input values.
- Clear the **Display Table Results** checkbox in the **Calculate Results** dialog box.
- In the **Display graph results** section, change **Select X-axis variable** to be **Midflame Wind Speed (upslope)**.

The **Calculate Results** dialog box should look like this:



- Click the **Ok** button to view the results.

Since there is no table output, the Rate of Spread graph is the first output page, and should look like this:



There are now three curves, one for each of the 1-h fuel moisture input values. Wind speed is the X-axis variable as specified in the dialog box.

Exercises

1. Use the same **BasicStart Worksheet** as you did above.

- The fire is in a hardwood stand late in the fall after leaf drop (Fuel Model 9)
- Fine dead fuel moisture is 7%; 10-h is 8% and 100-h is 10%.
- Midflame wind is upslope and 4 mi/hr.
- Average slope is 40%.
- Calculate the Rate of Spread and Flame Length of the head fire.

Question – Why are graphs not produced for this run?

2. Continue to do another run with a range of values for **10-h Moisture**. Include values both higher and lower than the one you used for the first run (4, 8, 12%).

Question – How does 10-h fuel moisture affect the calculated Rate of Spread and Flame Length?

3. Continue to do another run with the previous values used for **1-h** and **10-h** reversed (**1-h** = 4, 8, 12%; **10-h** = 7%).

Question – How does 1-h fuel moisture affect the calculated Rate of Spread and Flame Length?

4. Continue to do a run with the following changes to the input:

- Return **1-h Moisture** to 7%.
- Return **10-h Moisture** to 8%.
- Enter a range of values for **Midflame Wind Speed** of “0, 5, 10, 15”
- Enter the values “0, 10, 40, 60” in the **Slope Steepness** input field.
- Click the  toolbar to calculate the results.
- Click the **Ok** button to view the results.

Question – How much does the change in the slope steepness from 0% to 10% change the fire behavior?

5. Repeat the Run again, changing the graph display as follows.

- Click the  toolbar button.
- Change Select the **X-Axis Variable** to be **Slope Steepness**.
- Click the **Ok** button to view the results.

The output tables are the same for Question 4 and Question 5. View the output graphs. Notice the difference in the graphs that results from the choice of the x-axis variable.

Question – Does wind or slope have a greater effect on fire behavior? How do the graphs help you reach that conclusion?

6. Try the above exercises with other fuel models. (Try fuel model 13.) Are the results different?

Summary

By now you have gotten a feel for the operation of BehavePlus. It is useful not just for calculating fire behavior characteristics, but also to help you better understand fire behavior and modeling concepts. BehavePlus can help you get a good understanding of the basics, which is important when working with more complex tools like FARSITE, FlamMap, FVS-FFE, and FSPro.

The skills you have learned in this Basic Start lesson allow you to produce tables and graphs to examine the influence of fuel model, fuel moisture, wind and slope on head fire surface rate of spread and flame length.

You have completed the first lesson in the Introduction Unit.

1. Basic Start – simple entry of input to get answers in the form of tables and graphs

Continue in order with the next three lessons to gain a basic understanding of program operation.

2. Worksheets – how the worksheet is developed from user selections
3. Input Methods – various ways of entering input values
4. Calculations – table and graph output options