

Spread Distance

Spread distance (SD) is the forward distance a fire spreads in a given amount of time. SD can be calculated from rate of spread (ROS) and projected time (PT).

Spread Distance = Rate of Spread × Projected Time
SD = ROS × PT

Example 1 - What is the spread distance, in feet, for a fire that has a rate of spread of 6 chains per hour for a 3-hour time span?

Step 1. Use the equation for determining the spread distance.

$$SD = ROS \times PT = \frac{6 \text{ chains}}{1 \text{ hour}} \times 3 \text{ hours} = 18 \text{ chains}$$

Step 2. The answer needs to be in feet. Set up the cancellation table so all units will cancel, except the desired unit, feet.

$$\frac{18 \text{ chains}}{1 \text{ chain}} \times \frac{66 \text{ feet}}{1 \text{ chain}} = 1,188 \text{ feet}$$

The spread distance is 1,188 feet.

Example 2 - Using the information in Example 1, find the map distance of the fire spread. The map scale is 1:31,680 (inch/inch).

Step 1. Convert inch/inch to feet/inch. Set up the cancellation table so all units will cancel, except the desired unit, feet/inch.

$$\frac{31,680 \text{ inches}}{1 \text{ inch}} \times \frac{1 \text{ foot}}{12 \text{ inches}} = 2,640 \text{ feet/inch}$$

5.3 Spread Distance

Step 2. Convert the ground spread distance to a map spread distance.

$$\frac{1.188 \text{ feet}}{2,640 \text{ feet}} \times 1 \text{ inch} = 0.45 \text{ inch}$$

The map distance is 0.45 inches.

Map spread worksheet

These values can be summarized in a Map Spread Worksheet.

Map Spread Worksheet (blank version)

| Line | Input | | |
|---------------|-------|---|-------|
| 0 | PP | Projection point | _____ |
| 1 | ROS | Rate of spread, ch/h | _____ |
| 2 | PT | Projection time, h | _____ |
| 3 | SDCM | Spread distance, ch (line 1 x line 2) | _____ |
| 4 | SDFT | Spread distance, ft (line 3 x 66 ft/ch) | _____ |
| 5 | SCL | Map scale | _____ |
| 6 | CF | Conversion factor, ft/in (see map scale conversion) | _____ |
| Output | | | |
| 1 | MD | Map spread distance, in (line 4 divided by line 6) | _____ |

5.3 Spread Distance

Map Spread Worksheet (completed)

| Line | Input | | |
|-----------------|-------|---|----------|
| 0 Given | PP | Projection point | A |
| 1 Given | ROS | Rate of spread, ch/h | 6 |
| 2 From ex. 1 | PT | Projection time, h | 3 |
| 3 From ex. 1 | SDCM | Spread distance, ch (line 1 x line 2) | 18 |
| 4 From ex. 9 | SDFT | Spread distance, ft (line 3 x 30 ft/ch) | 540 |
| 5 From ex. 2 | SCL | Map scale | 1:31,680 |
| 6 From ex. 2 | CF | Conversion factor, ft/in (see map scale conversion) | 2640 |
| Output | | | |
| 1 from ex. 2 | MD | Map spread distance, in (line 4 divided by line 6) | 45 |

When completing the map spread worksheet, notice that the projection point is line zero. Line 1 begins with the rate of spread.

Fire Area Size Worksheet

| Line | Input | | |
|------|-------|---------------------------|-------|
| 0 | PP | Projection point | _____ |
| 1 | ROS | Rate of spread, ch/h | _____ |
| 2 | EWS | Effective windspeed, mi/h | _____ |
| 3 | PT | Projection time, h | _____ |

5.3 Spread Distance

| | | | |
|---|-----|---------------------|-------|
| 4 | SDF | Spread distance, ch | _____ |
|---|-----|---------------------|-------|

| Output | |
|--------|---------------|
| PER | Perimeter, ch |
| AC | Area, ac |

Practice

Exercise 1. Fill in the Map Spread Worksheet values for a fire with ROS of 12 chains/hr and PT of 3 hrs. The map scale is 1:21,120.

1. Do I have the information I need to fill out a map spread worksheet?

- Yes
- No

The correct answer is a, yes. If you know the rate of spread, projection time, and map scale, you can fill out a map spread worksheet.

2. What is the rate of spread?

5.3 Spread Distance

The rate of spread is 12 chains/hr.

3. What is the projection time?

The projection time is 3 hours.

4. What is the spread distance in chains?

- 15 chains
- 12 chains
- 4 chains
- 36 chains

The correct answer is d, 36 chains. $SD = ROS \times PT = 12 \times 3 = 36$.

5. What is the spread distance in feet?

$$36 \text{ chains} \times 66 \text{ ft/chain} = 2376 \text{ ft.}$$

6. What is the map scale (in/in)?

1:21,120

1:21

The correct answer is a, 1:21,120.

7. What is the conversion factor to ft/in?

253,440

42,240

1760

147

The correct answer is c, 1760 ft/in.

8. What is the map spread distance?

- 1.74 in
- 1.35 in

The correct answer is 1.35 in. A ground distance of 2376 ft translates to 1.35 in on this map.

Forward Rate of Spread

The shape of a fire is dependent on slope and effective windspeed. The higher the windspeed and slope percent, the longer, more cigar-shaped the burn area.

Slope Percents

- 0- 20 percent slope
- 20 - 40 percent slope
+1 mph wind equivalent effect from slope; 4x spread
- 40 - 60 percent slope
+2 mph wind equivalent effect from slope; 8x spread
- 60 - 80 percent slope
+3 mph wind equivalent effect from slope; 14x spread;



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Using a Scaled Ruler for Spread Measurements

When drawing or measuring distances, a scaled ruler is sometimes necessary for direct measurements. A scaled ruler, or engineer's ruler, has 1-inch increments subdivided into 1/10-inch increments, convenient for ground measurements. Ground measurements are usually given in fractions of multiples of 10. Consider a map distance of 3.7 inches, where 1 inch equals 100 feet. In this case, each tenth of an inch will equal 10 feet. Consequently, 3.7 inches equals 370 feet.



Map Spread Worksheet

All data collected and calculated related to spread distance and rate of spread can be put into a map spread worksheet.

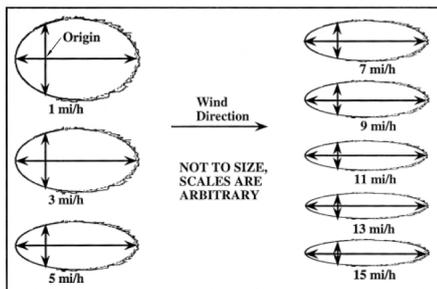
Example 3 - Using a ruler scaled in 1/10 inch or 0.1 inch increments, draw a sketch of the burn in Example 2. The effective windspeed is 3 miles/hour. Complete the map spread worksheet. See the steps and illustrations below.

Step 1. Draw a line of 0.5 inches from point A up the slope to point B.

A - B

Step 2. See the fire shapes in the fire shape figure below to determine how wide to make the ellipse.

Step 3. Draw an ellipse around the line drawn.



Fire shape depends on effective windspeeds.