



## Worksheets Lesson

### Introduction

The Worksheet, the form used to create a fire behavior analysis, is a core part of the BehavePlus fire modeling system design. A BehavePlus Worksheet includes a wealth of information, including the modules that have been selected, output values that are being calculated, input values required for calculation, notes on selected Run options, and space for user documentation of the Run. The measurement units of each value are provided as well.

The program will only request input values for the modules and outputs that you have selected. In addition, BehavePlus allows you to design a Worksheet to meet specific needs. A Worksheet can be developed on the fly, or it can be saved for repeated use.

### Objectives

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

1. Explore the various options for changing a Worksheet.
2. Save a Worksheet.
3. Open a saved Worksheet.
4. Develop a new Worksheet.

### 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 second 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 12.

## Worksheet Development

A Worksheet contains fields for entering input values. It is created based on selections that you make in the program. Only required inputs are requested. Selections that affect the Worksheet are described briefly below. You will examine each one in more detail later in this lesson.

- **Module Selection:** More than 40 different models are included in the BehavePlus fire modeling system. You will very likely only need to use a few of them. The models are grouped by module to assist you in finding the model(s) you plan to use. For example, the SURFACE module is used to calculate surface fire spread and intensity, while the SPOT module calculates spotting distance for several different types of fire.
- **Output Variable Selection:** A number of output variables are available for each module. For example, the SIZE module can be used to calculate point source fire area, perimeter, length-to-width ratio, maximum fire width, etc. The IGNITE module, on the other hand, is used to calculate only probability of ignition.
- **Input Option Selection:** Some of the modules allow you to specify the inputs. For example, the SURFACE module offers the option of entering wind speed as either midflame wind speed or 20-ft wind speed and a wind adjustment factor. The CROWN module allows you to select between the Rothermel (1991) and the Scott and Reinhardt (2005) crown fire models.
- **Worksheet Appearance:** If desired, you can alter many aspects of the Worksheet's appearance. For example, extra lines can be added to the Description, and you can change the border's appearance.

## Worksheets

When you open BehavePlus, the **BasicStart.bpw** Worksheet loads automatically. All BehavePlus Worksheets have a **.bpw** extension. You have the option of defining your own startup Worksheet, which is covered in the **Operation Unit Advanced Worksheets Lesson**.

Let's examine the options found in the **BasicStart.bpw** Worksheet (shown below). As we examine the components of the Worksheet, you can either view the Worksheet in BehavePlus or print out a copy, which can be found in the document entitled **Worksheets\_Handout.pdf**. In the following discussion, **Refer to the Handout** refers to this document.

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**Inputs: SURFACE**

Description [ ]

**Fuel/Vegetation, Surface/Understory**

Fuel Model [ ]

**Fuel Moisture**

1-h Fuel Moisture % [ ]

10-h Fuel Moisture % [ ]

100-h Fuel Moisture % [ ]

Live Herbaceous Fuel Moisture % [ ]

Live Woody Fuel Moisture % [ ]

**Weather**

Midflame Wind Speed (upslope) mi/h [ ]

**Terrain**

Slope Steepness % [ ]

**Run Option Notes**

Maximum effective wind speed limit is imposed [SURFACE].

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

Wind is blowing upslope [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 (#) [SURFACE]

**Notes**


[ ]

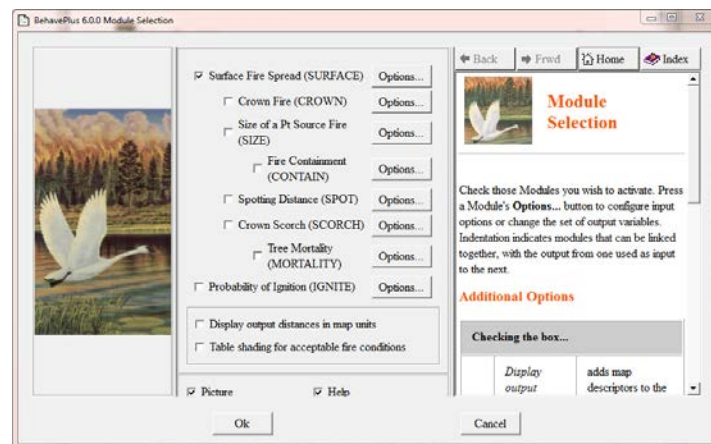
There are four general sections in a Worksheet: **Inputs**, **Run Option Notes**, and **Output Variables**, and **Notes**. Inputs and outputs are selected in the **Module Selection** window. The **Run Option Notes** tell you the assumptions and limitations associated with the current analysis.

*1. What are the four main categories of inputs (shown in blue) on this Worksheet?*

### Module selection

Once you have decided what analysis is needed, select the appropriate modules.

- Click on the **Module selection** () button, or go to **Configure > Module selection**.



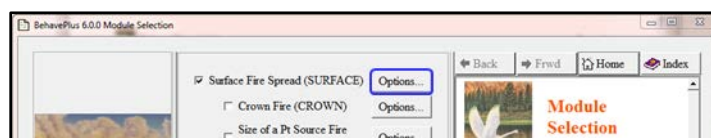
For the **BasicStart.bpw** Worksheet, only the SURFACE module is selected.

- **Refer to the Handout** as we examine this selection.
  - The word SURFACE appears on the first line of the Worksheet beside the word **Inputs**. Therefore, the calculations in this Worksheet relate only to surface fire behavior. All modules selected on a given Worksheet will be shown in this line.
  - The module associated with every **Run Option Note** and **Output Variable** is, therefore, SURFACE.

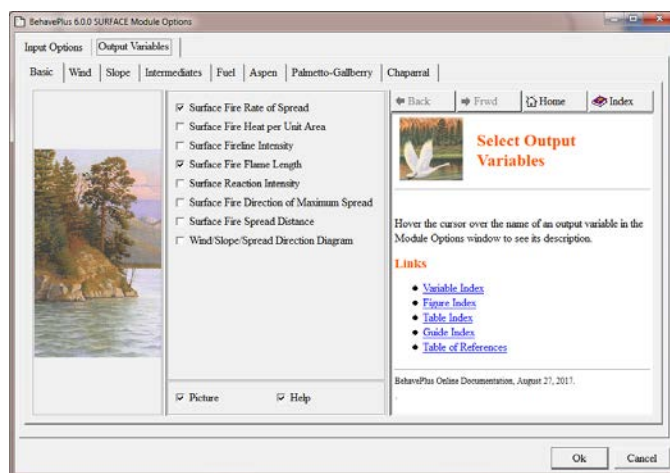
### Module options

The SURFACE module is by far the most complex module in BehavePlus. Inputs and outputs are divided into two tabs: **Input Options** and **Output Variables**.

- Click on the **Options...** button associated with the SURFACE module.



The **Module Options** window opens.



The program defaults to the **Output Variables > Basic** tab. These outputs are the most commonly used in the SURFACE module. Since outputs determine which inputs are needed, select the desired outputs first.

- In the center pane, move the cursor over the variable **Surface Fire Flame Length**. A description of the variable appears in the right-hand **Help** pane. Scroll through the help file to see the complete description.
- 2. *When is Surface Fire Flame Length an input to the SCORCH module?*
- 3. *At what flame length is hand line unreliable for holding a fire?*

The SURFACE module offers a number of output variables.

- Click on each of the tabs to the right of the **Basic** tab to see the additional outputs.
- 4. *Which tab is most useful for exploring variables from Rothermel's (1972) fire spread model?*

### Input option selection

Input options for a Worksheet are on the **Input Options** tab. Let's briefly explore each tab to see what options are available. Answers to the questions can be found in the **Input Options** window, the Help system or on the **BasicStart.bpw** Worksheet.



- Click on the **Fuel** tab.
- 5. *What are the special case fuel models? Next, refer to the Handout. Which fuel model option is selected on the BasicStart.bpw Worksheet?*
- Click on the **Moisture** tab.
- Uncheck the **Picture** option at the bottom of the window to close the left-hand picture window, allowing more space for the **Help** window. Clicking this option only affects the current tab.
- Scroll down in the **Help** window for an explanation of options.

6. *What is a moisture scenario? Next, refer to the Handout. Which fuel moisture option is selected on the **BasicStart.bpw** Worksheet?*

➤ Click on the **Wind Speed** tab.

7. *What options are available as ways to enter wind speed? Next, refer to the Handout. Which wind speed option is selected on the **BasicStart.bpw** Worksheet?*

On the **Wind Speed** tab, there is an option to specify wind direction on the Worksheet (**Wind is in specified directions**). Use this option whenever wind and slope are not aligned to allow the program to properly calculate the combined effects of wind and slope on fire behavior.

➤ Click on the **Slope** tab.

8. *What inputs are needed if slope is calculated from map measurements? Next, refer to the Handout. Is slope entered directly or calculated from map measurements on the **BasicStart.bpw** Worksheet?*

➤ Click on the **Directions** tab.

There are five options for calculating surface fire spread. For more information about these options, refer to the lesson titled *Surface Fire Spread Directions: Options and Definitions* in the **Modeling Unit**.

9. *In what two ways can you define wind and spread directions? Next, refer to the Handout. Which option is selected on the **BasicStart.bpw** Worksheet?*

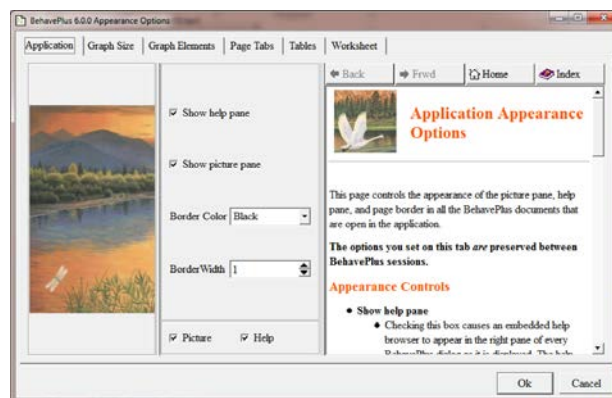
➤ Finally, click on the **Chaparral** tab, which is only used if the chaparral special case fuel model is selected. This tab allows you to specify or calculate the total fuel load.

➤ Click **Ok** or **Cancel** twice to close the **Module Options** window and then the **Module Selection** window.

## Worksheet Appearance

In addition to selecting the fire behavior analyses that you want to create, you can also change the Worksheet appearance if desired.

➤ Select **Configure > Appearance preferences** from the main menu.



The **Application** tab opens by default. On this tab, you can change the border color and width. You can also choose to hide both the Help pane and picture pane by unchecking the boxes next to each option. These options only apply to the current Worksheet. However, we *strongly* suggest that you leave the Help pane open.

Two other tabs affect Worksheet appearance: **Page Tabs** and **Worksheet**. **Page Tabs** allow you to enter additional information on the right-hand edge of the Worksheet, which you can use to enter additional information about a Run if desired.

- Click on the **Worksheet** tab.

The **BasicStart.bpw** Worksheet only contains a **Description** line. You can add additional description information if desired for prescribed fire, fire behavior projections, or training.


#### 10. Which additional input fields appear when the **Training worksheet header** is selected?

Additional **Worksheet** tab options include:

- **Show descriptions for all discrete variable codes:** If this option is selected, *all* available discrete variable selections will be printed, including all 53 fuel models. This option is seldom selected.
  - **Show descriptions only for entered discrete variable codes:** More typically, you want to *only* show descriptions for the discrete variables that are used in a Run. These appear on the very last page of the Run. They are helpful if you are sharing the results with someone who is less familiar with modeling fire behavior.
  - **Show output variables to be calculated:** This option is typically selected as it shows the currently selected output variables on the Worksheet before you create a Run.
  - **Show notes section:** The **Notes** section appears at the bottom of the Worksheet. It is helpful to provide additional documentation that will not show up on the output pages, but that will be saved with a Run.
- Close the **Appearance Options** window.

## Module Selection

There are eight different modules that can be selected, each with a different purpose. Let's examine another one.

- Click on the **Module selection** () button, or go to **Configure > Module selection**.
- Uncheck the box next to SURFACE, and check the box next to SIZE.



- Click **Ok**.



Your Worksheet should look like the following.

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**Inputs: SIZE**  
 Description [ ]

**Weather**  
 Effective Wind Speed mi/h [ ]

**Fire**  
 Surface Fire Rate of Spread (maximum) ch/h [ ]  
 Elapsed Time h [ ]

**Run Option Notes**  
 None

**Output Variables**  
 Surface Fire Area (ac) [SIZE]  
 Surface Fire Perimeter (ch) [SIZE]

- Return to the **Module Selection** window and check the box next to SURFACE as well.
- Click **Ok**.

The Worksheet now looks like the following.

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**Inputs: SURFACE, SIZE**  
 Description [ ]

**Fuel/Vegetation, Surface/Understory**  
 Fuel Model [ ]

**Fuel Moisture**  
 1-h Fuel Moisture % [ ]  
 10-h Fuel Moisture % [ ]  
 100-h Fuel Moisture % [ ]  
 Live Herbaceous Fuel Moisture % [ ]  
 Live Woody Fuel Moisture % [ ]

**Weather**  
 Midflame Wind Speed (upslope) mi/h [ ]

**Terrain**  
 Slope Steepness % [ ]

**Fire**  
 Elapsed Time h [ ]

**Run Option Notes**  
 Maximum effective wind speed limit IS imposed [SURFACE].  
 Fire spread is in the HEADING direction only [SURFACE].  
 Wind is blowing upslope [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]  
 Surface Fire Area (ac) [SIZE]  
 Surface Fire Perimeter (ch) [SIZE]

Notice that module names are listed at the top of the Worksheet and are associated with each output variable. This lets you know which module produces the output variable.

There is a blue **Guide** button (🔍) next to each input variable. This opens an **Input Guide** window containing information related to the variable. The right-hand pane includes a help file similar to those that we examined earlier for output variables. We will examine the center pane in the next lesson.

- Click on the **Guide** button associated with **Midflame Wind Speed**.
- Scroll to the bottom of the Help window. There are a number of related variables listed.
- Click on **Effective Wind Speed**.

### 11. How are Effective Wind Speed and Midflame Wind Speed related to each other?

## Modify the Worksheet

So far, we have done little to modify a Worksheet. Let's start doing that now.

- In the **Module Selection** window, uncheck SIZE, leaving SURFACE checked.
- Click on the **SURFACE Options...** button.
- Uncheck the boxes next to **Surface Fire Rate of Spread** and **Surface Fire Flame Length**.
- Select **Surface Reaction Intensity**. *There should be only one output selected.*

### 12. What is Surface Reaction Intensity?

- Click **Ok** twice to return to the Worksheet.

The Worksheet has changed since only the inputs required to calculate the selected outputs are included.

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**Inputs: SURFACE**

Description [🔍]

**Fuel/Vegetation, Surface/Understory**

Fuel Model [🔍] [ ]

**Fuel Moisture**

1-h Fuel Moisture	%	[🔍]	[ ]
10-h Fuel Moisture	%	[🔍]	[ ]
100-h Fuel Moisture	%	[🔍]	[ ]
Live Herbaceous Fuel Moisture	%	[🔍]	[ ]
Live Woody Fuel Moisture	%	[🔍]	[ ]

**Run Option Notes**

Maximum effective wind speed limit IS imposed [SURFACE].

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

Wind is blowing upslope [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 Reaction Intensity (Btu#2/min) [SURFACE]

### 13. Refer to the Handout. What inputs are required for Surface Fire Rate of Spread and Surface Fire Flame Length that are NOT required for Reaction Intensity?

Let's make a few more changes to the Worksheet.

- In **Module Selection > SURFACE Options... > Output Variables**, change the selected outputs back to **Surface Fire Rate of Spread** and **Surface Fire Flame Length**.
- Go to **Input Options > Moisture**.



- Change the selection to **Moisture is entered by dead and live categories.**

Moisture is entered by

- ☐ individual size class.
- ☒ dead and live categories.
- ☐ dead, live herb, and live woody categories.
- ☐ moisture scenario.

- Click on the **Wind Speed** tab and
- Change the selection to **Wind speed is entered as 20-ft wind and Calculated wind adj factor.**

Wind speed is entered as

- ☐ midflame height.
- ☐ 20-ft wind and Input wind adj factor.
- ☒ 20-ft wind and Calculated wind adj factor.
- ☐ 10-m wind and Input wind adj factor.
- ☐ 10-m wind and Calculated wind adj factor.

The **Inputs** portion of the Worksheet has changed.

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**Inputs: SURFACE**

Description [dropdown]

**Fuel/Vegetation, Surface/Understory**

Fuel Model [dropdown]

**Fuel/Vegetation, Overstory**

Canopy Cover % [dropdown]

Canopy Height ft [dropdown]

Crown Ratio fraction [dropdown]

**Fuel Moisture**

Dead Fuel Moisture % [dropdown]

Live Fuel Moisture % [dropdown]

**Weather**

20-ft Wind Speed (upslope) mi/h [dropdown]

**Terrain**

Slope Steepness % [dropdown]

#### 14. What new category is added to the Worksheet?

### Saving a Worksheet

If you find that you are repeatedly making the same changes to a Worksheet, you should consider saving a customized Worksheet for future use.

- Click on **File > Save as a worksheet.**
- The **Save As** dialog box opens. By default, the Worksheet files are filed in the **MyWorksheets** folder.

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Worksheet Folder / File	Files	Description	Last Modified
ExampleWorksheets	6	Examples that can't be changed in this folder	Wed Sep 27 10:48:11 201
MyWorksheets	2	Default user worksheet folder	Wed Sep 27 10:48:10 201
NewExampleWorksheets	6	Examples that can't be changed in this folder	Tue Feb 21 17:41:06 2017

Worksheet Folder: MyWorksheets

Worksheet File: [text box]

Worksheet Description: [text box]

To create a new Folder simply enter a new folder name in the Worksheet Folder field and press the Ok button.

☒ Picture

Ok Cancel

It is easy to create a folder for your Worksheets by simply typing in a new name for the **Worksheet Folder** if desired. More information is available in the *File Management Lesson* in the **Operation Unit**.

- In the **Worksheet Folder** field, the **MyWorksheets** folder will be selected. You can change it at any time. For now, we will accept the default folder.
  - *Note: You cannot save any files to the ExampleWorksheets folder.*
  - Double-click on another folder to use it; its name will replace the one in the **Worksheet Folder** field.
  - Create a new folder by simply typing in a new name and following the prompts after you click **Ok**. (Don't click it yet!)
- In the **Worksheet File** field, type WorksheetLesson.
  - *Note: There can be no spaces in the Worksheet file name.*
- In the **Worksheet Description** field, type Example saved worksheet.
  - *Note: This description is also added to the Worksheet. Delete or type over it to replace it.*
- Click **Ok** to save the Worksheet.

An **FYI** dialog box is displayed. Any problems or questions related to saving your file are displayed here. The **.bpw** extension, indicating a BehavePlus Worksheet, is added automatically to the file name.

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

## Opening a Worksheet

Once you have saved a Worksheet, you will want to open it again later. The **BasicStart.bpw** Worksheet opens whenever you open BehavePlus. You can open another Worksheet at any time, and you can open as many Worksheets at a time as you would like.

- Close the current Worksheet by going to **File > Close**, or clicking the black “X” in the upper right-hand corner of the Worksheet.
- Open a new Worksheet by going to **File > Open worksheet**.
- Navigate to the Worksheet you want to open. In this case, find your **WorksheetLesson.bpw** file.
- Click **Ok** to open the Worksheet.

Sample Worksheets are stored in the **ExampleWorksheets** folder. They can be opened and used but cannot be resaved to that folder. Explore the **ExampleWorksheets** on your own. Let's review one of them now.

## Defaults and the 0Default.bpw Worksheet

Sometimes you may want to return to the default settings in BehavePlus, particularly if you have made a number of changes. Since there is no Undo or Clear All button in the program, you have to either make changes to the current Worksheet or close the Worksheet and start over. Sometimes, it is just easier to start over.

- Open the **0Default.bpw** Worksheet, located in the **ExampleWorksheets** folder.

It appears that this is a simple, blank Worksheet, but there is a lot of information attached to it. This Worksheet contains default settings, allowing a common starting point for creating new Worksheets. The fact that so much information is part of the Worksheet is a key part of the BehavePlus design. As you have seen in this lesson, a Worksheet is much more than what is shown on the computer screen.

15. *What is the difference between the **0Default.bpw** and the **BasicStart.bpw** Worksheet? (Hint: Look at the top of the Inputs; making one change to the configuration will create a **BasicStart.bpw** Worksheet from the **0Default.bpw** Worksheet).*

## Summary

In this lesson you have seen some of the many, sometimes overwhelming, options that are available in BehavePlus. The goal of this lesson is to help you understand the Worksheets in BehavePlus. The best advice we can give to new users is to take your time. Make one change at a time and see what happens. Start by selecting the modules that you want to use. Then, select outputs in each of those modules. Then, and only then, should you determine which inputs are available to use. Finally, check the Run Option Notes to make sure the assumptions and limitations are correct for your analysis. And, create different fire behavior analyses, maybe for fires you have worked in the past. The more you use the program, the more comfortable you will become.

Of course, there is a lot more to using this program than pushing buttons. You should have both an understanding of fire modeling concepts and fire experience to effectively use the program. We will reinforce information about basic fire modeling concepts in following lessons. However, BehavePlus training is meant to supplement, not replace, other fire behavior training.

Exercises associated with this lesson start on page 14, after the answers to the questions in the lesson.

You have completed the first two 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**

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

3. Input Methods – various ways of entering input values
4. Calculations – table and graph output options

## References

Rothermel, Richard C. 1972. A mathematical model for predicting fire spread in wildland fuels. Research Paper INT-RP-115. Ogden, UT: USDA Forest Service, Intermountain Forest and Range Experiment Station. 40 p. <https://www.fs.usda.gov/treeearch/pubs/32533>

## Answers to Questions in the Lesson

1. *What are the four main categories of inputs (shown in blue) on this Worksheet?*

The four main categories include:

- **Fuel/Vegetation, Surface/Understory:** a description of the understory fuels that are carrying the fire, as identified by fuel model(s).
- **Fuel Moisture:** live and dead fuel moisture values needed to calculate surface fire behavior.
- **Weather:** in this Worksheet, the wind speed affecting fire behavior.
- **Terrain:** in this Worksheet, the steepness of the slope on which the fire is burning.

2. *When is Surface Fire Flame Length an input to the SCORCH module?*

According to the help file, flame length is an input to the SCORCH module if the SURFACE module is not selected and if *Fire intensity is entered as flame length* is selected as an input option. Otherwise, the Surface Fire Flame Length from SURFACE is used to calculate Scorch Height in the SCORCH module.

3. *At what flame length is hand line unreliable for holding a fire?*

According to the chart at the bottom of the help file, this occurs at flame lengths ranging from 4-8 ft.

4. *Which tab is most useful for exploring variables from Rothermel's (1972) fire spread model?*

The **Intermediates** tab contains variables that are part of the Rothermel fire spread model, and therefore, are most useful for exploring the model in detail.

5. *What are the special case fuel models? Next, refer to the Handout. Which fuel model option is selected on the **BasicStart.bpw** Worksheet?*

Special case fuel models have been developed for palmetto-gallberry, western aspen, and chaparral. These fuel models were developed to better describe the characteristics of these three fuel types for use with Rothermel's (1972) surface fire spread model. The fuel model option on the **BasicStart.bpw** Worksheet is simply Fuel Model, a defined standard or custom fuel model.

6. *What is a moisture scenario? Next, refer to the Handout. Which fuel moisture option is selected on the **BasicStart.bpw** Worksheet?*

A Moisture Scenario is a pre-defined set of fuel moisture values for 1-h, 10-h, and 100-h dead fuel moisture as well as for live herbaceous and woody fuel moisture. It is analogous to the fuel model concept in that a single code represents a set of values. Moisture scenarios give you more flexibility to examine multiple variables at a time. Fuel moisture values on the **BasicStart.bpw** Worksheet are entered by individual size class.

7. *What options are available as ways to enter wind speed? Next, refer to the Handout. Which wind speed option is selected on the **BasicStart.bpw** Worksheet?*

Wind speed can be entered as:

- midflame height,
- 20-ft wind and input wind adjustment factor,
- 20-ft wind and calculated wind adjustment factor,
- 10-m wind and input wind adjustment factor, or

- 10-m wind and calculated wind adjustment factor.

The **BasicStart.bpw** Worksheet asks for Midflame Wind Speed.

8. *What inputs are needed if slope is calculated from map measurements? Next, refer to the Handout. Is slope entered directly or calculated from map measurements on the **BasicStart.bpw** Worksheet?*  
From the help file, the inputs necessary to calculate slope from map measurements include: map representative fraction, contour interval, map distance, and number of contours crossed. Since these inputs are not requested on the Worksheet, Slope Steepness must be entered directly.
9. *In what two ways can you define wind and spread directions? Next, refer to the Handout. Which option is selected on the **BasicStart.bpw** Worksheet?*  
The two ways are degrees clockwise from upslope and degrees clockwise from north. If degrees clockwise from upslope is selected, the direction specified is the direction the *wind is pushing the fire*. However, if degrees clockwise from north is selected, the direction specified is the direction *from which the wind is blowing* since that is how wind direction is reported. In the Worksheet, the direction is upslope, which can be found both in the input for Midflame Wind Speed (upslope) and the **Run Option Note** “Wind is blowing upslope.”
10. *Which additional input fields appear when the **Training worksheet header** is selected?*  
If the **Training worksheet header** is checked, the additional fields include: Training Course, Training Exercise, Trainee Name and Date.
11. *How are Effective Wind Speed and Midflame Wind Speed related to each other?*  
Effective Wind Speed is the combined effect of both Midflame Wind Speed and Slope Steepness. Therefore, Midflame Wind Speed is needed to calculate Effective Wind Speed.
12. *What is Surface Reaction Intensity?*  
Surface Reaction Intensity is the rate of energy release per area within the flaming front of a fire. Surface Reaction Intensity is not affected by wind, slope, or direction of spread.
13. *Refer to the Handout. What inputs are required for Surface Fire Rate of Spread and Surface Fire Flame Length that are NOT required for Reaction Intensity?*  
The additional inputs required to calculate Surface Fire Rate of Spread and Surface Fire Flame Length are Midflame Wind Speed, Slope Steepness, and direction of wind or spread if needed.
14. *What new category is added to the Worksheet?*  
The calculated wind adjustment factor requires information about the canopy. Therefore, the category **Fuel/Vegetation, Overstory** has been added to the Worksheet.
15. *What is the difference between the **0Default.bpw** and the **BasicStart.bpw** Worksheet?*  
(Hint: Look at the top of the Inputs; making one change to the configuration will create a **BasicStart.bpw** Worksheet from the **0Default.bpw** Worksheet).  
No modules are selected in the **0Default.bpw** Worksheet. The only difference is the selection of the SURFACE module. If you select the SURFACE module in the **Module Configuration** window, the two Worksheets will be the same.

## Exercises

Remember the suggested order of changes:


- Make one change at a time and see what adjustments are needed next (Click **Ok** to look at the Worksheet between steps if you need to).
- Select the modules that you want to use.
- Then, select outputs in each of those modules.
- Change the inputs to match the data you have available to you.
- Finally, check the Run Option Notes to make sure the assumptions and limitations are correct for your analysis. If not, examine the inputs again to make sure they are correct.

1. Open a new **BasicStart.bpw** Worksheet. Develop a Worksheet that looks like the following.  
*Hint: Look at the top of page 5 for a suggestion on how to change the wind options. The Run Option Notes also provide information about the wind option to select.*


**Question:** If Wind Direction (from north) is 90°, which way is the wind blowing?

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**Inputs: SURFACE**


Description 

**Fuel/Vegetation, Surface/Understory**


Fuel Model 


**Fuel Moisture**

Dead Fuel Moisture % 


Live Fuel Moisture % 


**Weather**

Midflame Wind Speed mi/h 

Wind Direction (from north) deg 

**Terrain**

Slope Steepness % 

Site Aspect deg 

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**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 north [SURFACE].

Wind direction is the direction from which the wind is blowing [SURFACE].

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**Output Variables**

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

2. Develop a Worksheet that looks like this one.

**Question:** How does this Worksheet compare to the related tool (**Tools > Slope from map measurements**)?

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**Inputs: SURFACE**

Description ➡

**Map**

Map Representative Fraction (1.x) ➡

Contour Interval ft ➡

Map Distance in ➡

Number of Contour Intervals ➡

---

**Run Option Notes**

None

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**Output Variables**

Slope Steepness (%) [SURFACE]

Slope Elevation Change (ft) [SURFACE]

Slope Horizontal Distance (ft) [SURFACE]

3. Create this Worksheet.

**Question:** How many **Spot Tree Species** are there?

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**Inputs: SPOT**

Description ➡

**Fuel/Vegetation, Overstory**

Downwind Canopy Height ft ➡

Downwind Canopy Cover ➡

Torching Tree Height ft ➡

Spot Tree Species ➡

D.B.H. in ➡

**Weather**

20-ft Wind Speed mi/h ➡

**Terrain**

Ridge-to-Valley Elevation Difference ft ➡

Ridge-to-Valley Horizontal Distance mi ➡

Spotting Source Location ➡

**Fire**

Number of Torching Trees ➡

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**Run Option Notes**

None

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**Output Variables**

Spot Dist from Torching Trees (mi) [SPOT]



4. Finally, open the **0Default.bpw** Worksheet and change it to look like the following.

**Question:** How does the variable **Downwind Canopy Height** differ from **Canopy Height**?

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**Inputs:** SURFACE, SPOT, IGNITE

Description

**Fuel/Vegetation, Surface/Understory**

Fuel Model

**Fuel/Vegetation, Overstory**

Downwind Canopy Height ft

Downwind Canopy Cover

**Fuel Moisture**

1-h Fuel Moisture %

10-h Fuel Moisture %

100-h Fuel Moisture %

Live Herbaceous Fuel Moisture %

Live Woody Fuel Moisture %

**Weather**

Midflame Wind Speed (upslope) mi/h

20-ft Wind Speed (upslope) mi/h

Air Temperature oF

Fuel Shading from the Sun %

**Terrain**

Slope Steepness %

Ridge-to-Valley Elevation Difference ft

Ridge-to-Valley Horizontal Distance mi

Spotting Source Location

**Run Option Notes**

Maximum effective wind speed limit IS imposed [SURFACE].

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

Wind is blowing upslope [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]

Spot Dist from a Wind Driven Surface Fire (mi) [SPOT]  
(continued on next page)

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Input Worksheet (continued)

Probability of Ignition from a Firebrand (%) [IGNITE]

**Notes**

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