

Calculating Land Area

All living organisms require food for energy and nutrition. Plants produce their own food energy from sunlight through the process of photosynthesis. This transformation of energy provides the basic food source for all other organisms in the food web, including you.

A typical teenager's diet contains 2,500-3,000 Calories per day, or about 1 million Calories annually. Calories are units for measuring energy. The definition of a calorie is the amount of energy needed to raise the temperature of 1 gram of water 1°C. This is a small unit of measurement compared with what a person eats normally. Food energy is usually measured in kilocalories (kcal). One kcal equals 1,000 calories or one nutrition Calorie (spelled with an uppercase C). All energy values for food are reported in either Calories or kcals.

You can find nutritional information on the box or wrapper of most packaged foods. Fast-food restaurants provide nutritional information for their menu items on request. For other items, you will need to look up the Calorie information in a calorie counter, a reference book that lists most foods and their caloric content.

The estimated energy captured by crop food plants is about 2,000 Calories per square meter of cropland per year (a number based on the average energy values of several different crops). Likewise, an estimate of livestock or animal energy production is about 200 Calories per square meter of cropland. This figure is much lower because animals absorb only a fraction of the energy contained in the plants they eat. The values for energy production for plants and animals can be used to calculate the amount of cropland required to maintain a particular diet.

How much of Earth's resources does it take to provide the food energy to support you, your family, or the people in your community? These are important questions as the human population continues to increase. In this activity, you will investigate the land resources necessary to support the food that you eat.

OBJECTIVES

Collect data on your eating habits.

Discover how much farmland is required to support your diet.

Compare how much land is required to support an entire city on your diet to the land required to support a city on a vegetarian diet.

MATERIALS

- calculator
- Calorie charts

Procedure

1. Prior to class, keep track of types and quantities of food you eat in a 24-hour period, including between-meal snacks and desserts. Write this information in Table 1 on the next page. List plant items (vegetables, fruits, and grains) and animal items (meats, dairy, eggs, fish) separately.

Calculating Land Area *continued*

2. During class, using the Calorie charts, record the number of Calories for the food you consumed in Table 1. For some food items, such as pizza or cheeseburgers, you'll need to estimate the proportion of total Calories of plant sources and animal sources and assign them accordingly.

TABLE 1: CALORIE COUNTING DATA

	Item	Quantity	Plant Calories	Animal Calories
Breakfast	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
Lunch	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
Dinner	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
Snack or other	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
Daily totals			_____	_____
Annual totals			_____	_____
Annual Calorie consumption			_____	

Calculating Land Area *continued*

3. Total the number of Calories you consumed from plant and animal products and record the totals in Table 1.
4. Multiply the daily total of plant Calories by 365 and record the result in Table 1. This is an estimate of your yearly Calorie consumption of plant foods.
5. Multiply the daily total of animal Calories by 365 and record the result in Table 1. This is an estimate of your yearly Calorie consumption of animal foods.
6. Add the results of steps 4 and 5 and record the result in Table 1. This is an estimate of your total yearly Calorie consumption.

Analysis

1. **Describing Events** Describe how your eating habits may have been affected during the performance of this lab.

2. **Organizing Data** Calculate the amount of cropland required to support you for a year by dividing your annual plant Calories by 2,000 Calories per square meter, dividing your annual animal Calories by 200 Calories per square meter, and add the results of the two division operations. Show all calculations. How many total square meters of farmland do you require?

3. **Examining Data** Compare your diet to that of the average teenager. The land area necessary to produce the yearly food energy in a typical teenager's diet is about 2,000 square meters. How do you compare?

4. **Classifying** Break down the number of your Calories into percentages of plant food and animal food. Show calculations.

Calculating Land Area *continued*

5. Analyzing Data Compare the percentage of plant food Calories in your diet to animal food Calories in your diet. Do you tend to eat more plant or animal food? How do you think this compares to the average teenager?

6. Identifying Patterns Identify patterns that you see in your eating habits and how they may have affected your results.

Conclusions

7. Drawing Conclusions Model a city that has a population of 10 million people (e.g., New York) with a diet similar to yours. How many square meters of land would it take to grow the food for your model city? There are 2.56 million square meters in 1 square mile of land. How many square miles of cropland would it take to feed all of the people of your model city? Show all calculations.

8. Applying Conclusions Model another city with the same population on a vegetarian diet. Assume that each person consumes an average of 1 million Calories per year. Assuming the 2,000 Calories per square meter captured by plants, calculate the number of square meters and the number of square miles needed to support this model city. Show all calculations.
