



Input Methods Lesson

Introduction

There are several ways to enter data on a BehavePlus Worksheet. Values can be typed directly into the input field, a choice can be made from a list of valid inputs values, a range of values can be specified, and for some variables, a selection can be made from a list of common choices. A help file provides a description of each variable, shows which modules use it, and in some cases, provides diagrams to better define the input. The file may contain additional information to help you choose the correct input value. Once you have set it up, a worksheet can be saved as a run for documentation purposes.

Objectives

By the end of this lesson, you will be able to do the following.

1. Identify the various ways to enter inputs on a Worksheet.
2. Save a Worksheet with inputs as a Run.

Where This Lesson Fits In

This is a lesson in the **Introduction Unit**, which teaches you basic program operation. These lessons should be completed in order.

This is the third of four lessons that introduce you to the BehavePlus fire modeling system.

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

Lessons in other units cover the many features and fire modeling capabilities offered by BehavePlus. Those lessons can be done in any order unless otherwise specified in the lesson.

Note: There are questions (in blue) located throughout this lesson. The answers can be found at the end of the lesson starting on page 15.

Types of Variables

There are more than 180 variables in BehavePlus. Chances are you will use only a few of them. Some variables are inputs; some are outputs; and some can be both depending on how you set up the Worksheet. This lesson covers inputs. Input variables are categorized as either continuous or discrete. BehavePlus appropriately handles the input options for each type of variable as described in this lesson.

- **Continuous variables** are assigned numerical values. Any value in the valid range can be used. For example, 1-h Fuel Moisture can have a value of 4, 4.5, or 5%. The only limit for continuous variables is the minimum and maximum accepted value. Live Herbaceous Fuel Moisture, for example, ranges from 30% to 300%. Entering values outside the range triggers an error.
- **Discrete variables** are defined values or codes; no other values are accepted. For example, Fuel Model can be 4, 5, GR2, or 102, but 4.5 is not a valid input. BehavePlus is programmed to handle specific values. You can add discrete values for some variables (e.g., custom fuel models and moisture scenarios). Others cannot be changed. The variable Suppression Tactic in the CONTAIN module has two acceptable values: Head and Rear. You cannot choose to enter a suppression tactic for the flank of the fire.

Ways to Enter Input

Input values can be entered into a Worksheet in several ways. You will practice each of them in this lesson. In the end, choose the method(s) that work best for you.

- **Direct entry:** Type value(s) directly on the Worksheet. For example, you can type the numbers 50 100 150 200 250 on the line for **Live Herbaceous Fuel Moisture**. You can use spaces, commas or any combination of the two when entering values.

Fuel Moisture		
1-h Fuel Moisture	%	<input type="text"/>
10-h Fuel Moisture	%	<input type="text"/>
100-h Fuel Moisture	%	<input type="text"/>
Live Herbaceous Fuel Moisture	%	50 100 150 200 250
Live Woody Fuel Moisture	%	<input type="text"/>

You can also type head in the line for Suppression Tactic.

Note: BehavePlus is not case-sensitive; you can use capital or small letters. Head, head, HEAD, or even hEaD are all acceptable entries for attack at the head of the fire.

Suppression	
Suppression Tactic	<input type="text" value="head"/>

- **Range input:** Define a range of values for continuous variables by entering a starting value, ending value, and step size. For example, Live Herbaceous Fuel Moisture has an acceptable range of 30 – 300%, shown above the entry boxes. You can enter any values in that range, such as **From 50% Thru 250% in Steps of 50**. All of the values are then entered on the Worksheet.

(30 - 300 %)	
From	<input type="text" value="50"/>
Thru	<input type="text" value="250"/>
Step	<input type="text" value="50"/>

Fuel Moisture		
1-h Fuel Moisture	%	<input type="text"/>
10-h Fuel Moisture	%	<input type="text"/>
100-h Fuel Moisture	%	<input type="text"/>
Live Herbaceous Fuel Moisture	%	<input type="text" value="50, 100, 150, 200, 250"/>
Live Woody Fuel Moisture	%	<input type="text"/>

- Choices:** A list of common choices is available for some continuous variables. Look again at Live Herbaceous Fuel Moisture – you can click on any values to select them; they will turn blue on a white background. Click again to deselect them. Selected values appear on the Worksheet.

%	Season & Condition
300	Fresh foliage, annuals developing, early in growing cycle
200	Maturing foliage, still developing, with full turgor
100	Mature foliage, new growth complete and comparable to older perennial foliage
50	Entering dormancy, coloration started, some leaves may have dropped
120	Uncured for Dynamic Fuel Models
98	One-quarter cured for Dynamic Fuel Models
90	One-third cured for Dynamic Fuel Models
75	One-half cured for Dynamic Fuel Models
60	Two-thirds cured for Dynamic Fuel Models

Fuel Moisture		
1-h Fuel Moisture	%	<input type="text"/>
10-h Fuel Moisture	%	<input type="text"/>
100-h Fuel Moisture	%	<input type="text"/>
Live Herbaceous Fuel Moisture	%	<input type="text" value="200, 100, 50"/>
Live Woody Fuel Moisture	%	<input type="text"/>

- Selections:** Selections can be made from a list of all valid input values for discrete variables. This is particularly useful if you cannot remember the value to enter. For example, you can select one or more Fuel Models from a list rather than entering them directly.

Number	Code	Fuel Model Name
8	8	Short needle litter (S)
9	9	Long needle or hardwood litter (S)
10	10	Timber litter and understory (S)
11	11	Light logging slash (S)
12	12	Medium logging slash (S)
13	13	Heavy logging slash (S)
101	gr1	Short, sparse, dry climate grass (D) (101)
102	gr2	Low load, dry climate grass (D) (102)
103	gr3	Low load, very coarse, humid climate grass (D) (103)

Fuel/Vegetation, Surface/Understory	
Fuel Model	<input type="text" value="gr1"/>

- Is Slope Steepness a discrete or continuous variable? Which methods could you use to enter data?*

Entering Data

In the previous lesson, you learned about Worksheets. Remember, when BehavePlus is started, the **BasicStart.bpw** Worksheet opens (unless you define a custom startup Worksheet). Multiple Worksheets can be open during a session. We will modify the **BasicStart.bpw** Worksheet during this lesson.

- Open BehavePlus.
- On the Worksheet, enter the following **Description**: Input Methods Lesson. The Description that you type will appear on every output page associated with this Run.

2. *What outputs are requested on this Worksheet?*

To reduce mistakes when using BehavePlus, it is helpful to develop a method of setting up a Worksheet and entering data. Here is a suggested method developed after teaching a number of BehavePlus courses.

- a. Determine what analysis you want to do.
- b. Select the modules that you will use.
- c. Select the appropriate outputs for each module to answer your questions.
- d. Check the Run Option Notes to ensure the settings are appropriate. Change them if necessary.
- e. What inputs do you need? What inputs do you have? What inputs do you need to figure out?
Change settings in the relevant module to match the inputs.
- f. Enter input values.
- g. Calculate the Run.

The outputs that you choose determine which inputs are needed. Keep the default outputs for now. Then, fill out the rest of the Worksheet using the various input methods as described below.

***Note:** We provide units of measure in lessons to ensure they are correct. However, do not enter units with the values. Units are located before the **Guide** button for each variable. Ensure the units are correct and change them if needed. More information is available in the **Operation Unit Units and Decimals Lesson**.*

Select a variable

Fuel Model is a discrete variable. There are 53 standard fuel models available with the program. You can also develop, save, and use custom fuel models if necessary.

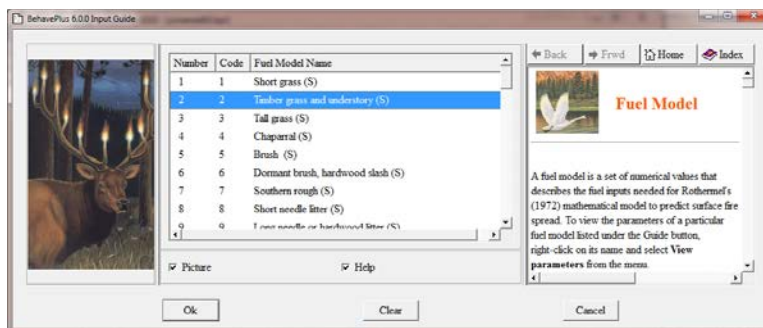
- Click on the **Fuel Model Guide** button () to open the **Input Guide** window.

The center pane of the **Input Guide** window shows all of the Fuel Models currently available for use. The **Number** corresponds to the Fuel Model Number (e.g., 165), while the **Code** Corresponds to the Fuel Model Code (e.g., TU5). You can enter either the Number or Code on the Worksheet.

- Scroll down in the center pane to see the original 13 Fuel Models followed by the 40 Fuel Models developed in 2005.

***Note:** Descriptions of all Fuel Models are available in the help window.*

- Select **Fuel Model 2, Timber grass and understory (S)** from the list.



- Click the **OK** button to return to the Worksheet. The value 2 has been entered for you.

Inputs: SURFACE	
Description	
Fuel/Vegetation, Surface/Understory	
Fuel Model	2

Range of values

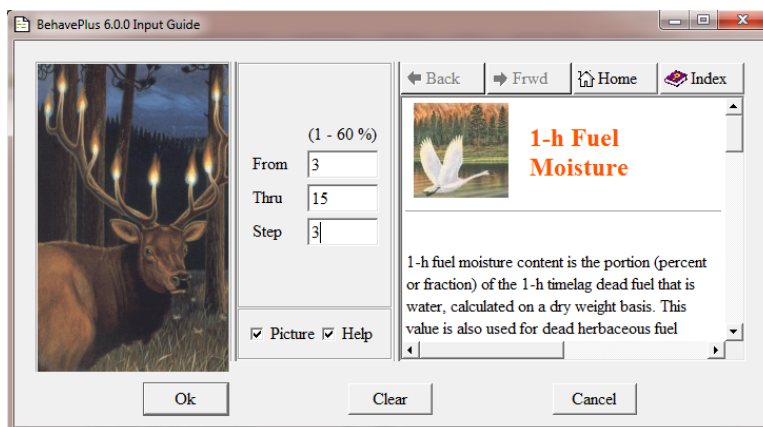
You can enter a range of values for a continuous variable.

- Click on the **1-h Fuel Moisture Guide** button. A description of the variable is located in the help file on the right-hand side of the window.

3. What is the acceptable range of values for 1-h Fuel Moisture?

- Type 3 in the **From** box, 15 in the **Thru** box, and 3 in the **Step** box.

Note: Click on a box to enter data or use the **Tab** or **Enter** key to move to the next box.



The **Step** indicates the increment that will be used for values between the **From** and **Thru** values.

- Click **Ok** to close the **Input Dialog** box. The values appear on the Worksheet.

Fuel Moisture	
1-h Fuel Moisture	% 3, 6, 9, 12, 15
10-h Fuel Moisture	%

4. What happens if you select **From 5 Thru 10 in Steps of 2**?

- If you changed values to answer Question 4, replace them with original values (**3-15%, Step 3**).

Direct entry

Single or multiple values can be typed directly onto the Worksheet. Multiple values can be separated by spaces, commas, or some combination.

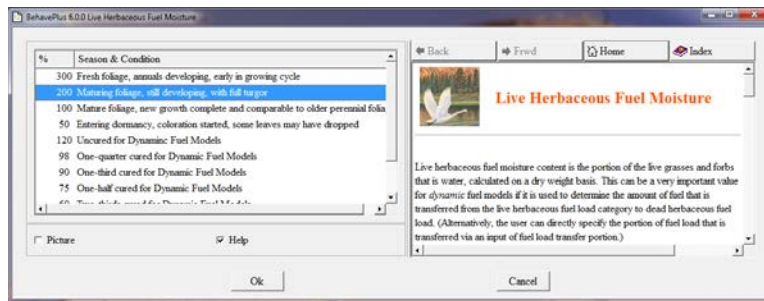
- Type 6, 8, 12 (with or without commas) in the **10-h Fuel Moisture** box.
- Type 9 in the **100-h Fuel Moisture** box.

Choices

As mentioned before, some continuous variables have a **Choices** button at the bottom of the **Input Guide** window. The center pane shows the acceptable range of values. The **Choices** button provides some of the most commonly used values. It may also provide descriptions to help you figure out which one to use.

- Click on the **Live Herbaceous Fuel Moisture Guide** button.
- Click on the **Choices** button.
- If you want, deselect the **Picture** option at the bottom of the box to make more room for the **Choices** list.
- Select the moisture value with the condition **Maturing Foliage, still developing, with full turgor** and click **Ok**.

5. *What moisture value did you select? What value would you select if the fuel were one-third cured?*



The value 200 is now in the input field.

Values are only required for the fuel moisture categories required by selected Fuel Models. In this example, note that the **Live Woody Moisture** text box is shaded blue, indicating a value is not required. There is no live woody fuel load in Fuel Model 2.

Completing the Worksheet

Continue to fill out the rest of the Worksheet. There is only one variable in the **Weather** section of the Worksheet.

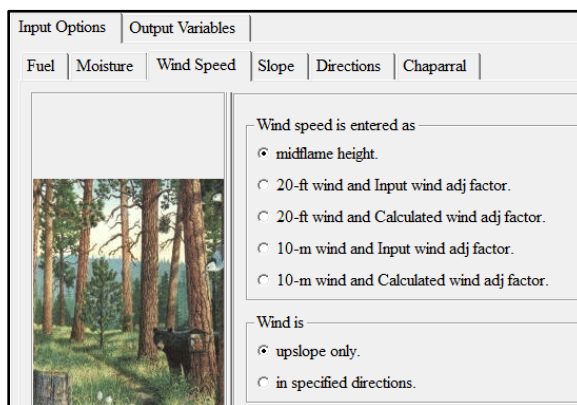
- Enter a **Midflame Wind Speed** of 5.

Getting help to enter values

Use what you learned in the **Introduction Unit Worksheet Lesson** to view the **Directions** options for the SURFACE Module. There are two **Input Options** tabs in the SURFACE module where you can specify directions.

- Click on the **Wind Speed** tab: Wind is either upslope only or in specified directions.

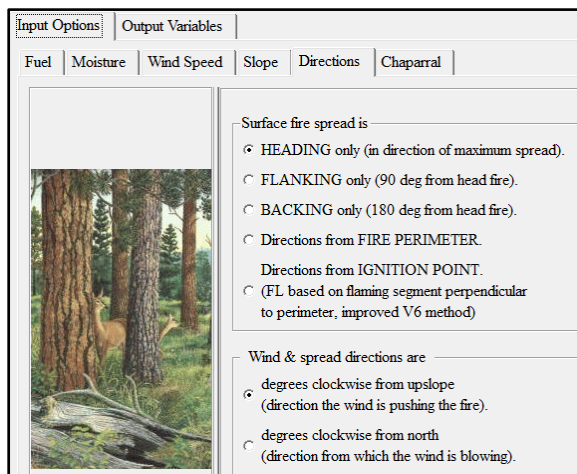
By default, **Wind is upslope only** in this Worksheet.



The screenshot shows the 'Input Options' dialog box for the SURFACE module, with the 'Wind Speed' tab selected. The 'Wind speed is entered as' section has five radio button options: 'midflame height.' (selected), '20-ft wind and Input wind adj factor.', '20-ft wind and Calculated wind adj factor.', '10-m wind and Input wind adj factor.', and '10-m wind and Calculated wind adj factor.'. The 'Wind is' section has two radio button options: 'upslope only.' (selected) and 'in specified directions.'. A landscape image of a forest is visible on the left side of the dialog.

- Click on the **Directions** tab: Wind and spread directions are degrees clockwise from either upslope or north.

By default, **Wind and spread directions are degrees clockwise from upslope** in this Worksheet.



The screenshot shows the 'Input Options' dialog box for the SURFACE module, with the 'Directions' tab selected. The 'Surface fire spread is' section has five radio button options: 'HEADING only (in direction of maximum spread).' (selected), 'FLANKING only (90 deg from head fire).', 'BACKING only (180 deg from head fire).', 'Directions from FIRE PERIMETER.', and 'Directions from IGNITION POINT. (FL based on flaming segment perpendicular to perimeter, improved V6 method)'. The 'Wind & spread directions are' section has two radio button options: 'degrees clockwise from upslope (direction the wind is pushing the fire).' (selected) and 'degrees clockwise from north (direction from which the wind is blowing)'. A landscape image of a forest is visible on the left side of the dialog.

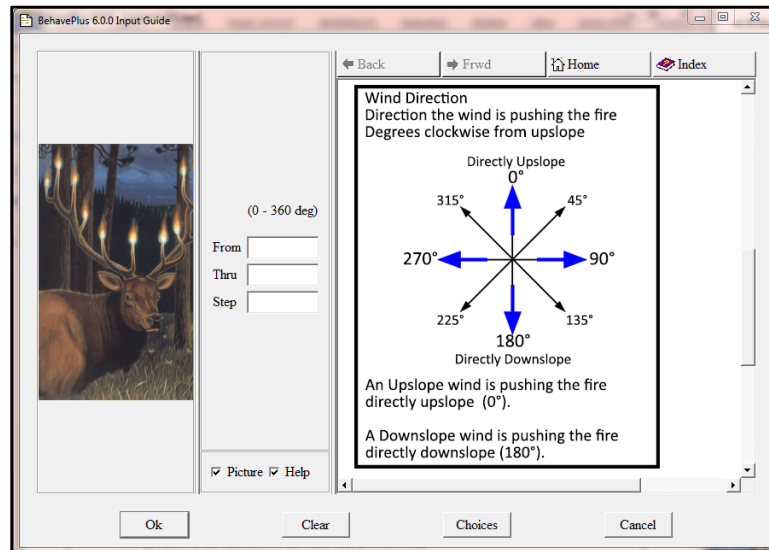
Let's change the wind so that it is in specified directions.

- On the **Wind Speed** tab, change to **Wind is in specified directions**.
- Click **Ok** twice.

6. What new variable is added to the Worksheet?

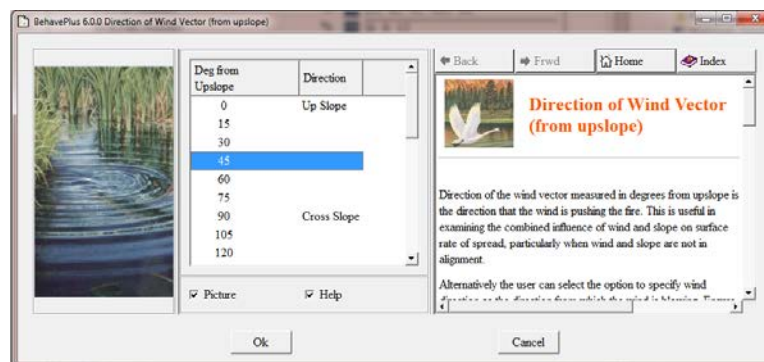
With this addition, you must enter values for the **Direction of Wind Vector**, in this case, from upslope. According to the Help file, this is defined as the direction the wind is pushing the fire.

- Click on the **Guide** button next to **Direction of Wind Vector (from upslope)**.
- Scroll down in the Help file to view the diagram, which looks like the following.



7. *Given this diagram, what would you enter for wind direction if the wind is pushing the fire to the northeast?*

- Click on the **Choices** button.
- Resize the **Help** window so that you can see all of the information in the center pane.
- Resize the **Choices** pane and scroll down to see all of the available choices. Remember, these are commonly used values; they do not necessarily represent all available values.
- Select 45 degrees (from Upslope). It will be shaded in blue.



- Click **Ok**.
- Enter a **Slope Steepness** of 15%.

Your completed Worksheet should look like the following image.

BehavePlus 6.0.0 Page 1

Inputs: SURFACE

Description [Input Methods Lesson]

Fuel/Vegetation, Surface/Understory

Fuel Model [2]

Fuel Moisture

1-h Fuel Moisture [%] [3, 6, 9, 12, 15]

10-h Fuel Moisture [%] [6 8 12]

100-h Fuel Moisture [%] [9]

Live Herbaceous Fuel Moisture [%] [200]

Live Woody Fuel Moisture [%] [150]

Weather

Midflame Wind Speed [mi/h] [5]

Direction of Wind Vector (from upslope) [deg] [45]

Terrain

Slope Steepness [%] [15]

Run Option Notes

Maximum effective wind speed limit IS imposed [SURFACE].

Fire spread is in the HEADING direction only [SURFACE].

Wind is in specified directions [SURFACE].

Wind and spread directions are degrees clockwise from upslope [SURFACE].

Direction of the wind vector is the direction the wind is pushing the fire [SURFACE].

Output Variables

Surface Fire Rate of Spread (ch/h) [SURFACE]

Surface Fire Flame Length (ft) [SURFACE]

Changing Inputs

Fuel Models have different fuel moisture requirements. This depends on the fuel load in each size class found in the Fuel Model.

- Change the **Fuel Model** from **2** to **TU5**.
Note: You can also type in 165, which is the fuel model number associated with TU5. Remember, BehavePlus is not case-sensitive, so you can also enter tu5.

8. What changes were made to the Worksheet?

- Enter a **Live Woody Fuel Moisture** of 150%.

The value entered for Live Herbaceous Fuel Moisture is shown on the Worksheet, but it will not be used when calculating fire behavior for a Fuel Model TU5. There is no Live Herbaceous Fuel Load in this Fuel Model.

- Click on the **Fuel Model Guide** button.
- Select both **Fuel Model: 2** and **TU5**.
- Click the **Ok** button to close the **Input Guide** dialog box.

The Worksheet now indicates that both Fuel Models will be used when calculating fire behavior. All of the fuel moisture categories are needed since they are needed for at least one Fuel Model.

With these changes, the Worksheet should look like the following.

BehavePlus 6.0.0 Page 1

Inputs: SURFACE

Description ➡ Input Methods Lesson

Fuel/Vegetation, Surface/Understory

Fuel Model ➡ 2, tu5

Fuel Moisture

1-h Fuel Moisture % ➡ 3, 6, 9, 12, 15

10-h Fuel Moisture % ➡ 6 8 12

100-h Fuel Moisture % ➡ 9

Live Herbaceous Fuel Moisture % ➡ 200

Live Woody Fuel Moisture % ➡ 150

Weather

Midflame Wind Speed mi/h ➡ 5

Direction of Wind Vector (from upslope) deg ➡ 45

Terrain

Slope Steepness % ➡ 15

Run Option Notes

Maximum effective wind speed limit IS imposed [SURFACE].
 Fire spread is in the HEADING direction only [SURFACE].
 Wind is in specified directions [SURFACE].
 Wind and spread directions are degrees clockwise from upslope [SURFACE].
 Direction of the wind vector is the direction the wind is pushing the fire [SURFACE].

Output Variables

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

- **Calculate** the Run.

9. *What happened to the Run? How might you fix it?*

At most, only two variables can be assigned a range of values. In this case, you must change one of the three variables to a single value.

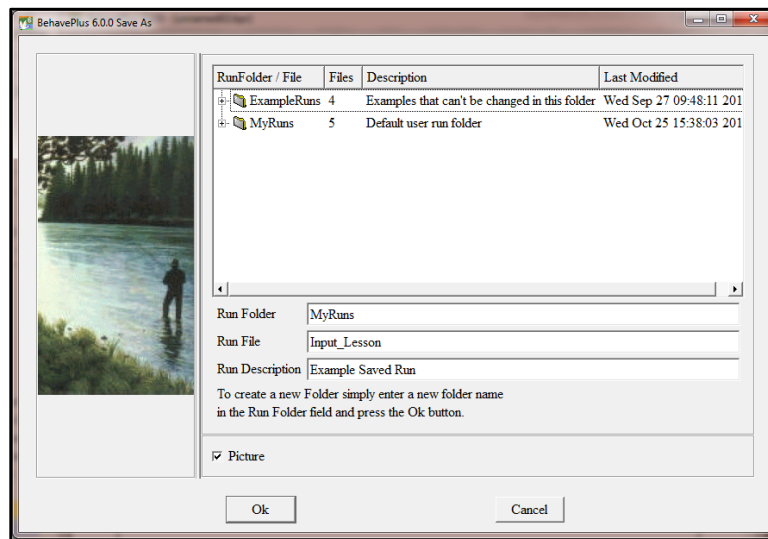
- Click on **Ok** to close the **Error** window.
- Change the **Fuel Model** entry to 2.
- **Calculate** the Run, clicking **Ok** in the **Calculate Results** window.

BehavePlus generates results, which we will examine in more detail in the next lesson on calculations.

Saving a Run

A Run can be saved for documentation, sharing with other BehavePlus users, and future reference. In the *Worksheets Lesson*, you saved a Worksheet for later use. A Worksheet is a blank form. When values are entered, it is called a Run. If you have entered values and select **Save as a Worksheet**, the values are not saved. However, if you choose **Save as a Run**, the values are saved. The calculations are not. When you want to view results of a saved run, simply open the Run and press **Calculate**. Results are not saved to reduce file size, which was important when BehavePlus was first developed.

- Choose **File > Save as a run**. The **Save As** window opens.



By default, the **Run Folder** contains two folders: **ExampleRuns** and **MyRuns**. **MyRuns** is the default option to save a Run. You can create additional folders as needed to organize your files. More information is in the **Operation Unit File Management Lesson**.

- Type the file name `Input_Lesson` in the **Run File** field (no spaces are allowed in file names).

The **Run Description** field is pre-populated with the information from the **Description** line of the Worksheet. You can change it if you like.

- Change the **Run Description** to **Example Saved Run**.
- Click **Ok**.

An **FYI** window is displayed. This window lets you know exactly where the file is saved on your computer and if there are any issues with saving this Run.

- Click **Ok** to finish saving the Run.

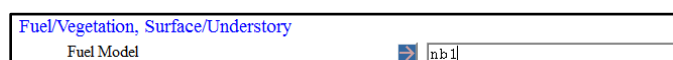
Notice that the **Description** on the Worksheet has changed. It now matches what you typed in the **Run Description** when saving it.

Error Checking

The error demonstrated earlier in this lesson (ranges of values for three variables) appeared only when the **Calculate** button was pushed because each of the individual lines contained valid input.

Try entering an invalid value.

- Return to the Worksheet by clicking on the **First Page** button (.
- Enter a Fuel Model of `nb1`.

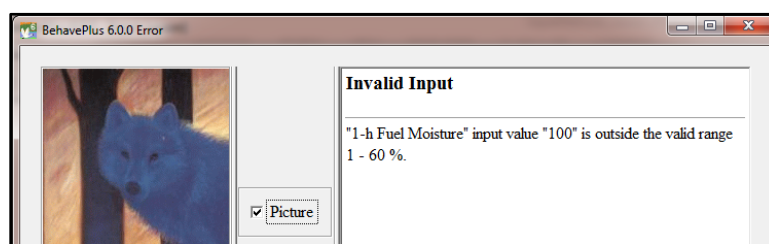


An **Error** window appears as soon as you press **Enter** or tab to a different variable. You must fix it before you proceed any further.



- Click **Ok**.
- Enter **Fuel Model 2**.
- Change **1-h Fuel Moisture** to **100%**.

An error statement lets you know that the value is outside the accepted range.



- Click **Ok** and delete the value.
- Enter **1-h Fuel Moisture From 3 Thru 15, Step 3**.
- Change **Slope Steepness** to **250%** and tab out of the box.

There is no error. Is this surprising?

- Click on the **Slope Steepness Guide** button.

10. What is the valid range for Slope Steepness?

- For more information, click on **Choices**.

11. A Slope Steepness of 250% is equivalent to what degree slope?

Range Input Options

There are a number of ways you can use the Range Input Options to quickly enter values.

Single value

It is easy to type a single value into an input field. But, you may want to verify that it is a valid input. In this case, you can type the value into the **From** box and click **Ok**.

- Click on the **Live Herbaceous Moisture Guide** button.
- Type 90 in the **From** box, leaving the other two boxes blank.
- Click **Ok**.

The number 90 appears on the Worksheet.

12. What is the valid range for Live Woody Moisture?

Two values

Similarly, you can use the Range Input Option to enter two values, such as the lowest and highest values needed to graph the predicted fire behavior. Enter them in the **From** and **Thru** fields, leaving the **Step** field blank. The two values appear on the Worksheet. The table of results will contain these two values. The graph of the results will be based on calculations of 100 points within the range of values.

High to Low

Often, we enter a range of values from low to high using a positive **Step** size. For example, we enter **1-h Fuel Moisture** as 5, 6, 7, 8, 9, 10%. However, you can also define values from high to low using a negative **Step** size.

- Open a new **BasicStart.bpw** Worksheet.
- Enter the following values
 - **Description:** Range Input Options Test
 - **Fuel Model:** 2
 - **1-h Fuel Moisture:** 5-10% in steps of 1
 - **10-h Fuel Moisture:** 10%
 - **100-h Fuel Moisture:** 12%
 - **Live Herbaceous Fuel Moisture:** 200%
 - **Midflame Wind Speed:** 2-10 mi/h in steps of 2.
 - **Slope Steepness:** 15%
- **Calculate** the Run.

13. What is the range of Surface Fire Flame Lengths in this Run?

- Next, click on the **1-h Fuel Moisture Guide** button
- Enter the following values in the **Input Guide** window.
 - **From:** 10
 - **Thru:** 5
 - **Step:** -1
 - Click **Ok**.

(1 - 60 %)	
From	10
Thru	5
Step	-1

- **Calculate** the Run.

We know that fire behavior increases as the wind speed increases and as the fuel moisture decreases. Setting up the Run in this way creates tables that have the lowest fire behavior (low wind speed, high fuel moisture) is in the upper left-hand corner of the table, while the greatest fire behavior (high wind speed, low fuel moisture) is in the lower right-hand corner of the table.

Range Input Options Test
Head Fire
Surface Fire Flame Length (ft)

1-h Fuel Moisture	Midflame Wind Speed (upslope) mi/h				
%	2	4	6	8	10
10	2.6	4.0	5.5	6.9	8.3
9	2.7	4.2	5.8	7.2	8.7
8	2.8	4.4	6.0	7.5	9.0
7	2.9	4.5	6.1	7.7	9.2
6	3.0	4.6	6.3	7.9	9.5
5	3.1	4.8	6.5	8.2	9.8

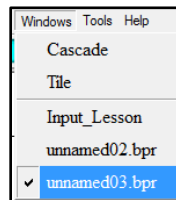
In this way, you can more easily determine the range of possible fire behavior. The Surface Fire Flame Length varies from 2.6 to 9.8 ft – or roughly 2 to 10 ft.

Saved Input

Like most computer programs, changes that you make to a Worksheet (options, values, descriptions) stay with that Worksheet. Setup options are saved when you save a Worksheet. Input values are only saved when you save the Run. However, values do not disappear when you change options within an open Worksheet. Earlier, we changed the Fuel Model. The Live Herbaceous Fuel Moisture did not disappear.

- Open a new **BasicStart.bpw** Worksheet.

If you didn't close any of them, you should now have three Worksheets open in BehavePlus. You can toggle between Worksheets by clicking on the **Windows** button.



The Worksheet that we saved as a Run has a name (**Input_Lesson**). The other Worksheets have not yet been saved, so they are unnamed. The **.bpr** at the end indicates that it would be saved as a BehavePlus Run. A Worksheet ends in **.bpw**. The file name for the Worksheet we saved is actually **Input_Lesson.bpr**.

- Go to **unnamed03.bpr**.
- Enter the following fuel moisture values.

Fuel Moisture				
1-h Fuel Moisture	%	➤	<input type="text" value="3"/>	
10-h Fuel Moisture	%	➤	<input type="text" value="4"/>	
100-h Fuel Moisture	%	➤	<input type="text" value="5"/>	
Live Herbaceous Fuel Moisture	%	➤	<input type="text" value="100"/>	
Live Woody Fuel Moisture	%	➤	<input type="text" value="150"/>	

- Change the fuel moisture option to dead and live by going to **SURFACE Options... > Input Options > Moisture** and selecting **Moisture is entered by dead and live category**.
- Enter the following fuel moisture values.

Fuel Moisture		
Dead Fuel Moisture	%	6
Live Fuel Moisture	%	125

- Change the fuel moisture option back to **Moisture is entered by individual size class**.

The values you entered earlier are still there. If you saved this as a Run, it would store all of the moisture values, not only the ones showing on the screen.

Summary

BehavePlus sets up the Worksheet to request only required inputs based on your selections, as covered in the **Introduction Unit Worksheets Lesson**. There are several ways to enter input values including direct entry, selecting a discrete value from a list of possible options, or making a choice from a selection of commonly used continuous variables. The program will notify you of any entries that do not meet its requirements. Help files provide information about each variable including a definition, which modules use the variable, and often tips to determine a realistic value for the current situation. You also learned how to save a Run, which will save all of the input values that you have entered.

There is an exercise associated with this lesson (page 17), after the answers to the questions in the lesson.

You have now completed three lessons in the **Introduction Unit**.

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**

Continue to the final Introduction lesson to gain a basic understanding of program operation.

4. Calculations – table and graph output options

Answers to Questions in the Lesson

1. *Is Slope Steepness a discrete or continuous variables? Which methods could you use to enter data?*
Slope Steepness is a continuous variable that ranges from 0 to 600%. You could directly type in a value, enter a range of values, or select a value from the **Choices** menu.
2. *What outputs are requested on this Worksheet?*
Surface Fire Rate of Spread and Surface Fire Flame Length are the outputs on the **BasicStart.bpw** Worksheet.
3. *What is the acceptable range of values for 1-h Fuel Moisture?*
The acceptable range for 1-h Fuel Moisture is 1- 60%.

(1 - 60 %)	
From	<input type="text"/>

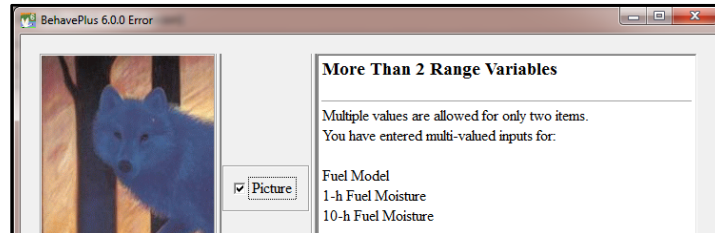
4. *What happens if you select **From 5 Thru 10** in **Steps** of 2?*
Input values for 1-h Fuel Moisture are 5, 7, and 9%, which are all of the values that meet the criteria.

5. *What moisture value did you select? What value would you select if the fuel were one-third cured?*
The Live Herbaceous Fuel Moisture is 200%. If the fuel is one-third cured, the Live Herbaceous Fuel Moisture is estimated to be 90%. These numbers are estimates based on past research. If you have measured values or better information from the field, you should use those numbers instead.
6. *What new variable is added to the Worksheet?*
The variable **Wind Direction (from upslope)** is added to the Worksheet.
7. *Given this diagram, what would you enter for wind direction if the wind is pushing the fire to the northeast?*
You would enter a value of 45°.
8. *What changes were made to the Worksheet?*
The live fuel moisture changes because of changes in fuel load. Fuel Model 2 requires Live Herbaceous Fuel Moisture, while Fuel Model Tu5 requires Live Woody Fuel Moisture.

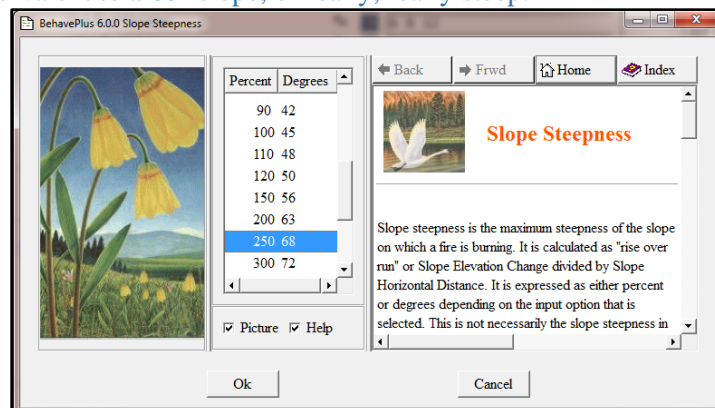
Fuel/Vegetation, Surface/Understory	
Fuel Model	2
Fuel Moisture	
1-h Fuel Moisture	% 3, 6, 9, 12, 15
10-h Fuel Moisture	% 6 8 12
100-h Fuel Moisture	% 9
Live Herbaceous Fuel Moisture	% 200
Live Woody Fuel Moisture	% 150

Fuel/Vegetation, Surface/Understory	
Fuel Model	Tu5
Fuel Moisture	
1-h Fuel Moisture	% 3, 6, 9, 12, 15
10-h Fuel Moisture	% 6 8 12
100-h Fuel Moisture	% 9
Live Herbaceous Fuel Moisture	% 200
Live Woody Fuel Moisture	% 150

9. *What happened to the Run? How might you fix it?*
There is a range of values for three variables. BehavePlus only allows you to use a range for two variables. You need to change one of these inputs to a single value to calculate the Run.



10. *What is the valid range for Slope Steepness?*
The valid range for Slope Steepness is 0-604%, which is equivalent to 0-81° (flat to nearly vertical).
11. *A Slope Steepness of 250% is equivalent to what degree slope?*
A 250% slope is equivalent to a 68° slope, or really, really steep.



12. *What is the valid range for Live Woody Moisture?*

The valid range for Live Woody Moisture is 30-300%. However, Live Woody Moisture rarely falls below 60%, which is generally considered dormant for fire modeling purposes.

(30 - 300 %)	
From	<input type="text"/>

13. *What is the range of Surface Fire Flame Lengths in this Run?*

The Surface Fire Flame Length varies from 2.6 to 9.8 ft – or roughly 2.5 to 10 ft.

Exercises

Develop a new Worksheet that looks like the following one and answer the questions below.

BehavePlus 6.0.0 Page 1

Inputs: SCORCH, MORTALITY

Description

Fuel/Vegetation, Overstory

Canopy Height ft

Crown Ratio fraction

Mortality Tree Species

D.B.H. in

Weather

Midflame Wind Speed (upslope) mi/h

Air Temperature oF

Fire

Surface Fire Flame Length ft

Run Option Notes

None

Output Variables

Scorch Height (ft) [SCORCH]

Probability of Mortality (%) [MORTALITY]

- Practice entering valid values, illegal values, and ranges.
- Look at the **Help** files associated with the variables.

Answer the following questions.

1. What is the valid input range for Canopy Height?
2. Which other modules use the Canopy Height variable?
3. Is there a diagram that helps you visualize Crown Ratio?
4. How many Mortality Tree Species are available to choose from?
5. What is Mortality Tree Species used for?
6. Which module uses Air Temperature – SCORCH or MORTALITY?
7. How can you calculate Surface Fire Flame Length rather than entering it as an input?

Answers to these exercises can be found in the accompanying PDF file.