

12 Soil and Agriculture




Before you read the chapter, answer each question with information you know. After you complete the chapter, re-answer the questions using information you learned.

BIGQUESTION How Can We Balance Our Growing Demand for Food with Our Need to Protect the Environment?

	What I Know	What I Learned
<p>12.1 What is soil?</p>	<p><i>Sample answer: Soil is the substance in which plants grow.</i></p>	<p><i>Sample answer: Soil is a complex and varied substance.</i></p>
<p>12.2 How do erosion, desertification, and soil pollution affect the productivity of soil?</p>	<p><i>Sample answer: Erosion can wash away soil, making it hard to grow crops; desertification refers to deserts; soil pollution reduces soil productivity.</i></p>	<p><i>Sample answer: The dissolved salts in irrigation water can increase salt buildup in soil and ultimately reduce the soil's productivity.</i></p>
<p>12.3 How has agriculture evolved?</p>	<p><i>Sample answer: Farming practices have changed with the development of farm machinery.</i></p>	<p><i>Sample answer: Although farm machinery was key to the shift from traditional to industrial agriculture, the development of new crops, fertilizers, and pesticides also played an important role.</i></p>
<p>12.4 How can we produce enough food for a rapidly growing population while sustaining our ability to produce it?</p>	<p><i>Sample answer: We can make farming more efficient.</i></p>	<p><i>Sample answer: Genetically modified crops could help meet the growing demand for food if nutrient-rich and drought-tolerant crops are made available to farmers in developing nations.</i></p>

12.1 Soil

Key Concepts

-  Soil is a complex substance that forms through weathering, deposition, and decomposition.
-  A soil profile consists of layers known as horizons.
-  Soils can be classified by their color, texture, structure, and pH.



SKILL BUILDER Vocabulary Preview

Define each vocabulary term in your own words. Then, write yourself a quick note on how you will remember each. One term has been done for you.

Term	Definition	How I Remember
Soil	<i>A complex plant-supporting system made up of disintegrated rock, remains and wastes of organisms, water, gases, nutrients, and microorganisms</i>	<i>Accept all reasonable responses for How I Remember. A few samples are provided.</i>
Parent material	The base geological material in a particular location	Soil comes from parent material, like children come from <i>parents</i> .
Bedrock	<i>The continuous mass of solid rock that makes up Earth's crust</i>	<i>I can remember that bedrock is made up of rock.</i>
Weathering	<i>The physical and chemical processes that break down rocks and minerals into smaller particles</i>	
Soil horizon	<i>A distinct layer of soil</i>	<i>At the horizon, land and sky appear as distinct layers; a soil horizon is a distinct layer of soil.</i>
Soil profile	<i>A cross-section of all the soil horizons in a specific soil</i>	

Term	Definition	How I Remember
Clay	Soil with particles less than 0.002 millimeter in diameter	
Silt	Soil with particles 0.002–0.05 millimeter in diameter	
Sand	Soil with particles 0.05–2 millimeters in diameter	On the beach, I can see individual grains of sand, so I can remember that sand is the biggest of the three particle sizes.
Loam	Soil with a relatively even mixture of the three particle sizes	

Soil Formation

1. Mineral matter and organic matter together make up about 50 percent of soil. What two substances make up the other 50 percent?

Air, water

For Questions 2–4, write True if the statement is true. If the statement is false, replace the underlined word or words to make the statement true. Write your changes on the line.

True _____ 2. Parent material is the base geological material from which soil is formed.

first _____ 3. Weathering is often the last process in soil formation.

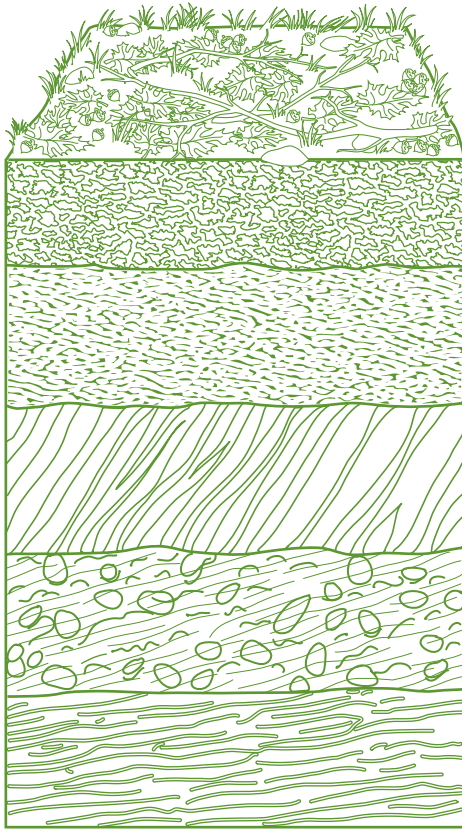
Decomposition _____ 4. Deposition of formerly living things allows nutrients to be incorporated into soil.

Soil Horizons

5. Why is topsoil crucial for agriculture?

Topsoil has the most plant nutrients available.

6. **Think Visually** Label the diagram with the name and a description of each soil horizon. The first one has been done for you.



O Horizon: Litter layer
Consists mostly of organic matter

A Horizon: Topsoil
Sample answer: Consists of organic material mixed with minerals

E Horizon: Leaching layer
Sample answer: Minerals and organic matter leach out of this layer to the layer below.

B Horizon: Subsoil
Sample answer: Where minerals and organic matter from the leaching accumulate

C Horizon: Weathered parent material
Sample answer: Consists mostly of unaltered or only slightly altered parent material

R Horizon: Parent material
Sample answer: The underlying material from which soil is formed

Soil Characteristics

For Questions 7 and 8, circle the letter of the correct answer.

7. Soil texture is based on
- A. fertility.
 - B.** particle size.
 - C. acidity or alkalinity.
 - D. the arrangement of soil particles.
8. The type of soil with the smallest average particle size is
- A. silt.
 - B.** clay.
 - C. sand.
 - D. loam.
9. Explain how the size of pores between particles in soil affect plant growth.

Sample answer: Generally, the smaller the spaces between particles of soil, the harder it is for water and air to reach a plant's roots.



SKILL BUILDER Organize Information

10. Fill in the table by identifying the three main processes involved in soil formation and the four main characteristics used in soil classification.

Soil	
Is Formed By	Is Classified By
<p><i>Weathering</i></p> <p><i>Deposition</i></p> <p><i>Decomposition</i></p>	<p><i>Color</i></p> <p><i>Texture</i></p> <p><i>Structure</i></p> <p><i>pH</i></p>

EXTENSION On a separate sheet of paper, redraw this table. Add a third column labeled "Is Influenced By." Then, fill in three factors that influence the formation of soil. *Answers will vary, but include climate, organisms, landforms, parent material, and time.*

12.1 SELF-CHECK

Answer the questions to test your knowledge of lesson concepts. You can check your work using the answers on the bottom of the page.

11. Explain the roles of physical and chemical weathering in soil formation.

12. Identify two common characteristics of soil as you move downward through the lower horizons.

13. What does the color of soil indicate about its fertility?

11. Sample answer: Physical weathering causes rocks to break down into smaller particles; chemical weathering changes parent material into other materials. 12. As you move downward through a soil profile, particle size increases and the concentration of organic material decreases. 13. Sample answer: Darker soil has a higher concentration of humus and nutrients than pale soil; therefore, it is more fertile.

12.2 Soil Degradation and Conservation

Key Concepts

-  Certain farming, ranching, and forestry practices can erode soil, but other practices can protect it.
-  Desertification reduces productivity of arid lands.
-  U.S. and international agricultural organizations promote soil conservation.
-  Irrigation and pesticide use can improve soil productivity in the short term, but they can pollute soil in the long term.



SKILL BUILDER Vocabulary Preview

Define each vocabulary term in your own words. Then, write yourself a quick note on how you will remember each. One term has been done for you.

Term	Definition	How I Remember
Soil degradation	<i>The deterioration of soil characteristics needed for plant growth or other ecosystem services</i>	<i>Accept all reasonable responses for How I Remember. A few samples are provided.</i>
Intercropping	<i>Planting different crops in mixed arrangements</i>	<i>The prefix inter- means "between," so intercropping means "planting crops between other crops."</i>
Crop rotation	<i>Alternating the crops grown in a field</i>	
Cover crop	A crop planted to reduce erosion after a field has been harvested and before the next planting	A cover crop covers the soil, reducing its exposure to wind and rain.
Shelterbelt	<i>A row of trees or other tall perennial plants that are planted at the edges of a field to slow the wind</i>	
Tilling	<i>The turning-over of soil before planting</i>	<i>Tilling and turning both start with T.</i>
Terracing	<i>Turning a steep slope into a series of steps</i>	

Term	Definition	How I Remember
Contour farming	<i>Planting on a hill that has been plowed sideways, perpendicular to its slope</i>	<i>I think of contour lines showing the elevation of a hill on a topographic map.</i>
Overgrazing	<i>Too many animals eating too much plant cover, impeding regrowth</i>	<i>I know cows eat by grazing, so I think of cows eating too much of the grass from an area.</i>
Desertification	<i>A loss of more than 10 percent of productivity due to erosion or other factors</i>	
Irrigation	<i>Providing water other than precipitation to crops</i>	
Salinization	<i>The buildup of salts in upper soil horizons</i>	
Pesticide	<i>A chemical that kills organisms that attack or compete with plants we value</i>	



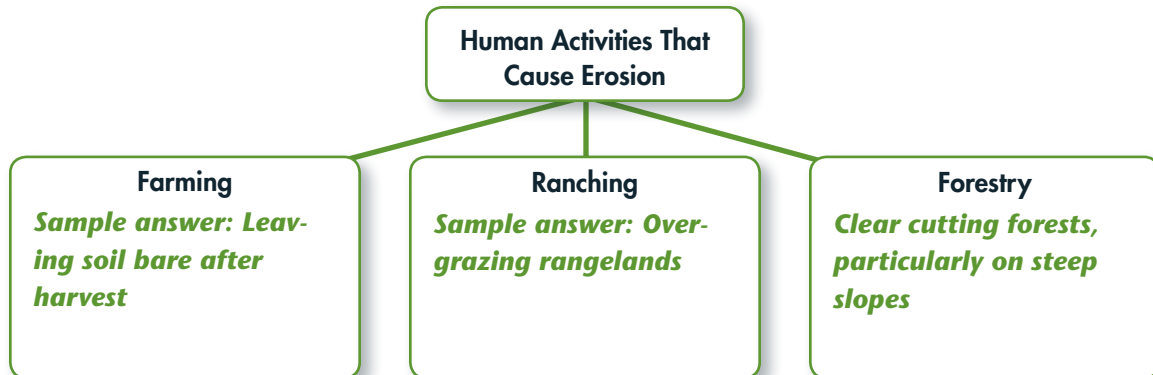
SKILL BUILDER Reading Strategy

As you read the lesson, take notes on key words covered under the heading. Make an outline and summarize lesson concepts in the chart below.

<p>Key Words <i>Answers will vary.</i></p>	<p>Outline Notes for each heading will vary.</p> <p>Erosion</p> <ul style="list-style-type: none"> -Farming Practices -Ranching Practices -Forestry Practices <p>Desertification</p> <ul style="list-style-type: none"> -Global Desertification -The Dust Bowl <p>Soil Conservation Policies</p> <ul style="list-style-type: none"> -U.S. Policies -International Programs <p>Soil Pollution</p> <ul style="list-style-type: none"> -Irrigation -Pesticides
<p>Summary <i>Answers will vary.</i></p>	

Erosion

1.  **Organize Information** Fill in the cluster diagram with short descriptions of the ways that specific human activities can cause erosion.



2. Describe two farming practices that can reduce erosion.

Sample answer: Planting cover crops after a field is harvested is one way to reduce erosion. Cover crops hold soil in place for the next season's planting. Terracing also reduces erosion. Changing a steep slope into a series of terraces, or steps, keeps soil and water from running straight down the side of the slope.

3. Describe a positive feedback cycle produced by overgrazing.

Sample answer: When animals remove too much plant cover, more soil is exposed, allowing for more erosion. Soil erosion makes it difficult for vegetation to regrow, allowing for even more erosion.

Desertification

4. List eight factors that contribute to desertification.

Erosion, soil compaction, forest removal, overgrazing, drought, salt buildup, climate change, depletion of water sources

5. Why is desertification a global problem?

Desertification is a global problem because it doesn't follow national boundaries. Gigantic dust storms from desertified land can even cross oceans.

Soil Conservation Policies

6. What environmental event in the 1930s led the U.S. government to formalize its soil conservation policies?

The Dust Bowl

7. Write a brief paragraph that describes one policy or organization that promotes soil conservation.

Sample answer: The Soil Conservation Act was passed in 1935 to help farmers preserve their land. The act also created the Soil Conservation Service, which was renamed the Natural Resources Conservation Service in 1994. When it was renamed, its scope was increased to include water quality protection and pollution control.

Soil Pollution

8. Compare and contrast pollution caused by irrigation and by pesticides.

Sample answer: Both irrigation and pesticides help crops grow, but both have disadvantages. Irrigation leaves behind salts as water evaporates. Certain pesticides kill pests, but they also kill helpful insects; and toxic pesticides can remain in the soil or filter into groundwater.

For Questions 9 and 10, complete each statement by writing in the correct word.

9. The best way to prevent salinization in dry areas is to plant crops that do not need a lot of water.

10. Drip irrigation is efficient because it gets water directly to a plant's roots.

12.2 SELF-CHECK

Answer the questions to test your knowledge of lesson concepts. You can check your work using the answers on the bottom of the page.

11. Write a sentence that shows the relationship between the terms *erosion* and *desertification*.





12. Identify one thing shelterbelts and terracing have in common. _____

13. Explain the role of farming and ranching in the formation of the Dust Bowl. _____

11. Sample answer: Erosion is one cause of desertification. 12. Sample answer: Both are farming methods that reduce erosion. 13. Sample answer: Farming and ranching removed native grasses, which left the soil exposed. During a drought, strong winds carried away the exposed topsoil.

12.3 Agriculture

Key Concepts

-  Agriculture began about 10,000 years ago, when a warmer climate enabled humans to plant seeds and raise livestock.
-  Industrial agriculture and the green revolution have saved millions of people from starvation.
-  Chemical pesticides, biological pest control, and integrated pest management can all effectively protect crops from pests.
-  Insects and other animals are essential to the reproduction of many crops.



SKILL BUILDER Vocabulary Preview

Define each vocabulary term in your own words. Then, write yourself a quick note on how you will remember each. One term has been done for you.

Term	Definition	How I Remember
Traditional agriculture	<i>Farming that relies on human and animal power, along with hand tools and nonmotorized machines</i>	<i>Accept all reasonable responses for How I Remember. A few samples are provided.</i>
Yield	<i>The amount of a crop produced in a given area</i>	
Industrial agriculture	<i>Farming that relies on mechanized technology and fossil fuels, manufactured chemicals, and irrigation</i>	<i>I know that industry uses machines, so I can remember that industrial agriculture uses machines for farming.</i>
Green revolution	A movement in which agricultural scientists from developed nations introduced new technology, crop varieties, and farming practices to the developing world	The green revolution increased the number of green plants that could grow in developing nations.
Biological pest control	<i>Battling pests or weeds with organisms that eat or infect them</i>	<i>The prefix bio- means "living," so biological pest control uses living things to control pests.</i>

Term	Definition	How I Remember
Integrated pest management (IPM)	Combining different techniques to achieve the most effective long-term pest reduction	
Pollinator	An animal that feeds on flower nectar, collects pollen on its body, and takes it to the next flower	



SKILL BUILDER Reading Strategy

Before you read the lesson, fill in the first column of the KWL chart below with what you already know about how agriculture has changed over time. Fill in the second column with what you want to know about this topic. After you have read the lesson, fill in the third column with what you have learned.

I Know	I Want to Know	I Learned
Sample answer: I know that farms today are very different from farms long ago.	Sample answer: What impact do the chemicals and machines modern farmers use have on the environment?	Sample answer: Modern farming techniques have both costs and benefits.

Development of Agriculture

1. What environmental change occurred on Earth 10,000 years ago that allowed humans to plant seeds and raise livestock?

The climate warmed.

2. Describe selective breeding.

Sample answer: Selective breeding is choosing which seeds to plant or which livestock to breed based on the characteristics of the plants or animals.

10.  **Organize Information** Fill in the table with a description of each type of pest management.

Type of Pest Management	Description
Chemical pesticides	<i>Chemicals developed to kill pests</i>
Biological pest control	<i>Using living things that control pests by eating or infecting them</i>
Integrated pest management (IPM)	<i>Using a combination of techniques such as biological pest control, habitat alteration, crop rotation, mechanical pest removal, and chemical pesticides to control pests</i>

Pollinators

11. Describe the role pollinators play in agriculture.

Sample answer: Pollinators transfer pollen from one flower to another. Without pollinators, fruit plants and other crops would not be able to reproduce.

12. Identify two factors that have reduced the populations of pollinators.

Sample answer: Pesticides, parasites

12.3 SELF-CHECK

Answer the questions to test your knowledge of lesson concepts. You can check your work using the answers on the bottom of the page.





13. Compare the yields of traditional agriculture and industrial agriculture.

14. Identify one way that the Industrial Revolution changed agriculture.

13. Industrial agriculture typically produces greater yields than traditional agriculture. 14. Sample answer: The Industrial Revolution introduced fossil-fuel engines to agriculture, which gave farmers more efficient ways to harvest, process, and transport crops.

12.4 Food Production

Key Concepts

-  Because hunger continues and the population is growing, we need to find a way to increase food production sustainably.
-  Genetically modified food is a promising way to increase food production, but there needs to be more research into potential risks.
-  Feedlots, aquaculture, and other methods of industrial food production are efficient, but they have disadvantages.
-  Sustainable alternatives to industrial agriculture include organic agriculture and locally supported agriculture.



SKILL BUILDER Vocabulary Preview

Define each vocabulary term in your own words. Then, write yourself a quick note on how you will remember each. One term has been done for you.

Term	Definition	How I Remember
Arable land	<i>Land suitable for farming</i>	<i>Accept all reasonable responses for How I Remember. A few samples are provided.</i>
Food security	<i>The guarantee of an adequate and reliable food supply for all people at all times</i>	
Malnutrition	A shortage of nutrients the body needs	The prefix <i>mal-</i> means “bad,” so <i>malnutrition</i> means “bad or poor nutrition.”
Genetic engineering	<i>Any process in which scientists directly manipulate an organism’s DNA</i>	
Genetically modified (GM) organism	<i>An organism that has undergone genetic engineering</i>	

Term	Definition	How I Remember
Biotechnology	<i>The use of genetic engineering to introduce new genes into organisms to produce more valuable products</i>	<i>I can look at the prefix bio-, which means "living," and at the word technology, which means "the application of science."</i>
Feedlot	<i>A huge warehouse or pen designed to deliver energy-rich food to livestock or poultry</i>	<i>I think of how a lot of animals are fed in a feedlot.</i>
Aquaculture	<i>Raising aquatic organisms for food in a controlled environment</i>	<i>Aqua is the Latin word for "water," which gives me a clue to the meaning of aquatic.</i>
Seed bank	<i>An organization that preserves seeds to preserve the genetic diversity of crops</i>	
Sustainable agriculture	<i>Agriculture that does not deplete soil faster than it forms</i>	
Organic agriculture	<i>Food-growing practices that use no synthetic fertilizers, insecticides, fungicides, or herbicides</i>	

Food Security

1. Identify three things that are required to make the food supply secure.

Maintaining healthy soil and water, protecting the biodiversity of food sources, distributing food safely

2. Describe the disease that results when people eat too little protein.

Kwashiorkor results; it causes bloating of the abdomen, poor hair quality, mental disability, lowered immunity, developmental delays in children, and anemia.

Genetically Modified Organisms

3. Identify one potential risk of GM crops.

Sample answer: Introducing GM genes into wild plants

4. Identify two potential benefits of GM crops.

Sample answer: Decreased reliance on chemical pesticides, reduced carbon emissions

5. Crops with GM traits that could benefit farmers in developing nations—increased nutrients, drought tolerance, and salinity tolerance—are not widely available. Why do you think this is so?

Sample answer: *Corporations have little economic incentive to develop crops that poor farmers cannot afford to plant.*

Industrial Food Production

6.  **Organize Information** Fill in the table by identifying one advantage and one disadvantage for each method of industrial food production.

Method of Food Production	Advantage	Disadvantage
Feedlots	Sample answer: <i>Animals in feedlots do not degrade soil through overgrazing.</i>	Sample answer: <i>Animals in feedlots require heavy doses of antibiotics to stay healthy, which can end up in groundwater and in the people who eat animal products.</i>
Aquaculture	Sample answer: <i>Aquaculture protects populations of wild aquatic animals.</i>	Sample answer: <i>Diseases spread easily through dense populations of aquatic organisms.</i>

7. Why is plant diversity important to the world's food supply?

Sample answer: *As the number of plant varieties goes down, the risk of a pest's destroying an entire crop rises.*

Sustainable Agriculture

For Questions 8–10, write True if the statement is true. If the statement is false, replace the underlined word or words to make the statement true. Write your changes on the line.

- True** _____ 8. Sustainable agriculture does not deplete soil faster than it forms.
- increased** _____ 9. In recent years, the market for organic produce has decreased sharply.
- True** _____ 10. A partnership between consumers and local farms is known as community-supported agriculture.

11. Is the demand for organic foods in the United States increasing or decreasing over time? Explain your answer.

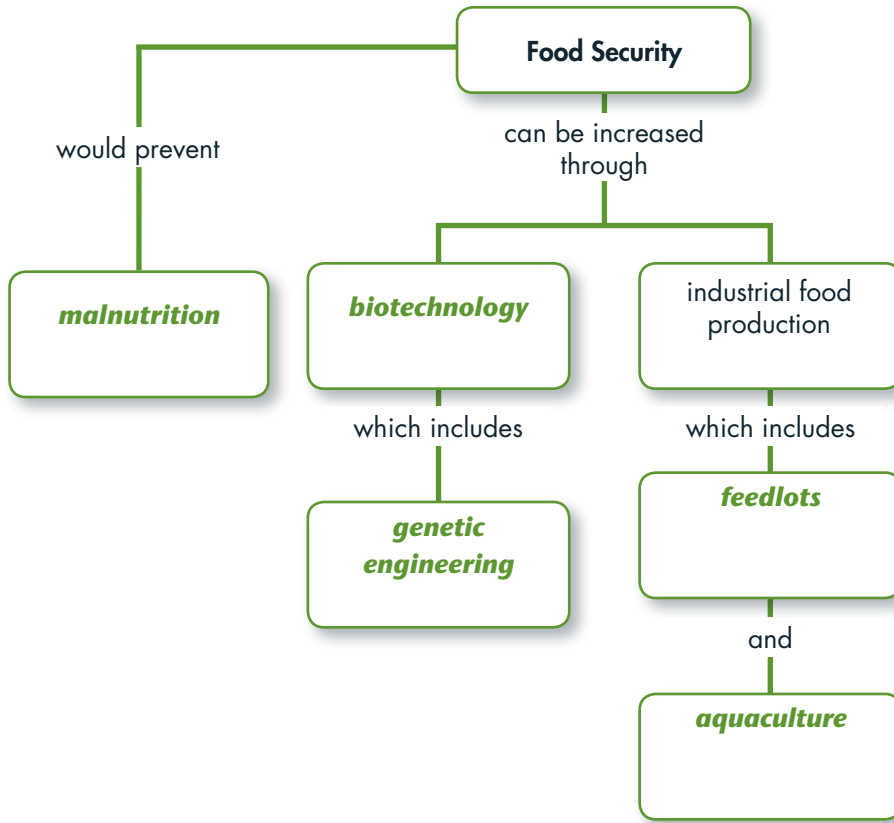
Sample answer: *Increasing; organic foods sales increased 200 percent over just nine years.*



SKILL BUILDER Organize Information

12. Fill in the concept map with terms from the word bank.

aquaculture biotechnology feedlots
genetic engineering malnutrition



12.4 SELF-CHECK

Answer the questions to test your knowledge of lesson concepts. You can check your work using the answers on the bottom of the page.

13. How is the availability of arable land related to the need for increased agricultural production? _____

14. What are two benefits of buying locally grown food? _____

13. Sample answer: There is not much more arable land available, so production on currently used land must increase to meet the increasing need for food. 14. Sample answer: Locally grown food is typically fresher than food that has traveled long distances. Also, buying food grown locally boosts local economies.

Chapter Vocabulary Review

Write a definition for each of the following terms.

1. Sustainable agriculture ***Agriculture that does not deplete soil faster than it forms***

2. Weathering ***The physical and chemical processes that break down rocks and minerals into smaller particles***

3. Irrigation ***Providing water other than precipitation to crops***

4. Yield ***The amount of crop that grows in a given area***

5. Soil profile ***A cross-section of all the soil horizons in a specific soil***

6. Bedrock ***The continuous mass of solid rock that makes up Earth's crust***

7. Aquaculture ***Raising aquatic organisms for food in a controlled environment***

8. Terracing ***Turning a steep slope into a series of steps for farming***

Write a sentence that shows the relationship between the terms.

9. Biological pest control, integrated pest management ***Sample answer: Biological pest control is one technique that can be included in an integrated pest management plan.***
10. Traditional agriculture, industrial agriculture, yield ***Sample answer: Industrial agriculture has greater yields than traditional agriculture.***

EXTENSION On a separate sheet of paper, write a letter that will convince a friend to buy locally produced food. Your letter should include at least four vocabulary terms from the chapter. Underline each of the vocabulary terms you use.

Answers will vary, but could include GM crops, feedlots, aquaculture, sustainable agriculture, and organic agriculture.



Ecological Footprints



Food Transportation Costs

In this activity, you will calculate the daily and annual food transportation costs for different groups of people.

Calculating Daily Costs

The price you pay for food includes the transportation costs of getting the food from the fields to your table. The daily cost of food transportation for one person equals about \$1.50.

To find the daily food transportation cost for a group of people, multiply the daily cost for one person, \$1.50, by the number of people.

► The calculation of the daily food transportation cost for people living in the United States in 2010 (about 309 million) is modeled at the right:

$$\begin{aligned} \text{daily cost} &= \text{number of people} \times \text{daily cost for 1 person} \\ &= 309 \text{ million} \times \$1.50 \\ &= \$463.5 \text{ million} \end{aligned}$$

- Record the number of people in your class, your town, and your state. Then, calculate the daily cost of food transportation for each group. Write your answers in the table.

Daily costs will vary depending on class size and current populations.

	Number of People	Daily Cost	Annual Cost
You	1	\$1.50	\$547.50
Your class			
Your town			
Your state			
United States	309 million	\$463.5 million	<i>\$169,177.5 million, or about \$169 billion</i>

Calculating Annual Costs

To find the annual transportation cost, multiply the daily cost by 365.

► The calculation of the annual cost for one person is modeled at the right:

$$\begin{aligned} \text{annual cost} &= \text{daily cost} \times 365 \\ &= \$1.50 \times 365 \\ &= \$547.50 \end{aligned}$$

- Calculate the annual cost of food transportation for each group in the table. Write your answers in the table.

Annual costs will vary depending on class size and current populations.

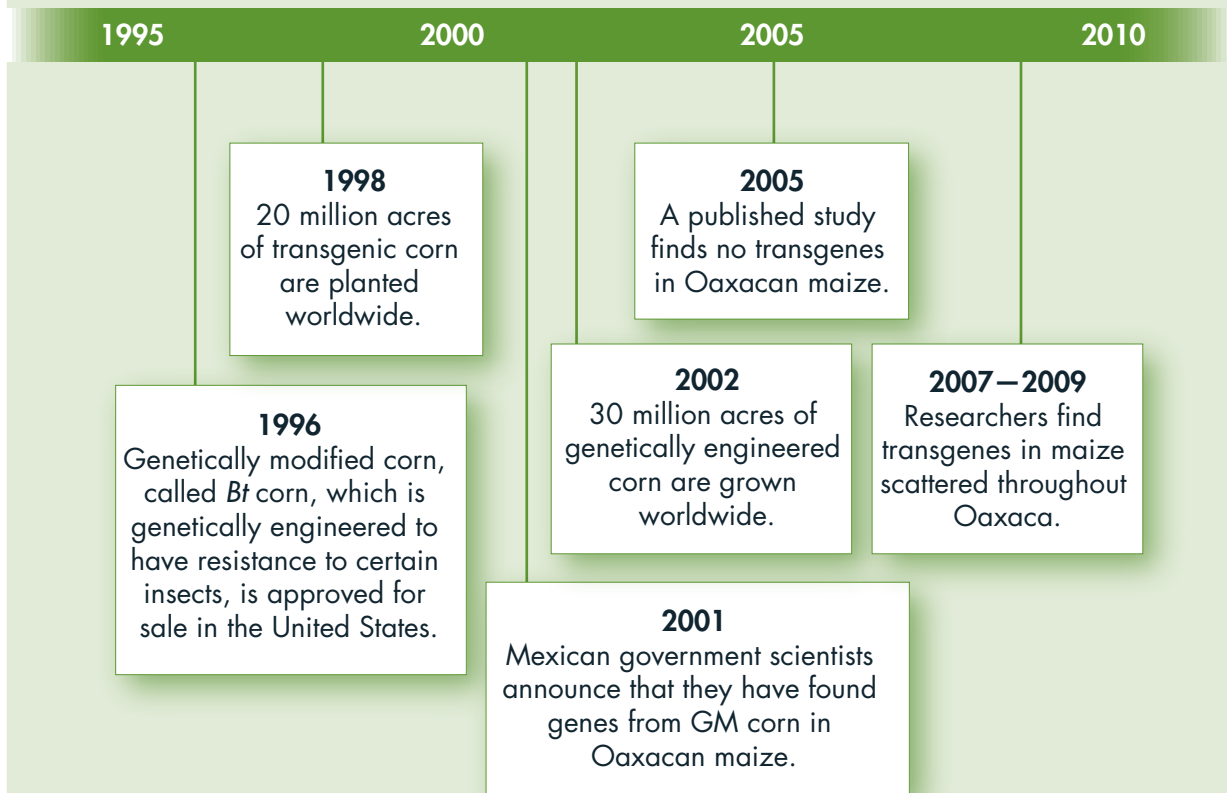


Possible Transgenic **MAIZE** in **OAXACA**, Mexico

Transgenic Crops

Transgenic crops are fast becoming more important to the world's food supply. Nations where transgenic crops are widely grown point to reduced dependence on pesticides and increased yields. But not all nations approve of genetically modified crops.

Some are concerned that inserted genes will become part of the genetic makeup of native wild plants through crossbreeding. The timeline below summarizes information about maize in Oaxaca and the distribution of transgenic corn worldwide.



Corn has a great importance as a food crop in Mexico. It also has tremendous cultural significance. After all, Oaxaca, Mexico, was the site where wild corn was first bred for desirable traits. It is no surprise, then, that the Mexican government has been actively involved in regulating the use of transgenic corn in Mexico. Before 1998, transgenic corn was grown in some experimental plots in Mexico. In 1998, the

Mexican government passed legislation that banned the use of transgenic corn in Mexico. For 11 years, experimental cultivation of transgenic corn was not permitted. In 2009, new legislation was passed that now permits the cultivation of transgenic corn on experimental plots. So, the story of transgenic corn in Mexico will continue to unfold in the coming years.

Use the information from **Transgenic Crops** to answer the questions below.

1. Explain how the information in the timeline could lead people to different conclusions about the impact of GM corn on native maize species.

Answers will vary. Accept any response that mentions the conflicting results of studies shown in the timeline.

2. Use the information in the timeline to infer whether the risk of contamination of native plants with transgenes is becoming more likely or less likely over time. Explain your answer.

Answers will vary, but should reflect an understanding that the number of acres of transgenic corn, and therefore the risk of contamination of native plants with transgenes, is increasing over time.

3. Notice that the information about the number of acres of transgenic corn provided in the timeline is for the entire world. Different nations have different regulations about transgenic plants. Give one reason why national regulations on transgenic crops might not prevent transgenes from showing up in another nation's wild plants.

Answers will vary, but should reflect an understanding that transgenes can move across national boundaries and that national regulations may not prevent them from integrating with another nation's plant species.

4. **BIG QUESTION** Use the information in the timeline to explain how transgenic corn can help people balance the growing demand for food and the need to protect the environment.

Sample answer: There has been a large increase in the amount of GM corn being grown, so more people can be fed. This is good for the environment because fewer pesticides are needed to grow GM corn. But it is still not clear how native plants might be affected.

21st Century Skills

Find out more about transgenic food crops and regulations associated with their use. With a small group, discuss what you have learned. Then, decide what regulations you think should be placed on the use or importation of transgenic food crops. Share your opinion with the class.

*The 21st Century Skills used in this activity include **Information, Communication, and Technology (ICT) Literacy; Communication and Collaboration; and Media Literacy.***



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*Log on for more information and activities on the Central Case, **Possible Transgenic Maize In Oaxaca, Mexico.***