Chopsticks and the Future of China’s Forests: Using Mathematics to Look at the Future

Students estimate the number of disposable chopsticks that can be obtained from one cubic meter of wood, and from that information determine the cubic meters of wood that China would use in a year under varying consumption rates.

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**National Geography Standards**

Element Five: Environment and Society

14. How human actions modify the physical environment.

**Geography Strand 4**

Concept 5 Environment and Society

GRADE 8

PO 1 Describe how humans modify ecosystems.

**Other Arizona Standards**

Mathematics Common Core Standards

Geometry

8.G.9. Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

Standards for Mathematical Practice


World History

Concept 10 Contemporary World

PO 3. Analyze how world events of the late 20th century and early 21st century affected, and continue to affect, the social, political, geographic, and economic climate of the world (e.g., terrorism, globalization, conflicts, interdependence, natural disasters, advancements in science and technology and environmental issues).

**Overview**

Looking at the consequences of everyday cultural habits, such as eating, helps to illuminate the environmental implications of culture. Mathematics is one tool to look at these habits and the way in which they impact world ecosystems.

**Purpose**

In this lesson students estimate the number of disposable chopsticks that can be obtained from one cubic meter of wood and, from that information, determine the cubic meters of wood that China would use in a year under varying assumptions of reuse.

**Materials**

- Meter sticks, one per group
- Calculators (preferably those capable of displaying 9 digits)
- Student background sheet
- Student worksheet

**Objectives**

Students will be able to:
1. Estimate how many chopsticks can be obtained from a cubic meter of wood.
2. Estimate how many cubic meters of wood China utilizes annually at 3 different assumptions of re-use.

**Procedures**

1. Review concept of volume and how it is determined.

2. Working in small groups, use the dimensions of a package of 40 chopsticks – 20 cm long, 13 cm wide, and 2 cm thick – and a calculator to determine how many chopsticks would be in each of the 3 dimensions. That is, how many 20cm, which is the length, is in a meter? (5)
   How many 13cm (width) is in a meter? (7.7)
   How many 2cm (thickness) is in a meter? (50)
   Multiply these 3 numbers (5 x 7.7 x 50) and then that answer by 40 (the total number of chopsticks in the package) to determine the total number of chopsticks in a cubic meter. Using the above measurements, this amounts to 77,000 chopsticks in a cubic meter. Another option would be to have the students place the chopsticks package (or a paper cut-out representing each dimension) against a meter stick to determine how many chopsticks packages there are in each dimension. Multiply the numbers together as above to determine the total number of chopsticks in a cubic meter.

3. Estimate the total number of cubic meters of wood used by China’s 1.3 billion people. If they were to use disposable chopsticks at every meal for one day, divide 1.3 billion people by 77,000 chopsticks in a cubic meter to get approximately 16,883 cubic meters per day.

4. Multiply that number by 365 days to get an annual figure of 6,162,295 cubic meters. (This figure assumes that all chopsticks are disposed after one use.)

5. To determine the number of actual chopsticks used, multiply 6,162,295 by .10, by .05, and by .01 to get the number of cubic meters used if 10%, 5%, and 1% of Chinese chopsticks, respectively, were disposable.

6. To put these numbers into perspective, the number of cubic meters of useable wood in an average 11-inch diameter ponderosa pine, the dominant tree of the Flagstaff area, is .26 cubic meters.

7. Discuss the following considerations. There are on average, 741 Ponderosa Pines on a hectare (2.47 acres). How many cubic meters of wood would be found on one hectare? How many hectares of ponderosa pines would be required to supply the 3 dimensions of chopstick use?

**Assessment**

Students should complete the student worksheet. Mastery will be considered 80% or higher.

**Extensions**

These figures for this lesson were compiled several years ago. Have students update the population figures and re-do the calculations.