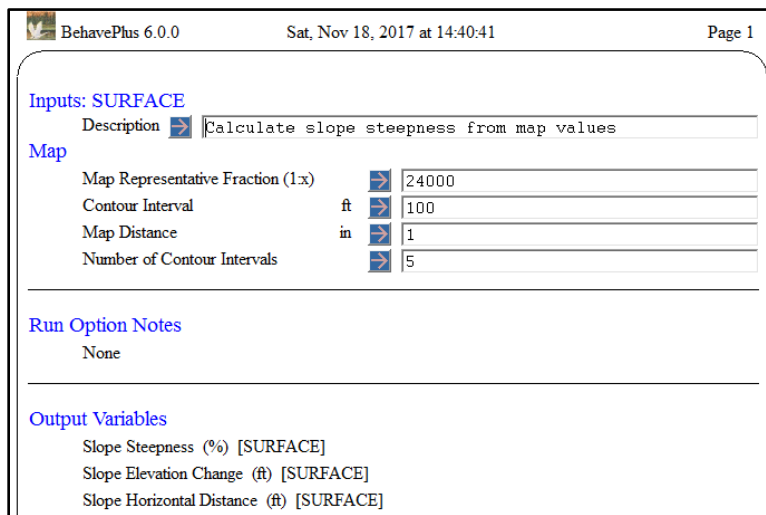


Calculations Lesson

Exercise Answers


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

*Hint: Go to **SURFACE Module Options...** > **Input Options** > **Slope** and select **Slope Steepness is calculated from map measurements**.*





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Inputs: SURFACE


Description  Calculate slope steepness from map values

Map

Map Representative Fraction (1x)  24000

Contour Interval ft  100

Map Distance in  1

Number of Contour Intervals  5

Run Option Notes

None

Output Variables

Slope Steepness (%) [SURFACE]

Slope Elevation Change (ft) [SURFACE]

Slope Horizontal Distance (ft) [SURFACE]

- Open a **BasicStart.bpw** Worksheet.
 - To create this Run, click on **SURFACE Module Options...** > **Input Options** > **Slope** and select **Slope Steepness is calculated from map measurements**.
 - In **Output Variables**, select all outputs on the **Slope** tab.
 - Enter the values and **Calculate** the Run.
- a. If the Map Representative Fraction is 24000, how many inches on the map represent a mile on the ground?
According to the **Choices** menu in the **Guide** button, there are 2.64 in/mi when the Map Representative Fraction is 1:24000.
 - b. What is the Slope Steepness in percent?
The Slope Steepness is 25%.

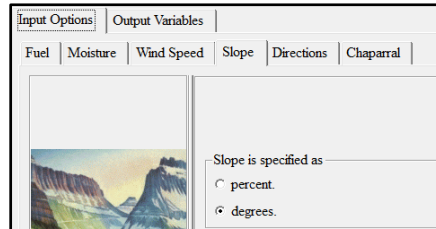
Calculate slope steepness from map values	
Head Fire	
Slope Steepness	25 %
Slope Elevation Change	500 ft
Slope Horizontal Distance	2000 ft

c. **What is Slope Steepness in degrees?** *Hint: Look in the SURFACE Module Input Options.*

To answer this question, you must change the units.

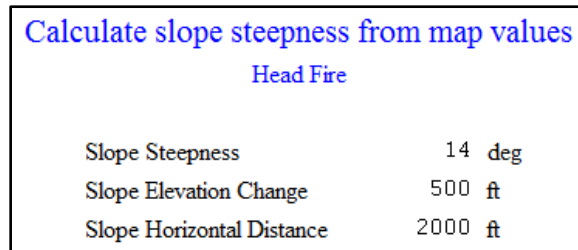
1. Go to **SURFACE Options... > Input Options > Slope.**
2. Change to **Slope is specified as degrees.**

*Note: Changing the units in **Configure > Custom units preferences** will only change the input value for slope to degrees. Change the output value in the SURFACE module, Input Options tab.*



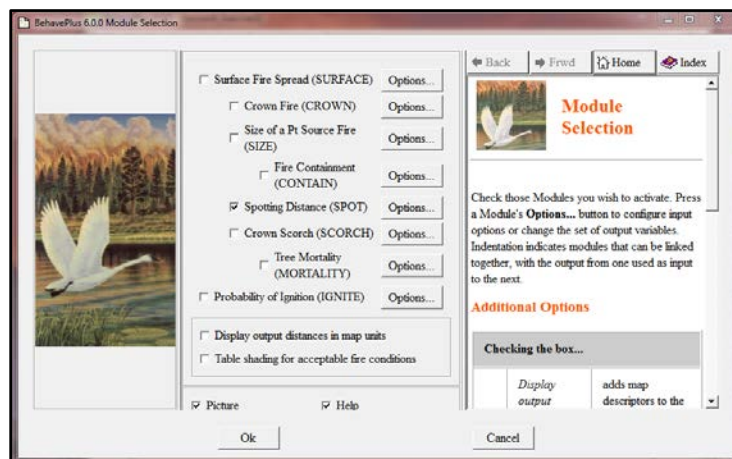
3. **Calculate** the Run.

Slope Steepness is 14°.



2. Calculate maximum spotting distance from a single 40-ft tall torching subalpine fir with a D.B.H. of 12 in. Trees downwind are 50 ft high, and Downwind Canopy Cover is open. The terrain is flat. Consider 20-ft wind speeds of 5, 10, 15, 20, and 25 mi/h.

- Open a **BasicStart.bpw** Worksheet.
- In the **Module Selection** window, deselect SURFACE and select SPOT.



- No other changes are needed. Fill out the Worksheet as shown below.

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Inputs: SPOT

Description [X] Exercise 2, Spotting from Subalpine fir

Fuel/Vegetation, Overstory

Downwind Canopy Height ft [X] 50

Downwind Canopy Cover [X] Open

Torching Tree Height ft [X] 40

Spot Tree Species [X] ABLA

D.B.H. in [X] 12

Weather

20-ft Wind Speed (upslope) mi/h [X] 5, 10, 15, 20, 25

Terrain

Ridge-to-Valley Elevation Difference ft [X] 0

Ridge-to-Valley Horizontal Distance mi [X]

Spotting Source Location [X]

Fire

Number of Torchng Trees [X] 1

Run Option Notes

None

Output Variables

Spot Dist from Torchng Trees (mi) [SPOT]

- **Calculate** the Run.

Maximum Spotting Distance from a Torchng Tree ranges from 0.1-0.5 miles.

Exercise 2, Spotting from Subalpine fir

20-ft Wind Speed mi/h	Torchng Tree Spot Dist mi
5	0.1
10	0.2
15	0.3
20	0.4
25	0.5

3. Using the following information, create a table for Surface Fire Rate of Spread and Surface Fire Flame Length that ranges from lowest value in the upper left-hand corner to highest value in the lower right-hand corner. Create tables and graphs that looks like the following.

Inputs to the Worksheet are as follows.

- **Description:** Exercise 3, Surface Fire Rate of Spread
- **Fuel Model:** TU5
Hint: You can also enter 165, the Fuel Model Number associated with Fuel Model Code TU5.
- **1-h Fuel Moisture:** 5-15%, Step 2
- **10-h Fuel Moisture:** 7%
- **100-h Fuel Moisture:** 9%
- **Live Herbaceous Fuel Moisture:** 90%
- **Live Woody Fuel Moisture:** 110%
- **Midflame Wind Speed:** 2-12 mi/h, Step 2
- **Slope Steepness:** 15%

- Open a **BasicStart.bpw** Worksheet.
- Enter values for **1-h Fuel Moisture From 15% Thru 5 Step -2**.
- Enter all other values as usual.

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Inputs: SURFACE

Description Exercise 3, Surface Fire Rate of Spread

Fuel/Vegetation, Surface/Understory

Fuel Model 165

Fuel Moisture

1-h Fuel Moisture % 15, 13, 11, 9, 7, 5

10-h Fuel Moisture % 7

100-h Fuel Moisture % 9

Live Herbaceous Fuel Moisture % 90

Live Woody Fuel Moisture % 110

Weather

Midflame Wind Speed (upslope) mi/h 2, 4, 6, 8, 10, 12

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 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]

Use the following steps to change the graphs.

- Go to **Configure > Appearance preferences**.
- On the **Graph Size** tab, change **X Axis Origin** to Min Value.
- On the **Graph Elements** tab, change the following.
 - **Background** to Grey
 - **Rainbow Colors** to 10
 - **Gridline Color** to White
- **Calculate** the Run.
- Click on the box next to **Specify graph Y axis limits**.
- Click **Ok**.
- In the **Graph Limits** window, change the **Y Axis Minimum** for **Surface Fire Rate of Spread** and **Surface Fire Flame Length** to 2.
- Click **Ok**.

Exercise 3, Surface Fire Rate of Spread

Head Fire

Surface Fire Rate of Spread (ch/h)

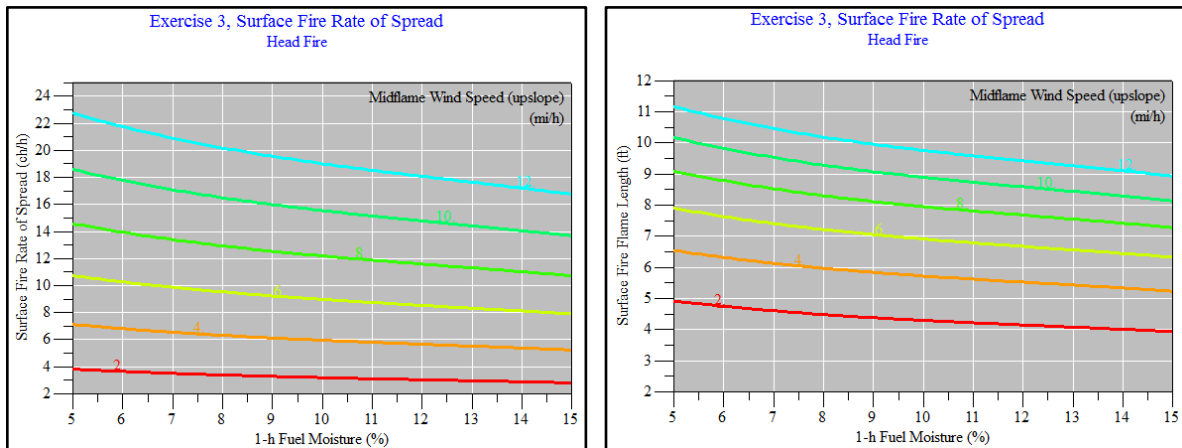
Midflame Wind Speed mi/h	15	13	11	9	7	5
2	2.8	3.0	3.1	3.3	3.5	3.8
4	5.2	5.5	5.8	6.1	6.5	7.1
6	7.9	8.3	8.8	9.2	9.9	10.7
8	10.7	11.3	11.9	12.5	13.4	14.6
10	13.7	14.4	15.1	16.0	17.1	18.6
12	16.7	17.6	18.5	19.6	20.9	22.8

Exercise 3, Surface Fire Rate of Spread

Head Fire

Surface Fire Flame Length (ft)

Midflame Wind Speed mi/h	15	13	11	9	7	5
2	3.9	4.1	4.2	4.4	4.6	4.9
4	5.2	5.4	5.6	5.8	6.1	6.5
6	6.3	6.6	6.8	7.1	7.4	7.9
8	7.3	7.6	7.8	8.1	8.5	9.1
10	8.1	8.4	8.7	9.1	9.5	10.2
12	8.9	9.3	9.6	10.0	10.5	11.2



4. Produce a table and graph as shown below. All of the information you need can be obtained by reading the Description and looking at the variables in the table.

- Open a **BasicStart.bpw** Worksheet.
- In the **Module Selection** window, deselect SURFACE and select IGNITE.
- Enter **Description** of No shading from the sun.
- Based on this **Description**, **Fuel Shading from the Sun** is 0.
- Enter **1-h Fuel Moisture From 2 Thru 20 Step 2**.
- Enter **Air Temperature From 60 Thru 90 Step 5**.
- Go to **Configure > Appearance preferences**.
- On the **Graph Size** tab, change **X Axis Origin** to **Min Value**.
- On the **Graph Elements** tab, change the following.
 - **Rainbow Colors** to **10**
 - **Gridline Colors** to **Grey**
- **Calculate** the Run.
- Change **Select the X-Axis Variable** to **Air Temperature**.

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Inputs: IGNITE

Description ➤ No shading from the sun

Fuel Moisture

1-h Fuel Moisture % ➤ 2, 4, 6, 8, 10, 12, 14, 16, 18

Weather

Air Temperature oF ➤ 60, 65, 70, 75, 80, 85, 90

Fuel Shading from the Sun % ➤ 0

Run Option Notes

None

Output Variables

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

No shading from the sun
Probability of Ignition from a Firebrand (%)

1-h Fuel Moisture %	Air Temperature °F						
	60	65	70	75	80	85	90
2	93	95	96	98	99	100	100
4	70	71	73	74	75	77	78
6	53	54	55	56	57	58	59
8	39	40	41	42	43	44	45
10	29	30	31	31	32	33	34
12	21	22	23	23	24	25	25
14	15	16	16	17	17	18	19
16	11	11	12	12	12	13	13
18	7	8	8	8	9	9	9
20	5	5	5	6	6	6	6

