Export to Spreadsheet Lesson **Operation Unit**

Introduction

BehavePlus offers the option of exporting table output as an HTML file, which can viewed with a browser. The HTML file can also be opened with spreadsheet software where additional analysis can be done and graphs can be formatted in ways not available in BehavePlus.

Objectives

1. Export results as an HTML file.
2. Open the HTML file as a spreadsheet for further analysis.
3. Save the file as a spreadsheet.

Where This Lesson Fits In

This is an optional lesson in the Operation Unit. The prerequisites are the four lessons in the Introduction Unit.

It is assumed that you know how to use spreadsheets, although we do take you through most of the steps. A classroom instructor for this lesson should be proficient with spreadsheets. A person doing it as self-study might want to have a helper on standby.

We use Microsoft Excel® as an example in this lesson.

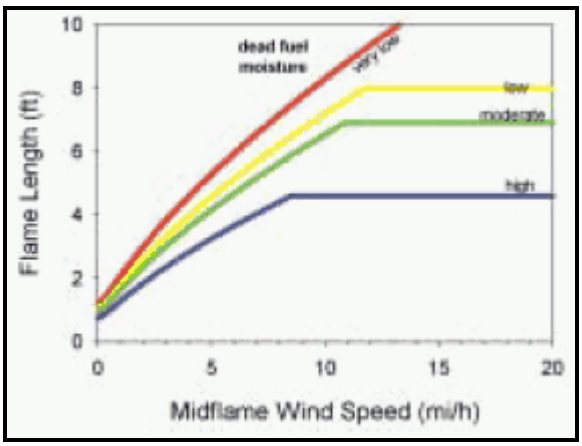
Lesson Changes: V4.0 to V5.0

Changes to the BehavePlus program did not require changes to this lesson. We updated the headers and footers, but did not redo the screen captures labeled BehavePlus 4.0.0.

Using Excel to Reformat a BehavePlus Plot

We will produce a graph with BehavePlus that corresponds to one from Scott and Burgan's (2005) "Standard Fire Behavior Fuel Models…" paper. The BehavePlus plot is a bit different. We will export results to a spreadsheet and label the lines in a different way.

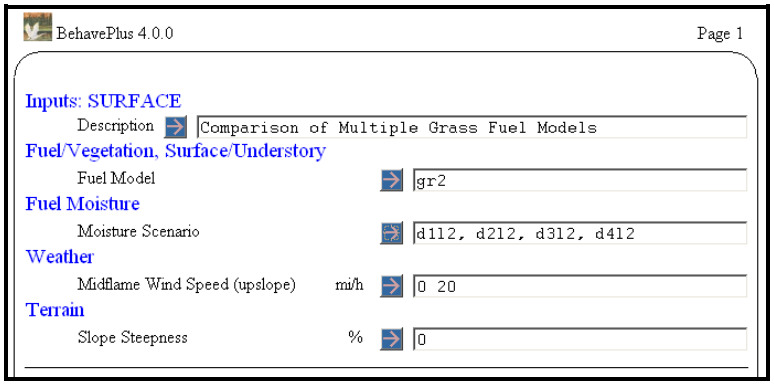
Following is a plot for Fuel Model GR2, p.27 in Scott and Burgan (2005). The moisture values used in the publication are described on p. 8.



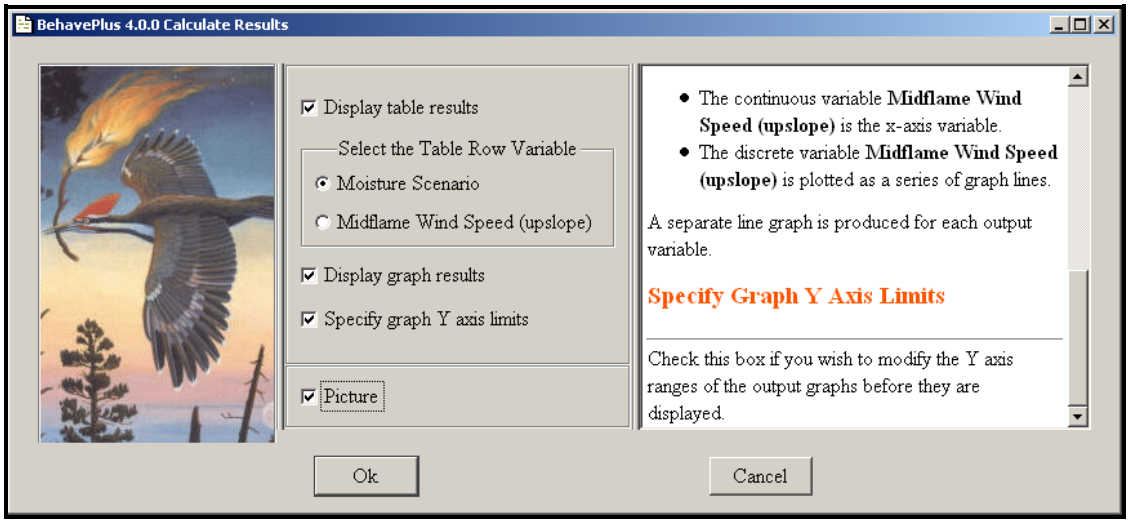
We will first use BehavePlus to produce a similar plot.

- Open a new **BasicStart.bpw** worksheet.
- Open the **Module Selection** window ( ).
- Open **SURFACE Options…**.
- Open the **Fuel & Moisture** tab and change the input option to **Moisture is entered by moisture scenario**.
- Open the **Basic Outputs** tab.
- Remove Surface Rate of Spread from the input selections, leaving only Flame Length.
- Click **Ok** twice.

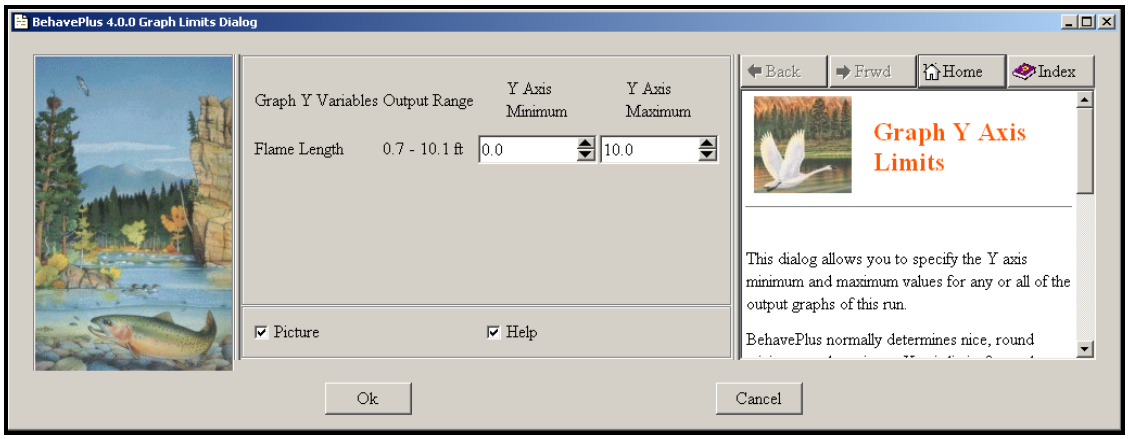
- Enter values on the worksheet as follows, entering Moisture Scenario values by clicking on the **Guide** button ( ):



- Calculate the run.
- Check the box to **Specify graph Y axis limits**.



- Change the maximum Flame Length from 12 to 10 feet.



- Click **Ok**.

The resulting table has calculated values for only the 0 and 20 mi/h Wind Speed specified in the Worksheet.

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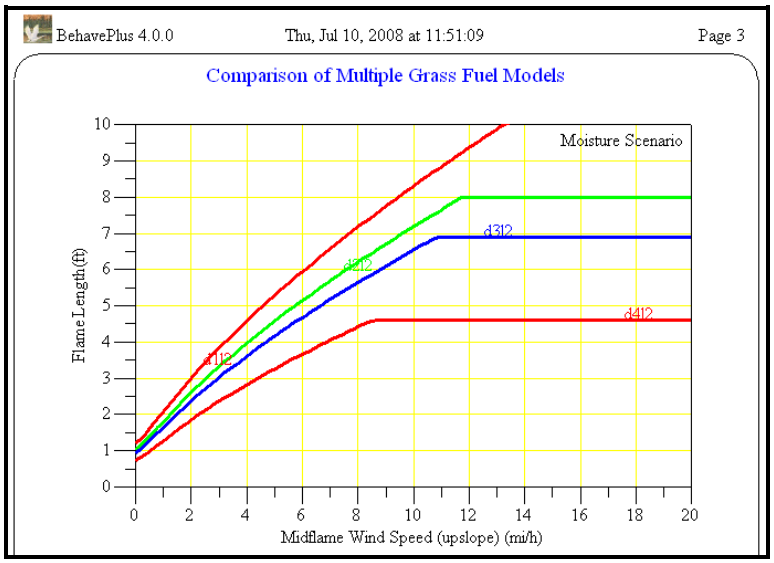
Comparison of Multiple Grass Fuel Models

Flame Length (ft)

Moisture Scenario	Midflame Wind Speed (upslope) mi/h	
	0.0	20.0
d112	1.2	10.1
d212	1.0	8.0
d312	0.9	6.9
d412	0.7	4.6

The plot is produced by 100 calculations from Wind Speeds ranging from 0 to 20 mi/h. (You can verify this by going to **Configure > Appearance preferences > Graph Elements > Curve Points**, which is set to 100.)



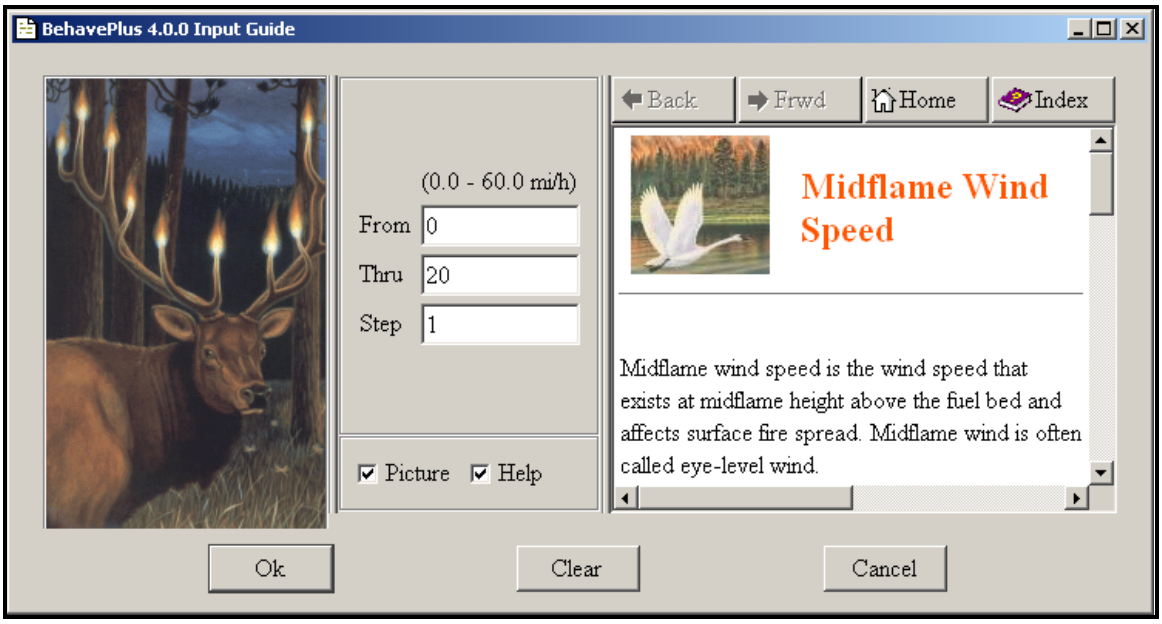
In BehavePlus you can delete the grid lines and change the curve colors and weight. But the labeling of the curves is automatic. If you want to change the curve labels, you have to use separate graphing software such as Microsoft Excel®.

Export Results

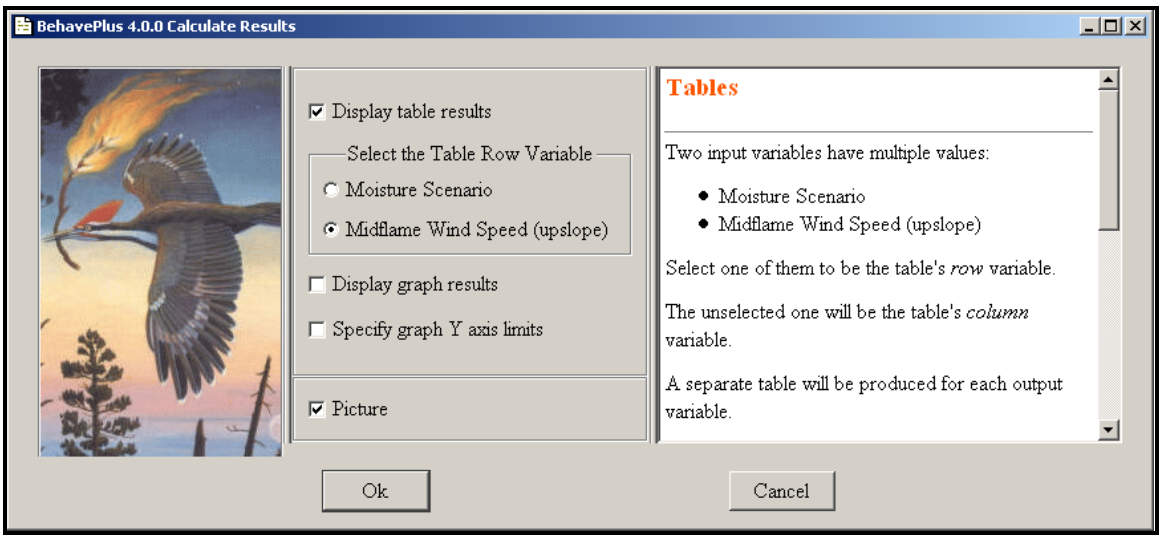
The export function only applies to the values in the tables produced by BehavePlus. We certainly need more than the flame length associated with 0 and 20 mi/h wind speed.

Therefore, we will change the input to include intermediate values between 0 and 20. In this example, we will calculate 21 values.

- Click on the **First Page** button ( ) to return to the worksheet.
- Change the Midflame Wind Speed to 0 to 20 in steps of 1 by clicking on the **Guide** button.



- Click **Ok**.
- Calculate the run.
- Display only the table results; there is no need to produce a graph.
- Change the table row variable to Midflame Wind Speed to better format the table.



The outputs appear on a single page. If Moisture Scenario were chosen as the Table Row, the table would appear on more than one page.

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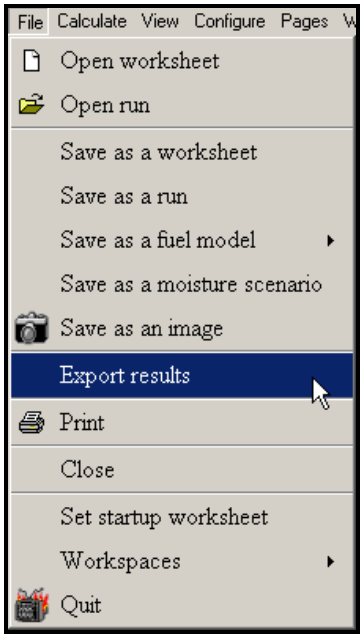
Comparison of Multiple Grass Fuel Models

Flame Length(ft)

Midflame Wind Speed mi/h	Moisture Scenario d112	d212	d312	d412
0.0	1.2	1.0	0.9	0.7
1.0	2.1	1.8	1.6	1.3
2.0	3.0	2.6	2.4	1.9
3.0	3.8	3.3	3.0	2.4
4.0	4.6	4.0	3.6	2.8
5.0	5.3	4.6	4.2	3.3
6.0	5.9	5.1	4.7	3.7
7.0	6.6	5.7	5.2	4.0
8.0	7.2	6.2	5.6	4.4
9.0	7.7	6.7	6.1	4.6
10.0	8.3	7.2	6.5	4.6
11.0	8.8	7.7	6.9	4.6
12.0	9.4	8.0	6.9	4.6
13.0	9.9	8.0	6.9	4.6
14.0	10.1	8.0	6.9	4.6
15.0	10.1	8.0	6.9	4.6
16.0	10.1	8.0	6.9	4.6
17.0	10.1	8.0	6.9	4.6
18.0	10.1	8.0	6.9	4.6
19.0	10.1	8.0	6.9	4.6
20.0	10.1	8.0	6.9	4.6

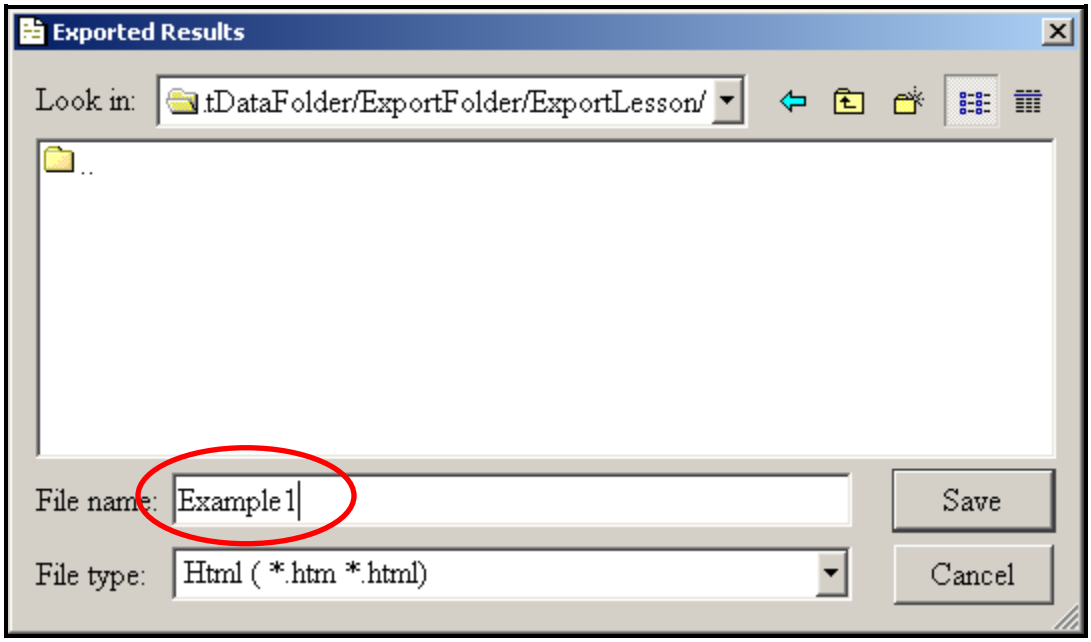
- Click on **File > Export results**.



The window opens to the default Export folder. You can save the results in **MyExports** or any other folder. You can also save it elsewhere on your computer. It is not necessary to keep it with your BehavePlus files.

- Double-click on **MyExports**.
- Create a new folder by clicking on the .

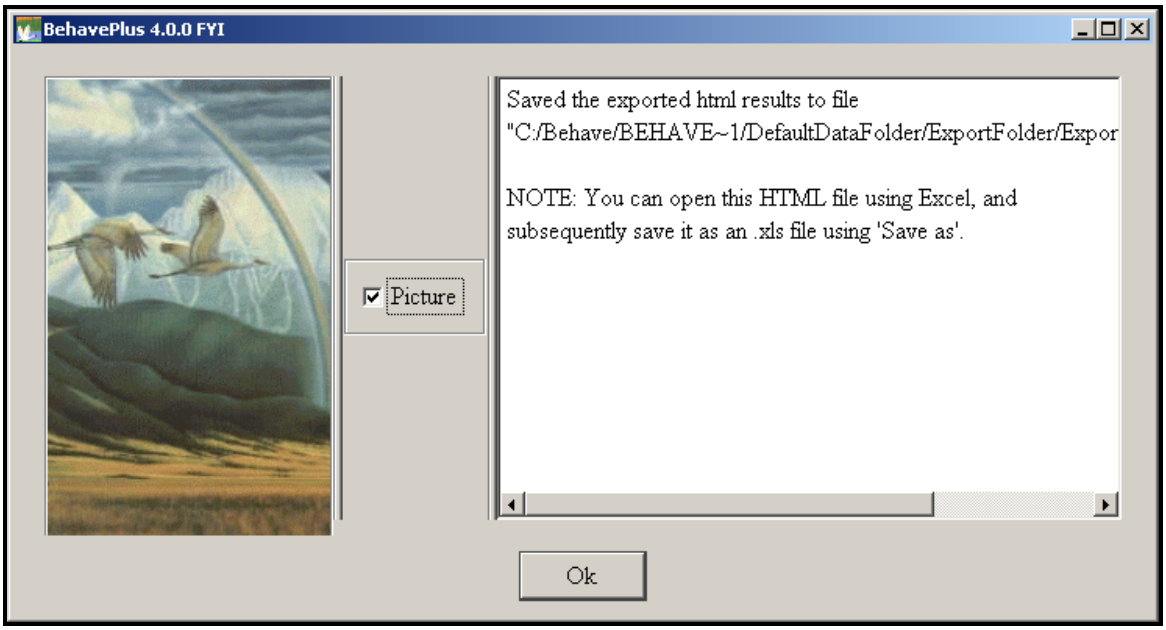
- Name the folder 'Export Lesson'.
- Double-click on the new **ExportLesson** folder in the window.
- Enter the file name 'Example1' in the **File name** field in the lower part of the window.



There is only one **File type** option (Html).

- Save the file.

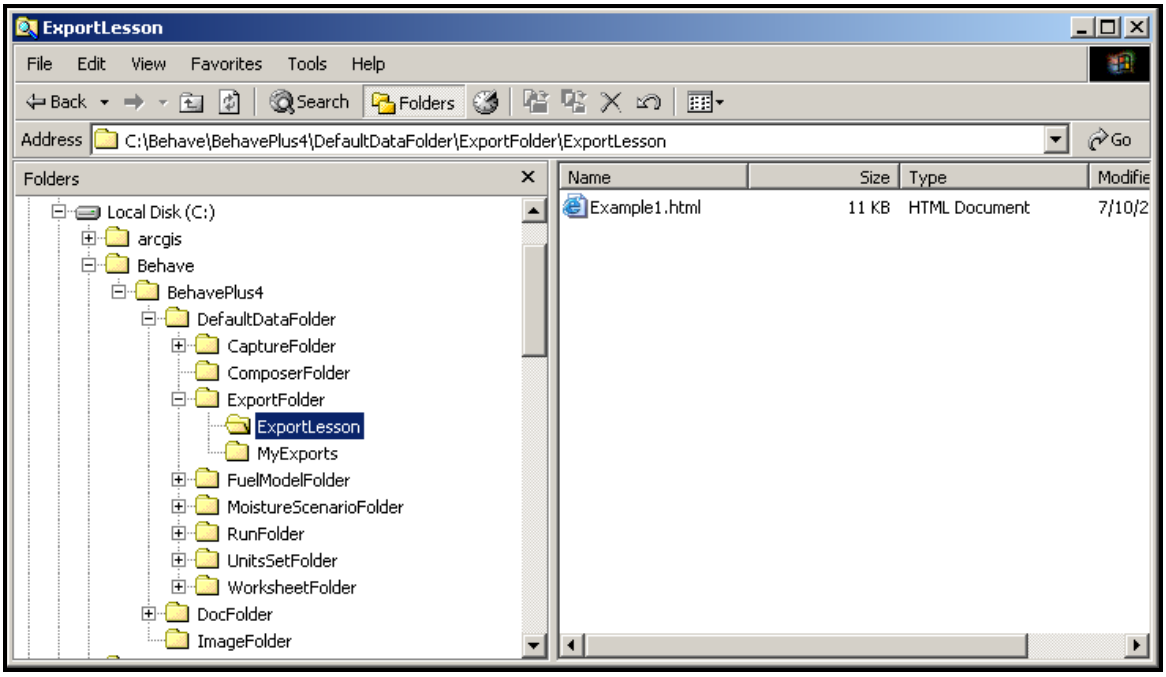
The message in the **FYI Window** reminds you that you can open an HTML file with Microsoft Excel® spreadsheet software.



- Click **Ok**.

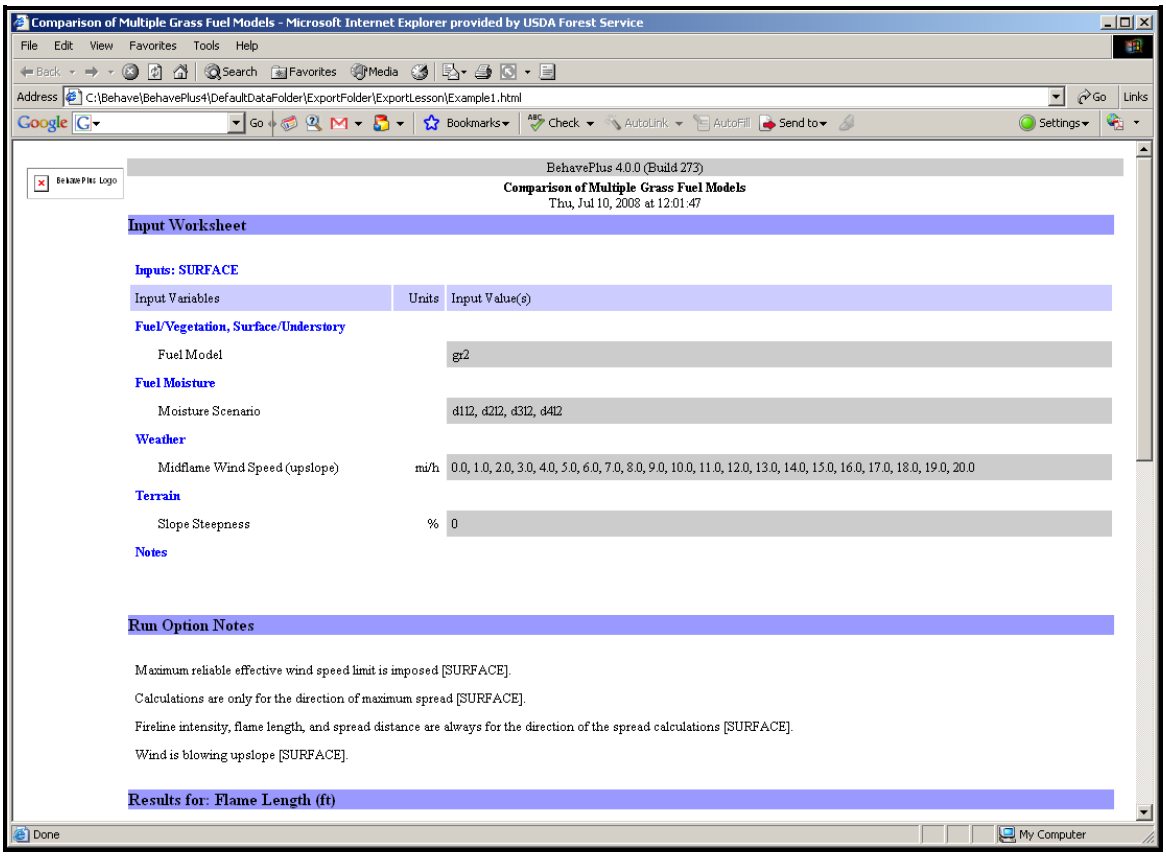
View the HTML File with a Browser

- Find the file you just saved using Microsoft Windows Explorer®.



- Double-click on the file name. Because it is an HTML file, wt will open by default in a web browser.

We will first open the file with a browser and then with a spreadsheet, so don't close Windows Explorer®.



The HTML file is nicely formatted with the information found in the BehavePlus Worksheet and the table. You can save this file in a documentation folder. It is a small file suitable for attaching to an e-mail. The HTML file will only include tables; it will not include graphs, even if they are created in the BehavePlus Run.

Set Browser Settings to Print Shading

The HTML file is formatted to include shading. In order for the shading to be visible when the file is printed, you may need to change your web browser settings. These settings are different for the various web browsers, two of which are described here.

In Internet Explorer:

- Select **Tools > Internet Options**.
- Select the **Advanced** tab.
- Scroll down to the **Printing** header.
- Enable the check box titled **Print background colors and images**.

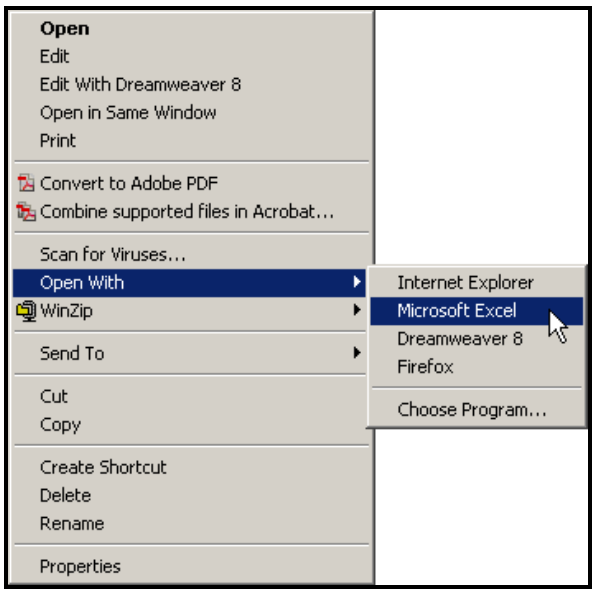
In Mozilla Firefox:

- Select **File > Page Setup**.
- Select the **Format & Options** tab.
- Enable the check box titled **Print Background (colors and images)**

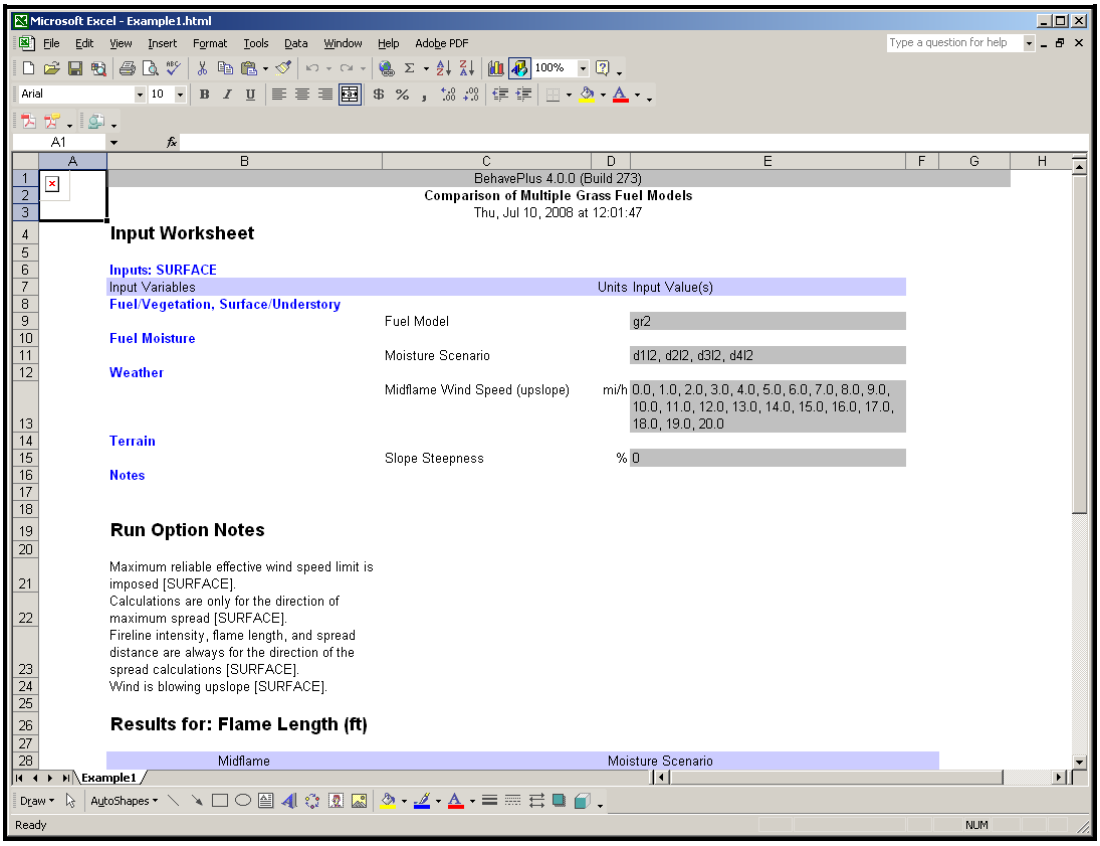
Open the HTML File as a Spreadsheet

You can open the HTML file with spreadsheet software to do additional analysis and create plots in ways not possible in the BehavePlus program.

- Right-click on the file name in Microsoft Windows Explorer®.
- Choose to Open With Microsoft Excel®.
- The first time you do this, you will need to select **Choose Program…**, highlight Microsoft Excel,
- Make sure there is no check by **Always use this program to open these files**!
- Click **Ok**.



- After this, Microsoft Excel® should show up as an option.

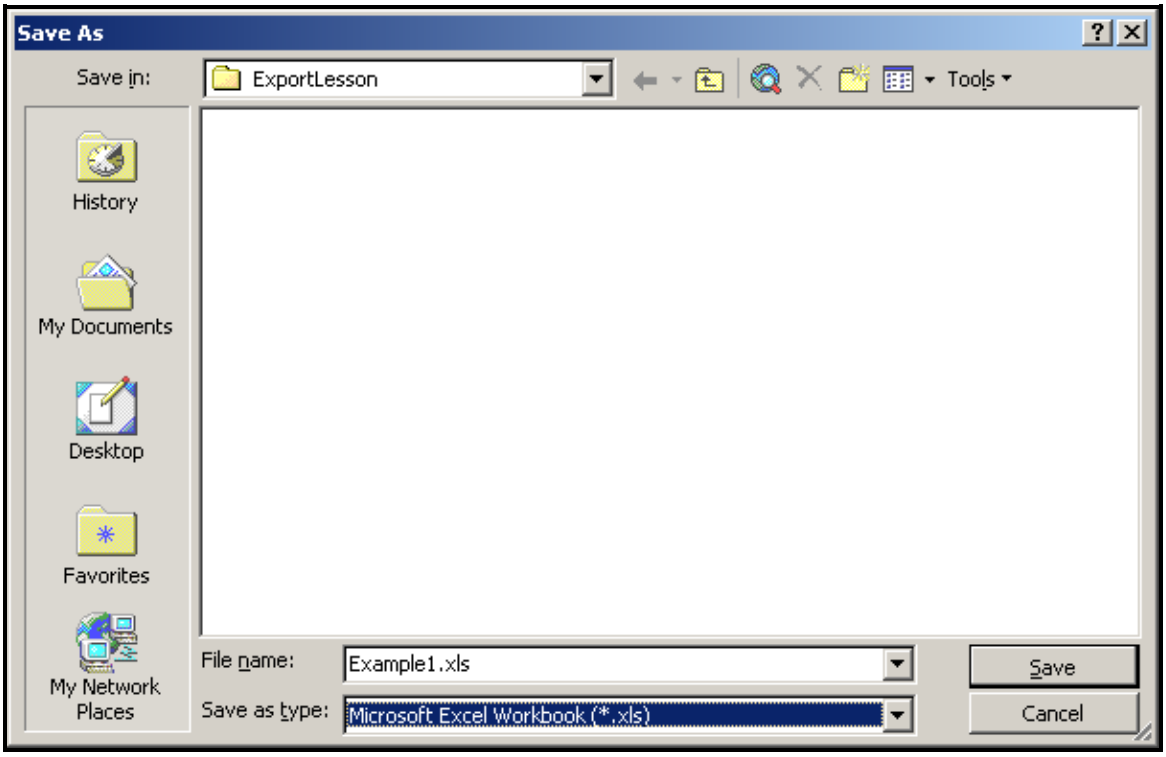


Because of the column widths, it does not look as good in the spreadsheet as it did in the browser. However, once you have the values in the spreadsheet, you can work with them in any way you see fit.

***** Note: It is important to save the document as a spreadsheet with the .xls extension. You should do this as soon as you open the worksheet. *****

- Click on **File > Save As…**.
- Change **Save as type:** to **Microsoft Excel Workbook (*.xls)**.

You can save it in the same folder or elsewhere on your computer.



Move Output to Another Worksheet

- Highlight the output lines 28-51 (or whichever lines are the output in your file).
- Click on **CTRL-C** to copy (or click on **Edit > Copy**).
- Click on **Insert > Worksheet**.
- Click in the upper left-hand cell.
- Click on **CTRL-V** to paste (or click on **Edit > Paste**).

Don't change the original page! You will work with the output page, which is currently labeled 'Sheet1'. You can change the name if you would like by double-clicking on the name and typing the new name.

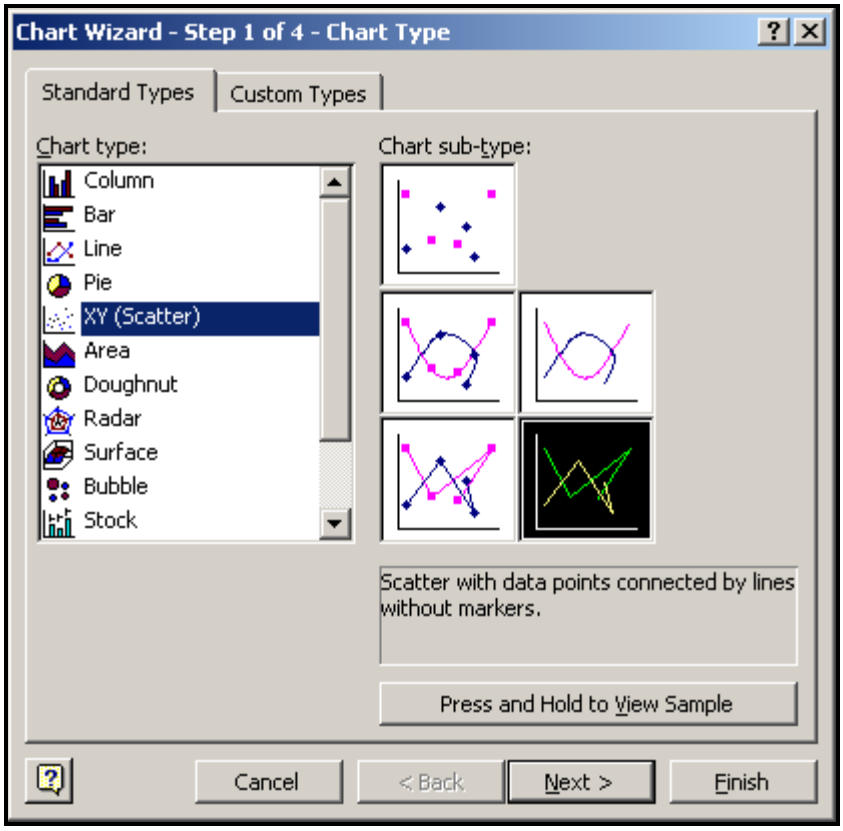
	A	B	C	D	E	F	G
1		Midflame		Moisture Scenario			
2		Wind					
3			d1l2	d2l2	d3l2	d4l2	
4		0	1.2	1	0.9	0.7	
5		1	2.1	1.8	1.6	1.3	
6		2	3	2.6	2.4	1.9	
7		3	3.8	3.3	3	2.4	
8		4	4.6	4	3.6	2.8	
9		5	5.3	4.6	4.2	3.3	
10		6	5.9	5.1	4.7	3.7	
11		7	6.6	5.7	5.2	4	
12		8	7.2	6.2	5.6	4.4	
13		9	7.7	6.7	6.1	4.6	
14		10	8.3	7.2	6.5	4.6	
15		11	8.8	7.7	6.9	4.6	
16		12	9.4	8	6.9	4.6	
17		13	9.9	8	6.9	4.6	
18		14	10.1	8	6.9	4.6	
19		15	10.1	8	6.9	4.6	
20		16	10.1	8	6.9	4.6	
21		17	10.1	8	6.9	4.6	
22		18	10.1	8	6.9	4.6	
23		19	10.1	8	6.9	4.6	
24		20	10.1	8	6.9	4.6	
25							
26							

Produce a Plot and Reformat

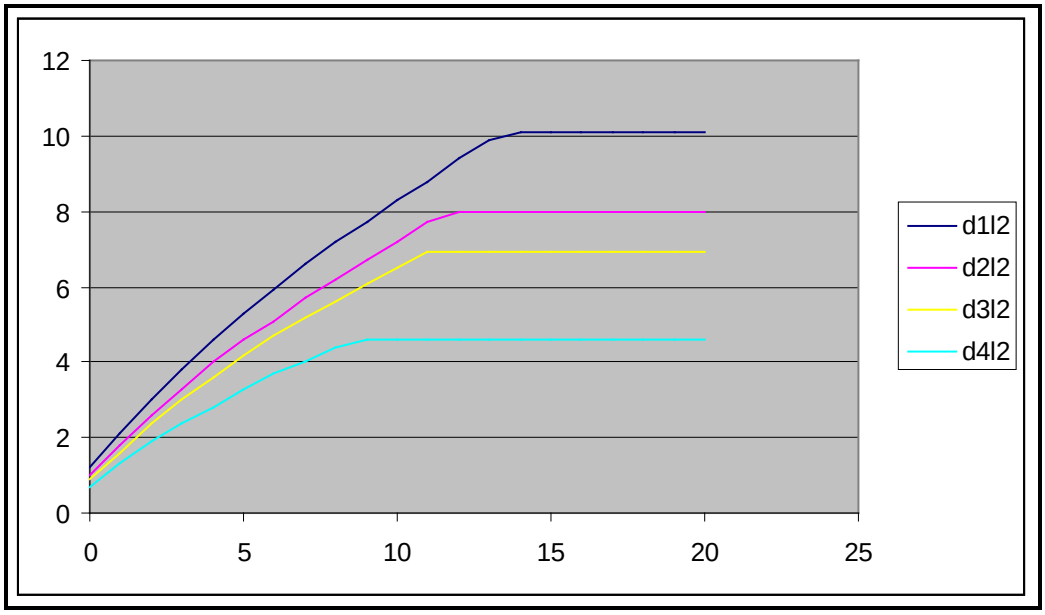
Now that the data are in the correct format, you can produce and format the graph.

- Highlight Columns B-F and Rows 3-24.
- Click on the Chart Wizard icon: .
- Choose **XY (Scatter)**.

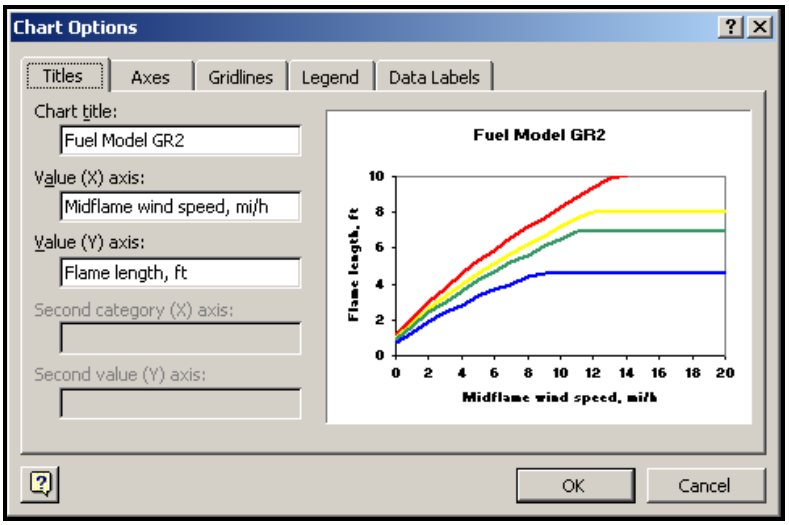
- Click on the **Chart sub-type Scatter with data points connected by lines without markers** (i.e., the line only; no points). This is the graph type in the bottom left-hand side of the **Chart sub-type** list.



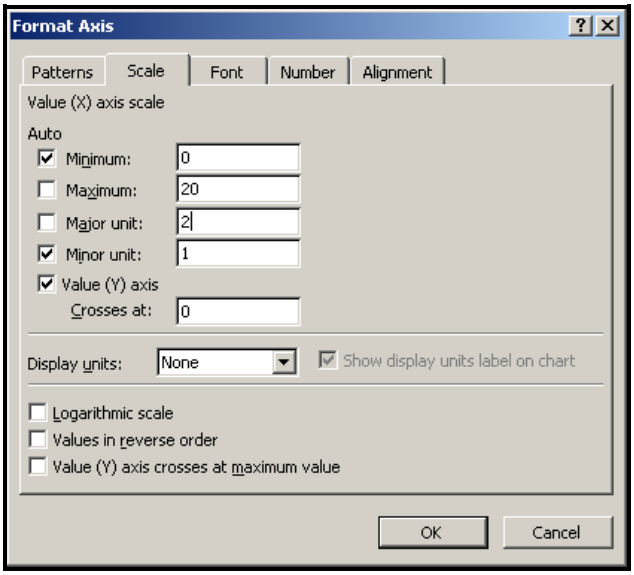
- Click **Finish** to produce the plot.



- Right-click in the white area of the plot.
- Click on **Chart Options**.
- Click on the **Titles** tab.
- Fill out the **Chart title**, **Value (X) axis**, and **Value (Y) axis** as follows:

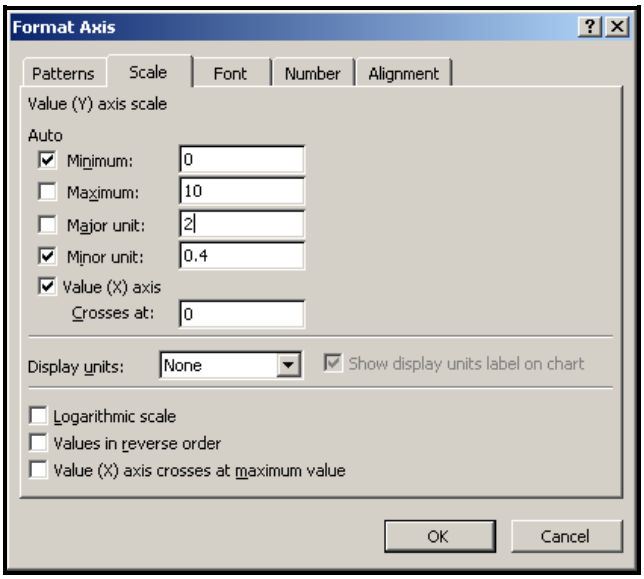


- Click on the **Legend** tab. Remove the check by **Show legend**.
- Click on the **Gridlines** tab. Remove the check by **Major gridlines**.
- Click **OK**.
- Right-click on the x-axis (on the line itself). A pop-up window should appear.
- Select **Format Axis**.
- Click on the **Scale** tab. Change the **Maximum** from 25 to 20. Change the **Major unit** from 5 to 2.

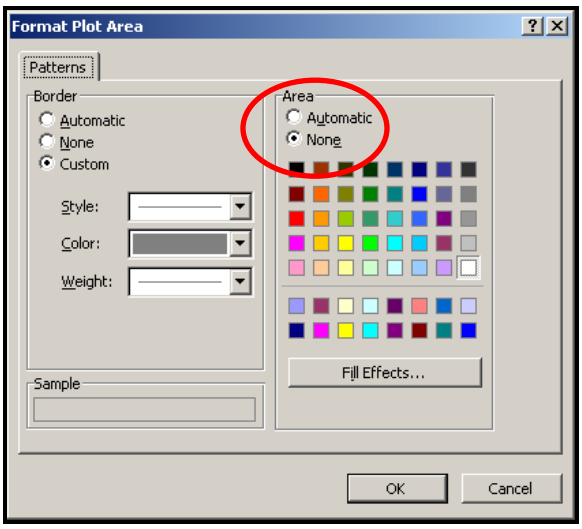


- Click on the **Font** tab. Change the **Font style** to **Bold**.
- Click **OK**.

- On the graph, right-click on the y-axis (on the line itself). A pop-up window should appear.
- Select **Format Axis**.
- Click on the **Scale** tab. Change the **Maximum** from 12 to 10. Ensure that the **Major unit** equals 2 and the box is not checked.

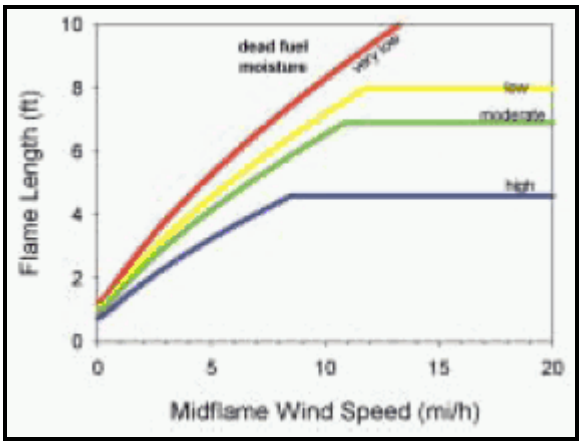


- Click on the **Font** tab. Change the **Font style** to **Bold**.
- Click **OK**.
- Right-click in the grey area of the graph. Click on **Format Plot Area…**.
- On the **Patterns** tab, click on **None** for **Area**.



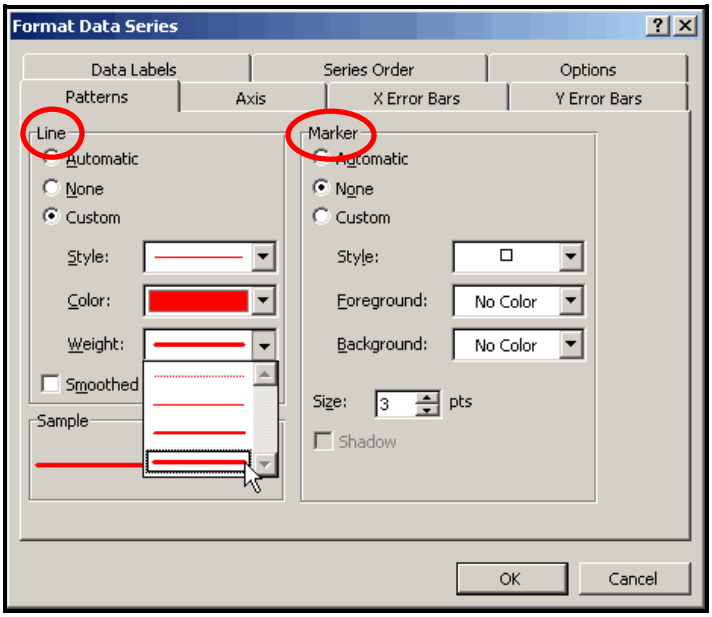
- Click **OK**.
- Hover over a curve and right-click on it. A pop-up window will appear.
- Click on **Format Data Series…**.

We want to make our graph look similar to this one for Fuel Model GR2 (Scott and Burgan 2005, p. 27).



On the **Patterns** tab, there are two sections: **Line** and **Marker**.

- Because of the **Chart sub-type** we chose, the **Marker** should initially be set to **None**. If the Marker is set to something else, change it to **None**.
- In the **Line** section, change the **Line Color** and **Weight**. The **Weight** should be the thickest possible line. In this example, we are working with the top line.

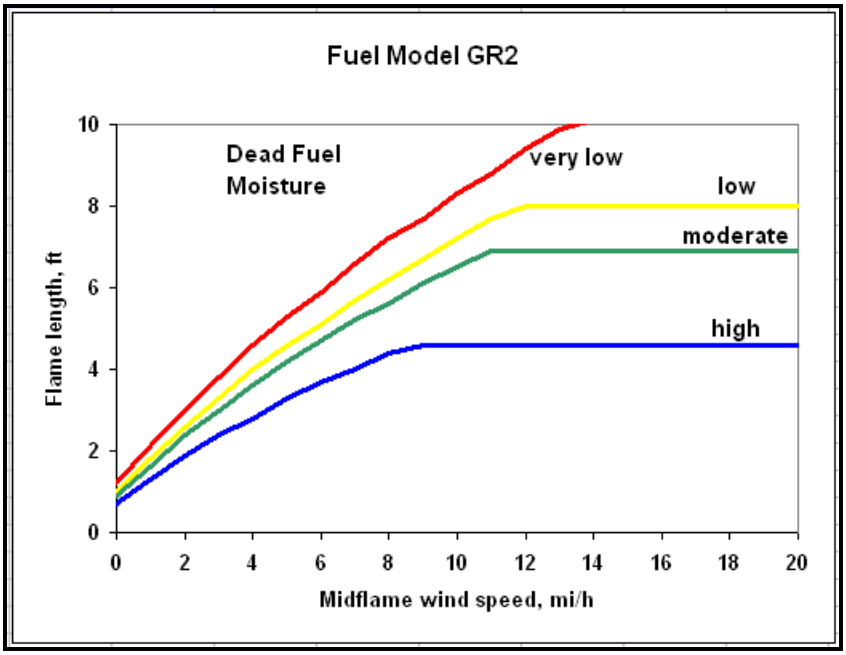


- Click **OK**.
- Repeat for each curve.

- Click on the chart. Grab the corner and resize the chart so that it is about 50-75% larger. You want to be able to see what you are doing in the next steps.

- Make sure the **Drawing** toolbar is showing. If not, click on **View > Toolbars > Drawing**.
- On the **Drawing** toolbar, click on the **Text box** button ( ).
- Left-click on the chart near where you want the label to appear.
- Begin typing the label. As you type, the text box will appear.
- Highlight the word and change the **Font** to **size 11** and **bold**.

- Repeat for each label. Or, click on the outside of the Text box, duplicate with via **Copy** and **Paste**, move it, and edit the text for the next label.



In this case, we had 21 points on the table. 100 points would have produced a smoother plot. In some cases, this will be important. It is no more difficult to include more points.

- Assuming you have already created an Excel spreadsheet, click on **File > Save** or the **Save** toolbar button to save the spreadsheet, which contains two worksheets. If you have not created an Excel spreadsheet, you **must** select **File > Save As** or you will have difficulty retrieving and sharing your files even if the files look OK!

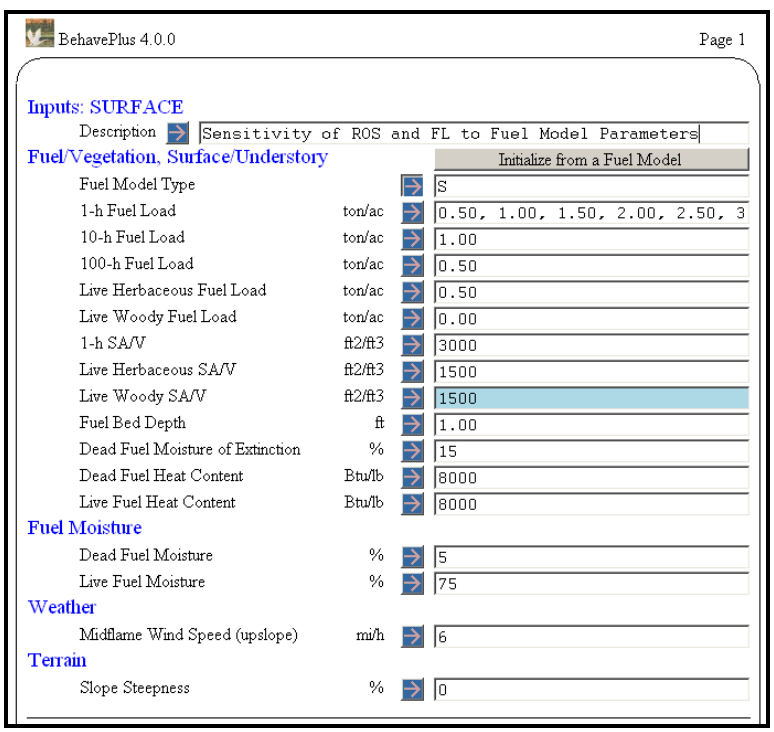
***** Note: Having made this mistake many times ourselves, we want to stress again that it is important to save the document as a spreadsheet with the .xls extension. You should do this as soon as you open the worksheet. *****

Using Excel to Calculate and Plot Another Variable

We will use Microsoft Excel® to look at the ratio of Surface Rate of Spread to Flame Length.

As stated by Burgan and Rothermel (1984, p. 47): "A common fuel modeling problem is having the spread rate about right, but the flame length too low, or vice versa." Their TSTMDL program (part of the old BEHAVE system) provided the opportunity to determine whether changing a particular Fuel Model parameter such as 1-h Fuel Load has a greater effect on the Surface Rate of Spread or the Flame Length. A plot of the ratio of Surface Rate of Spread to Flame Length for the range of a given Fuel Model parameter will show whether Surface Rate of Spread will increase faster than Flame Length (rising curve) or slower (decreasing curve) as the value of the selected parameter changes.

- Close the BehavePlus Worksheet that you were working with.
- Open **BasicStart.bpw** and set up the following worksheet.
- Go to **Module Options > SURFACE Options… > Fuel & Moisture** and select **Fuel is entered by Fuel parameters (for custom fuel modeling)**.
- In the same tab, change the moisture to **Moisture is entered by dead and live category**.
- Select only Surface Rate of Spread and Flame Length as output variables.
- Click **Ok** twice.
- Click on **Initialize from a Fuel Model** and select Fuel Model 2.
- Enter other input values as shown below.
- Change the 1-h Fuel Load to a range of values from 0.5 to 5.0 in steps of 0.5.



- Calculate the run to get the following table and graphs.

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Sensitivity of ROS and FL to Fuel Model Parameters

1-h Load ton/ac	ROS (max) ch/h	Flame Length ft
0.50	22.2	3.6
1.00	36.9	5.3
1.50	47.7	6.7
2.00	55.8	7.9
2.50	61.8	8.9
3.00	66.5	9.8
3.50	70.1	10.5
4.00	73.0	11.2
4.50	75.3	11.8
5.00	77.2	12.3

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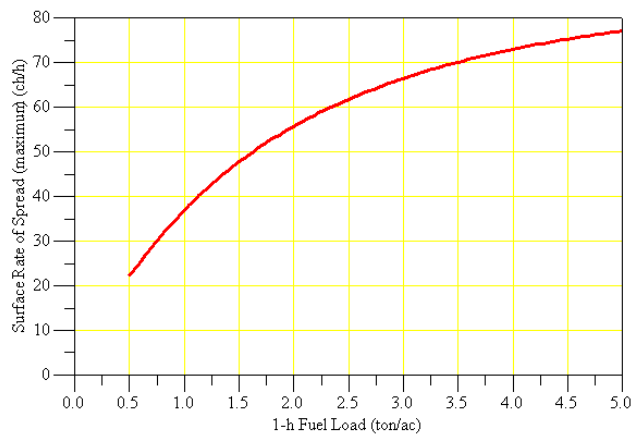
Sensitivity of ROS and FL to Fuel Model Parameters



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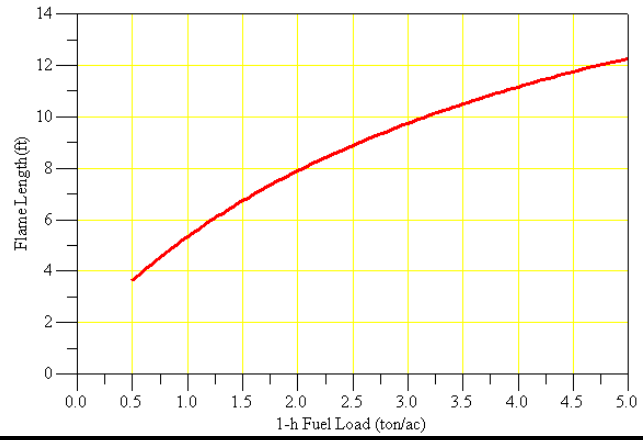
Sensitivity of ROS and FL to Fuel Model Parameters

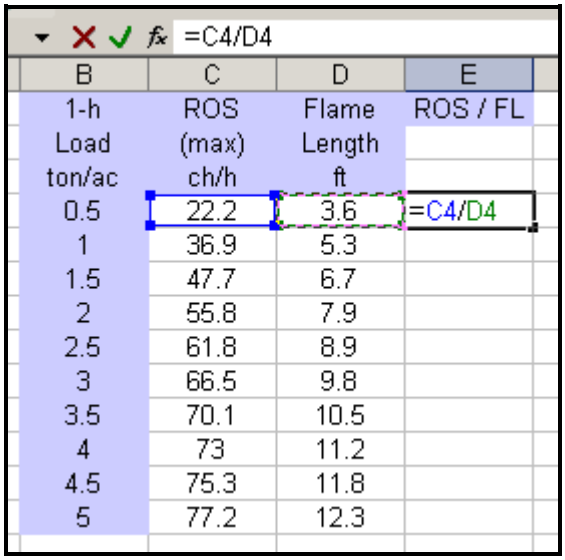


- Export the results as in the previous section.
- Save the results in the folder created earlier: ‘ExportLesson’.
- Name the file ‘ROS-FL-ratio2’.

- Open the file in Microsoft Excel®.
- Save the file as an .xls file called ‘ROS-FL-ratio2.xls’.
- Copy the results to a new worksheet.
- Add a column with the heading ‘ROS / FL’.

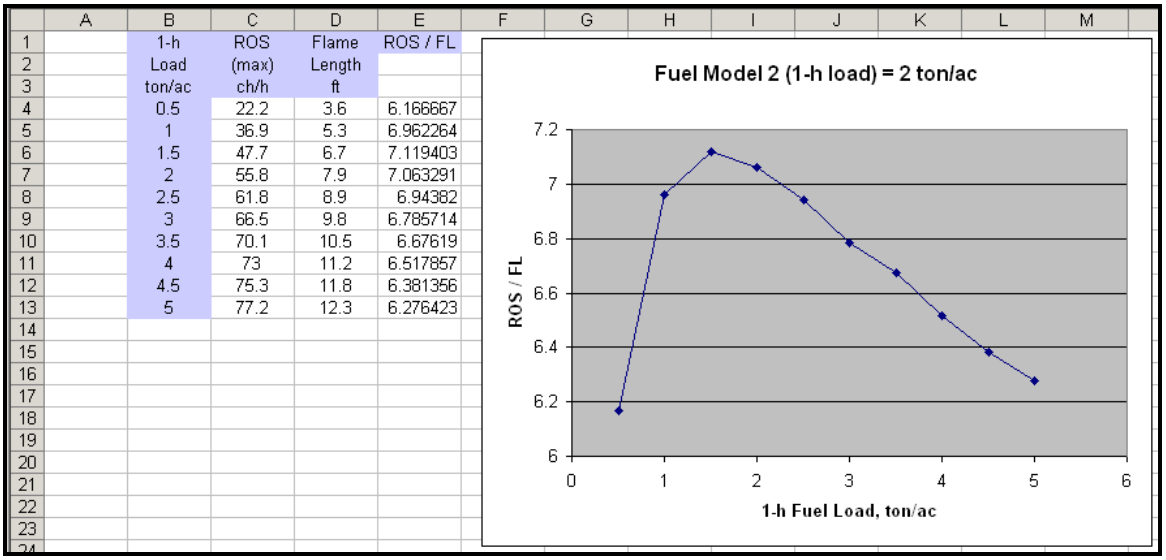
Now, we will add calculated values for this variable.

- Click on the cell associated with **1-h Fuel Load = 0.5 ton/ac** that is in the column called **ROS / FL**.
- Type ‘=’.
- Click on the **ROS** value for that row.
- Type ‘/’.
- Click on the **FL** value for that row.



- Click **Enter**.
- Click on the resulting value. If you get an error window or a result such as **#NAME?**, you may need to modify your equation.
- Double-click on the **Dot** in the lower right-hand corner of the cell.
- Values will be automatically calculated for the entire column.
- Plot the ratio and label the graph as follows.

- You can select two non-contiguous columns by selecting the values in the first column (x-axis), holding the CTRL key, and highlighting the values in the second column (y-axis).



1-h Load ton/ac	ROS (max) ch/h	Flame Length ft	ROS / FL
0.5	22.2	3.6	6.166667
1	36.9	5.3	6.962264
1.5	47.7	6.7	7.119403
2	55.8	7.9	7.063291
2.5	61.8	8.9	6.94382
3	66.5	9.8	6.785714
3.5	70.1	10.5	6.67619
4	73	11.2	6.517857
4.5	75.3	11.8	6.381356
5	77.2	12.3	6.276423

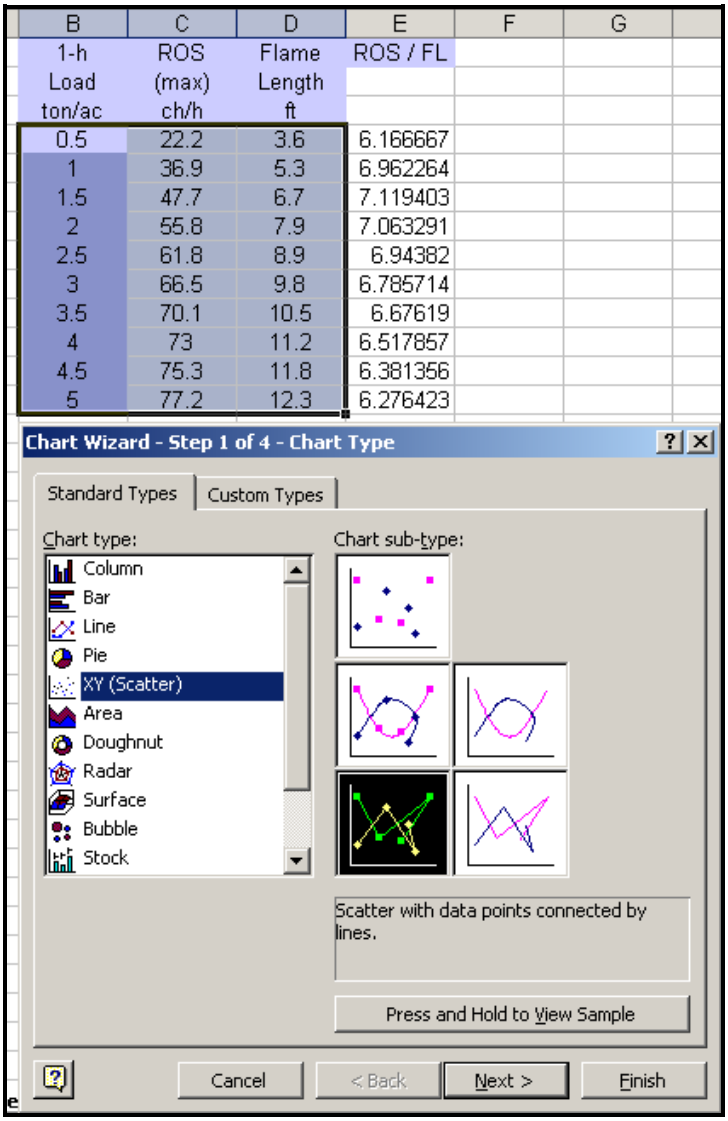
The plot shows the relative effect of 1-h fuel load on rate of spread vs. flame length for these fuel parameters. For 1-h load less than 1.5 tons/acre, rate of spread increases faster than flame length. Above that value, flame length increases faster than rate of spread. This relationship is hard to see by looking at the separate rate of spread and flame plots from BehavePlus.

Using Excel to Plot Two Variables on the Same Graph

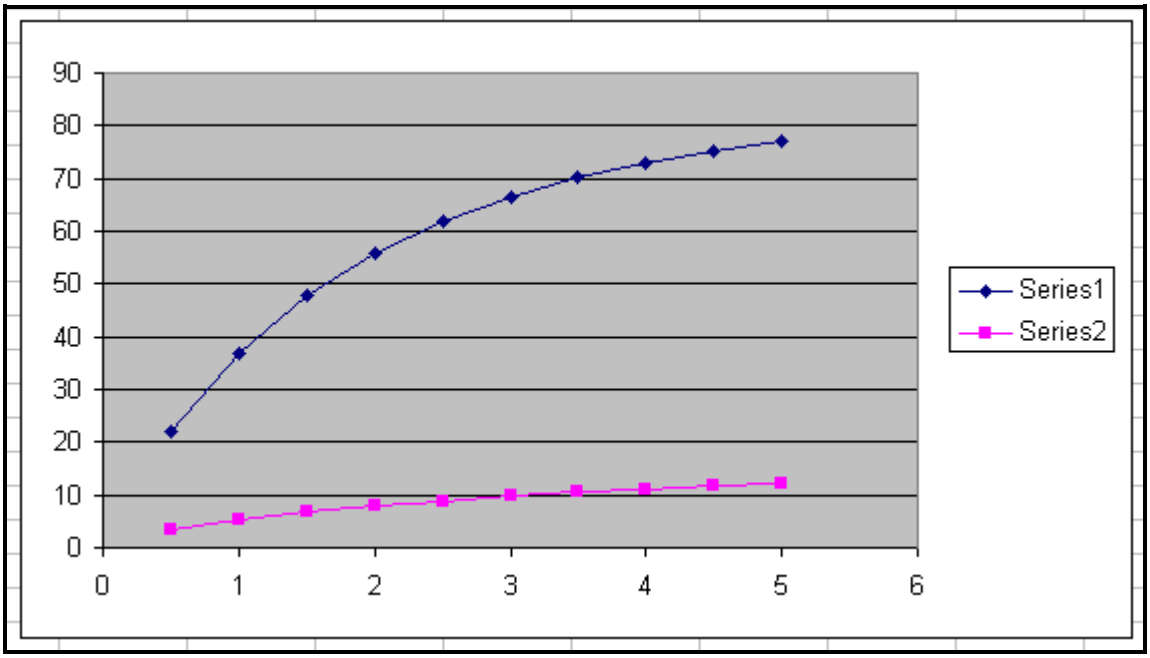
Continue with this example to plot Rate of Spread and Flame Length on the same graph.

- Highlight the 1-h Fuel Load, ROS, and FL values as shown below.

- Click on the **Chart Wizard** icon ( ) and select a **Scatter Plot**.



➢ Click **Finish** to create the following plot.



In Exercise 1, you will make changes to this graph to make it more informative.

Summary

In this lesson, you explored the option of exporting table output as an HTML file, which can viewed with a browser or opened with spreadsheet software where additional analysis can be done and graphs can be formatted in ways not available in BehavePlus..

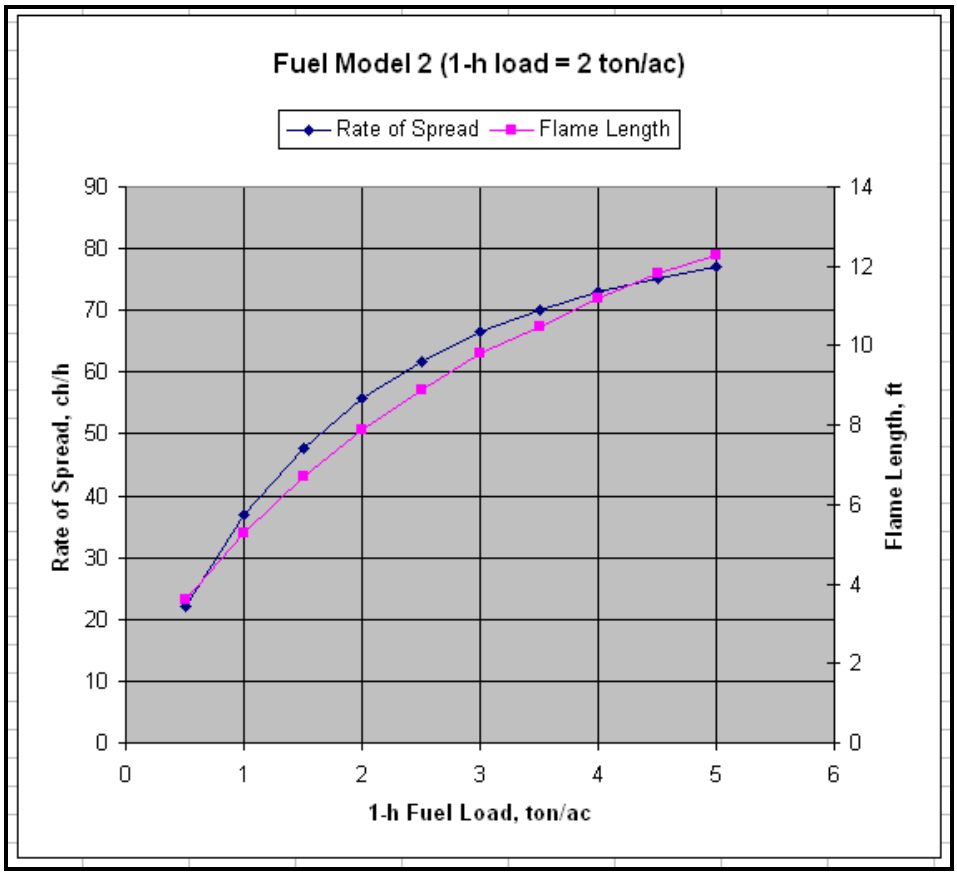
Specifically, you should have learned how to:

- Export BehavePlus table output as an HTML file.
- Include the number of values in a table necessary to produce suitable plots.
- View the output with a web browser.
- Open the output file with a spreadsheet.
- Save that output file as an .xls file for further analysis.
- Copy the output from the main data page to a new worksheet for analysis.
- Create graphs and additional computations.

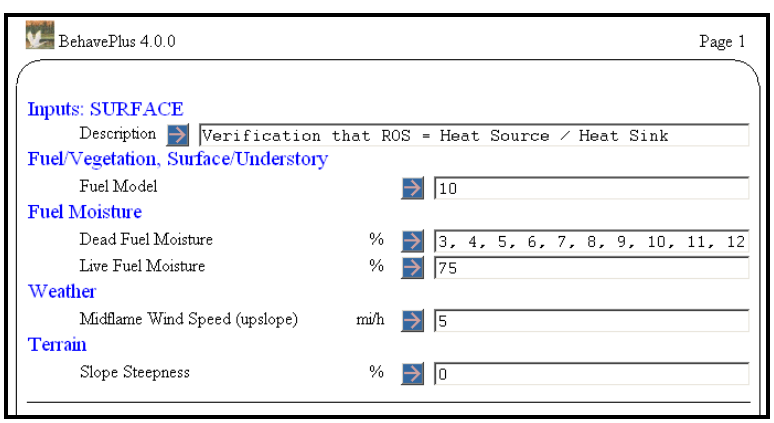
Microsoft Excel® is not the only spreadsheet software that you can use. SigmaPlot® is powerful graphing software that produces plots suitable for scientific publications. If you do not have access to purchased software, freeware such as Calc, which is included in OpenOffice.org, can be used.

Exercises

1. Continuing with the example at the end of this lesson, change the graph of Surface Rate of Spread and Flame Length to look like the following graph.



2. Confirm that the Heat Source / Heat Sink = Surface Fire Rate of Spread. Use the following inputs:



Question: Why are the results not equal to the Surface Rate of Spread calculated by BehavePlus?