

# Forest Rangers

## The Movie:

Forest rangers describe some of the techniques used to keep hundreds of thousands of acres of trees healthy. Featured: Arnold Wilson, forester, U.S. Forest Service; Brad Washa, fuel specialist, U.S. Forest Service. (Movie length: 1:44)



## Background:

America's forests represent not just one natural resource, but many. They support wildlife which is an important part of humankind's ecosystem, they nurture and protect rivers, streams, lakes, and ponds, and they offer a recreational refuge for millions of Americans every year.

Of the original 1.04 billion acres of forest which once carpeted much of the U.S., only about 40 million acres—4%—remains. Much of this forest lies on public lands, and its management in the public interest is the responsibility of the U.S. Forest Service.

## Curriculum Connections:



## Ratios

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A forest ranger wants to plant three kinds of trees on a mountain: Ponderosa Pine, Douglas Fir, and White Fir. He has decided that he wants these ratios for the trees:

Ponderosa Pine: Douglas Fir = 2:1  
White Pine: Ponderosa Pine = 3:2

Suppose he has 20 Ponderosa Pine trees to plant.

- How many Douglas Fir trees should he plant?
- How many White Fir trees should he plant?
- How many trees total would he plant?

Suppose he decides he wants to plant a total of 120 trees.

- How many Ponderosa Pine trees should he plant?
- How many Douglas Fir trees should he plant?
- How many White Fir trees should he plant?

This table lists the fires in Yellowstone National Park in the year 2003. Answer these questions:

- What is the average of the number of acres burned in a fire that year? Do you think that "average" is a good way to summarize the information in the table?
- What percent of fires were started by humans?
- In which month did the most fires occur? What percent of fires occurred in that month?
- Yellowstone National Park has a policy of putting out fires caused by humans, and letting fires that are started by natural causes burn themselves out. Does this information show whether or not that policy is being enforced? How?

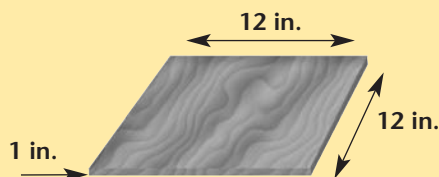
Start date	Cause	Acres
9/4/2003	lightning	0.1
9/3/2003	lightning	0.1
9/3/2003	lightning	0.25
8/28/2003	lightning	0.1
8/29/2003	lightning	0.1
8/24/2003	lightning	0.5
8/20/2003	lightning	3010
8/22/2003	lightning	0.1
8/22/2003	lightning	0.1
8/19/2003	lightning	1.0
8/17/2003	powerline	0.1
8/16/2003	lightning	0.1
8/16/2003	lightning	0.1
8/15/2003	lightning	0.1
8/14/2003	lightning	768
8/14/2003	lightning	0.1
8/13/2003	lightning	150
8/12/2003	human	0.1
8/12/2003	lightning	0.1
8/11/2003	lightning	0.1

8/11/2003	lightning	18,050
8/11/2003	lightning	0.1
8/11/2003	lightning	0.1
8/11/2003	lightning	0.1
8/10/2003	lightning	0.75
8/10/2003	lightning	0.1
8/10/2003	lightning	0.25
8/10/2003	lightning	0.1
8/10/2003	lightning	0.1
8/9/2003	lightning	0.2
8/9/2003	lightning-fire use	0.1
8/9/2003	lightning-fire use	0.1
8/9/2003	lightning	0.1
8/9/2003	lightning	0.1
8/8/2003	lightning	0.25
8/8/2003	lightning-fire use	0.1
8/8/2003	lightning	0.1
8/8/2003	lightning	0.1

8/8/2003	lightning	0.1
8/8/2003	lightning	0.1
8/8/2003	lightning-fire use	600
7/3/2003	human	0.1
8/6/2003	lightning	0.1
8/5/2003	lightning	0.1
8/4/2003	human	0.1
8/3/2003	lightning	0.1
8/2/2003	lightning	4460
8/2/2003	human	0.25
7/31/2003	lightning	0.1
7/21/2003	lightning	2
7/18/2003	lightning	4.0
7/16/2003	lightning	0.5
7/15/2003	lightning	315
7/12/2003	lightning	3.0
7/5/2003	human	506
6/16/2003	human	0.20
6/14/2003	lightning	0.25
6/14/2003	human	0.20

### Algebra (linear and quadratic functions)

The amount of useable lumber in a tree is measured in "board-feet". One board-foot is a piece of wood that is 12" by 12" by 1" thick.



This table relates the number of board-feet of lumber in a collection of Ponderosa Pines to the diameter of each tree.

Plot these points, with diameter as the independent variable.

- Does this seem to be a function? Explain
- Does it seem to be a linear function? Explain
- Assume that this is a quadratic function, as follows ( $y$  = board-feet,  $x$  = diameter):

$$y = ax^2 + bx + c$$

Use three points of the above data to determine  $a$ ,  $b$ , and  $c$ . Then graph the above equation on the same coordinate system you used to plot the above points. Does it seem to be a good fit?

Diameter (inches)	Board-Feet
17	190
19	250
20	320
23	570
25	710
28	1130
32	1230
38	2520
39	2590
41	2940

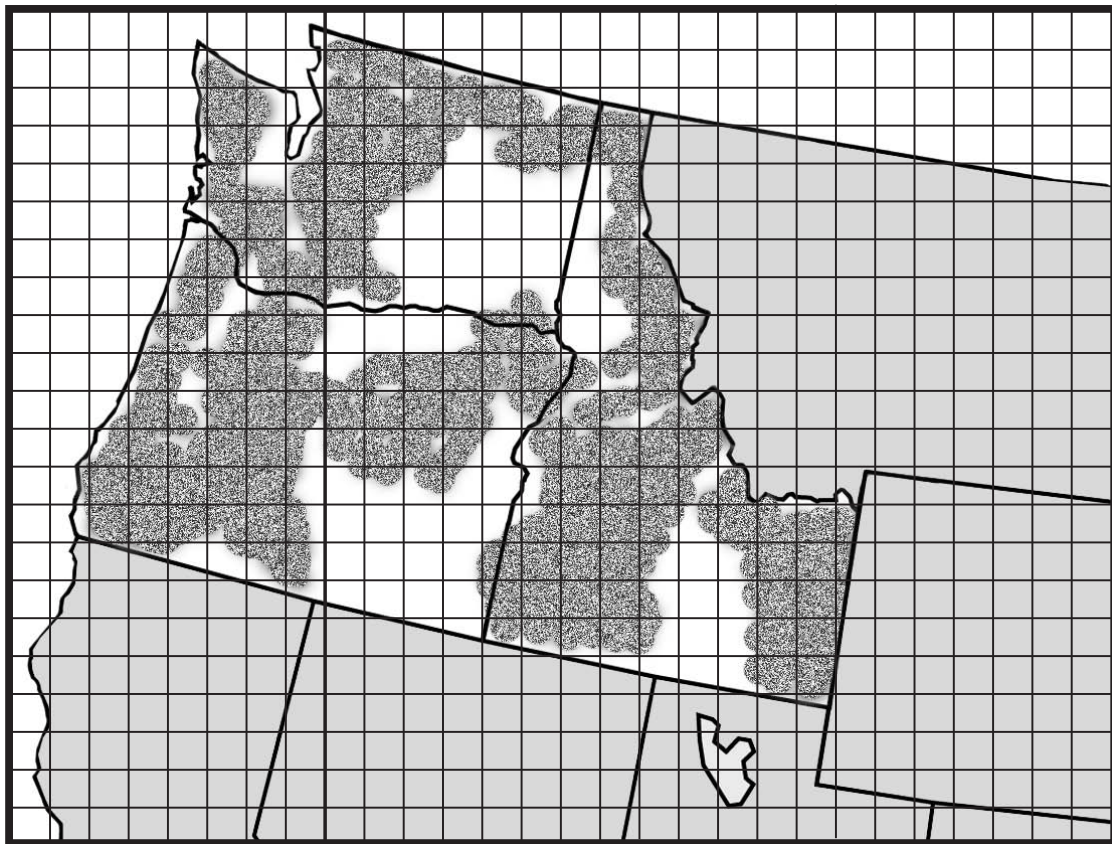
# The Pacific Northwest


Three states are shown on the map below: Washington, Oregon, and Idaho.

The parts of the states that are covered with forests are shaded in. The unforested land is not shaded.

For each state, find the ratio of the amount of forested land to unforested land.

Which state has the most forested land compared to its unforested land?



 = trees



## Teaching Guidelines: The Pacific Northwest

### Math Topic: Ratios

This activity is best done by students working in teams of two.

Hand out the activity sheets, and have students read them up to the first instruction ("For each state, find...").

Discuss this assignment with the class and ensure that all students understand what is being asked.

Have students carry out the first instruction. Circulate as students do the activity, helping as needed.

Once all students have found these ratios, have a student read the next question ("Which state has the most forested land compared to its unforested land?"). Ask students if this is the same question as

asking "Which state has the most forested land?", and discuss this until students clearly understand the difference between those two questions.

Write the three ratios on the board, and ask students how they could compare those ratios. Tell them that you will give them one hint, that ratios can also be written as fractions, and write the ratios in that form. Then have students talk the problem over with their teammates and try to find a way to compare the ratios.

A simple approach is to notice that two of the ratios are less than one half (because in fraction form the numerators are less than half of the denominators). Another is to convert each fraction to a decimal and compare the decimals.



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<i>Healing Injured Wild Animals, #2002</i>	Veterinarian Mark Pokras assesses, treats and nurses injured wild animals on their road back to health.
<i>Creating a Campground, #4009</i>	Creating campsites in the New Mexico wilderness calls for a knowledge of ratios and proportions.

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