Measuring the trees and the forest
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Target grade and subject

Unit Overview
This unit combines two subjects: Environmental science and mathematics. It focuses on measurement of individual trees and on describing tree plots; it incorporates the big idea society’s impact on forest resources. Students are expected to take careful measurements and perform calculations that allow them to determine the various dimensions of a tree and estimate the tree density of a given plot.

Teaching and Learning Objectives
A student will be able to (SWBAT):

• accurately measure a plot of 1/20th or 1/50th acre using a tape measure.

• evaluate if a given tree stands within a plot area and using either estimation or measurement determine if it falls within a given size category.

• accurately count the number of trees exceeding a given diameter or circumference within a measured plot.

• accurately measure the diameter or circumference of trees and calculate related values (radius, diameter, circumference and area).

• find the mean, median and mode diameter or circumference of their plot’s trees.

• calculate a tree’s approximate height using geometry and/or trigonometry.

• use plot measurements to extrapolate acreage estimates.

• enter data into a spreadsheet.

• manipulate spreadsheet data by using or creating formulas and graphs.

• use illustrations and/or numerical data to perform calculations similar to those done in the field.
PART I: Tree height (alt: can be done after part III)
Opening question: how can we measure the height of a tree? (without climbing it) Why would we want to measure the height of a tree? [setting records, monitoring forest health, suitability for lumber etc.]

Depending on prior knowledge and mathematical sophistication of your students you may not want to teach, practice and/or use all five methods. Select the method(s) that best suit the needs of your students.

View powerpoint “Tree height.”

Conduct tree height labs.
1. Thumbs up, Thumbs over (congruent triangles)
2a. Similar shadows (similar triangles)
2b. Similar triangles (also could use clinometer)
3. Geometry (isosceles right triangles)
4. Trigonometry (sin=opposite/adjacent)

Tree height homework. (proportional and/or trig. versions)
Supplemental practice from curriculum may be necessary to ensure mastery of geometrical and trigonometrical concepts/competencies.

Closing question: Which method did you find most useful for finding the trees’ heights? How did geometry or trigonometry help you to calculate the trees’ heights?

PART II:
Opening question: If we want to know a tree’s size, other than height, what else can we measure?

View powerpoint “tree c-d-r”

Practice calculations of circumference, diameter and radius. Supplemental materials from curriculum, including in-class problems and homework, may be necessary to ensure mastery of concepts and procedures.

Conduct c-d-r tree lab. c-d-r homework

Closing question sequence: Have students use white boards to draw and/or name the three dimensions (circumference, diameter, radius) that were the focus of this lesson.
Activities (continued)

PART III: Plot measurements
Opening question: If we have a whole forest, do we need to measure every tree to know how much wood we have? Why would a forester or scientist only measure a select set of trees?

View powerpoint “tree density activities”

Conduct Plot Density Lab

Plotting Homework I

Closing questions: A tree is on the plot boundary. How do you count it—in or out? Why?

Amber’s plot had 7 trees with the following circumferences: 0.6m, 0.4m, 0.9m, 1.0m, 1.2m, 0.3m, 0.4m. What was the average (mean) circumference? What were the median and mode circumferences?

PART IV: Estimating and extrapolating

Opening question: How can we use our plot surveys to estimate the trees in a large forest?

Enter plot data in spreadsheet.
Calculate mean, median, mode.
Use averages to estimate the approximate tree density of a forest.

Plotting Homework II

Closing question: If you measure a 1/30th acre plot, how many plots in an acre? If there were 5 large trees on that plot, how many trees in an acre?

Unit Assessment

Parts I-IV see homework, lab activities and closing questions

Unit Review: see attached

Unit Exam: see attached

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Sources Consulted and Use of Books


Benchmarks

*See attached*

This unit addresses benchmarks by both teaching fundamental skills such as measurement and calculations and by encouraging higher level thinking skills such as estimation and application.  The science concept of forests (and lumber) as resources should be woven through out the instruction and may form the basis of why all the measurements are taken.  Observational skills should also be emphasized; students should be encouraged to estimate forest ground cover type and percentage, canopy density and sunlight saturation, basic weather conditions, tree health etc.

NOTE: my students are visual learners and so I needed a lot of powerpoints and word documents to support my instruction.  The one that follows the syllabus, (lesson plan) was sent, but a fixed/updated version is attached.  The details for labs/activities are on a second document titled something like "lab directions."  Also you'll find the eval form attached.

I did make a few edits and changes to several of the documents (always seem to need double editing-- i'm famous for my many "little mistakes) and it'll be easier to just burn a CD than try to send all the revised (and hopefully error-free) versions your way.  Plus one of the PP was too big to send via e-mail, so this way you'll (and anyone else who wants it) can have it.

NOTE: