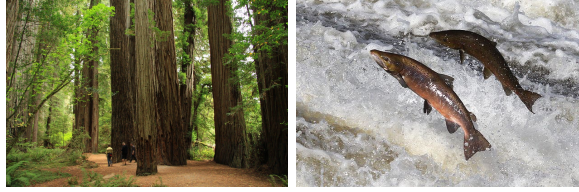


# Our Local Natural Resources



## LESSON 4: Indirect Measurement of Trees

### OVERVIEW & PURPOSE

Students will choose a method for measuring very tall trees. Students will practice using similar triangles with shadows, digital photography and an app called “Measure It”. This lesson helps prepare students to record data on the field trip to the Headwaters Forest.

### CONTENT STANDARDS

NGSS: MS-ESS3 Earth and Human Activity

CCSS Math: Math Practice Standards, CCSS.MATH.CONTENT.7.RP.A.2.C Represent proportional relationships with equations.

### OBJECTIVES

Students will use proportionality to determine the height of tall trees and understand the use of similar triangles. Students will understand calculation error and use known objects to investigate the errors in their methods.

### VOCABULARY

Similar triangles, length, proportion, units, correspond

## MATERIALS NEEDED

Measuring tools ( trundle wheel, meter stick, measuring tape), smartphone or tablet and “Measure it” app.

## TEACHER QUESTIONS

How can we find the height when we can't measure it?

How do we know if our calculations are accurate?

Which method is most useful? Why?

## ACTIVITY

### PART 1

Students will use the three methods defined below to calculate the heights of objects indirectly. In this experiment students will choose objects whose heights are measurable directly and then calculate the percent error in the method (  $\frac{\text{height-measured}}{\text{height}} \times 100$  )

### PART 2

Students will choose one of the methods and practice measuring very tall objects on campus. Students will record their data and calculations and be ready to estimate the error involved.

### Indirect Height Measurement

Method 1: Shadow Method ( sunny day required)

1. Measure the shadow cast by a tree.
2. Measure the shadow cast by a person and the height of the person.
3. Use a proportion to solve for the height of the tree.

Method 2: Digital photography

1. Tie or tape a measuring implement ( meter stick or ruler) to the tree or object.
2. Move back far enough to take a photo of the entire object.
3. Use editing software to cut and past the measuring implement multiple times on the image of the tree or object to obtain the measurement

### Method 3: Use an App

1. Use a tablet or smartphone and “Smart Measure App”. This app uses trig functions to determine the height of an object. There is an introductory lesson on the app that teaches you how to use it.

