

Grade 5 Science

Unit 4: Protecting Earth's Resources

15 lessons and a unit quiz. Use this pack with the **Protecting Earth's Resources Student Reader** (print it, or download it once from the course) to teach the whole unit without the internet.

What is in this pack

- A lesson plan for each chapter: the Big Question, words to know, which pages to read, questions to talk over and the activity pages.
- The unit quiz, ready to print.
- Answers for the teacher at the back: every discussion question and the quiz key.

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Lesson schedule

Two or three lessons a week, about 30 minutes each. Tick each one off as you go.

	Lesson	Reader pages	Activity pages
☐	Lesson 1: Developing Solutions for Ecosystem Problems	—	AP 1.1, AP 1.2, AP 1.3
☐	Lesson 2: Water Resources	PDF pages 7-12	AP 2.1, AP 2.2, AP 2.3
☐	Lesson 3: Water Resources, Problems, and Solutions	PDF pages 13-20	AP 3.1, AP 3.2
☐	Lesson 4: Researching Water Stewardship	—	AP 4.1, AP 4.2, AP 4.3
☐	Lesson 5: Water Protection Action Plan	—	AP 5.1, AP 5.2
☐	Lesson 6: Air Pollution	PDF pages 21-26	AP 6.1
☐	Lesson 7: The Need for Clean Air	PDF pages 27-32	AP 7.1
☐	Lesson 8: Researching Air Quality Protection	—	AP 8.1, AP 8.2
☐	Lesson 9: Air Quality Action Plan	—	AP 9.1, AP 9.2
☐	Lesson 10: Land Contamination	PDF pages 33-36	AP 10.1, AP 10.2
☐	Lesson 11: Living Off the Land	PDF pages 37-42	AP 11.1, AP 11.2
☐	Lesson 12: Researching Use of Land Resources	—	AP 12.1
☐	Lesson 13: Land Resource Action Plan	—	AP 13.1, AP 13.2
☐	Lesson 14: Sharing the Environment	PDF pages 43-50	AP 14.1, AP 14.2
☐	Lesson 15: Researching Environmental Protection	—	AP 15.1, AP 15.2, AP 15.3
☐	Unit review and assessment	—	AP UC.1, AP UC.2, AP UC.3
☐	Words quiz	—	—

Page numbers are the PDF page numbers of the Student Reader file, so they match what your PDF reader shows.

Lesson 1: Developing Solutions for Ecosystem Problems

THE BIG QUESTION

What is an environmental protection action plan?
Problem-Based Learning Project: Investigate the effects of human activities on natural resources, and determine recommended actions to reduce negative impacts on ecosystems.

Words to know

- **problem** — a want or a need
- **natural resource** — materials that occur in nature that can be used by people
- **ecosystem** — all the living and nonliving things that interact in a given area
- **action plan** — a set of steps needed to complete a successful project
- **environmental protection** — the practice of taking care of land, water, air, and living things
- **reliable source information** — authoritative information from competent, knowledgeable people without any conflicts of interest

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 27–33: the steps, materials and timing for this lesson.

Talk it over

1. What are Earth's interacting systems?
2. How do Earth's systems interact?
3. What is a natural resource?
4. What are examples of natural resources?
5. Why do people use natural resources?
6. How might human use of natural resources affect local ecosystems?
7. What could the difference between a plan and an action plan be?
8. What is the difference between an ecosystem and a community?
9. What can people do to protect our environment?
10. Does every problem have a solution?
11. Why is it important to use reliable source information when solving problems?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: What is an environmental protection action plan? Problem-Based Learning Project: Investigate the effects of human activities on natural resources, and determine recommended actions to reduce negative impacts on ecosystems.
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 1.1: Community Information Board — Teacher Guide PDF page 132
- Activity Page 1.2: Name the Resource — Teacher Guide PDF page 133
- Activity Page 1.3: Check — Teacher Guide PDF page 134

Lesson 2: Water Resources

THE BIG QUESTION

What is water quality? Problem-Based Learning Project: Investigate the effects of human activities on water resources to support determination of recommended actions to reduce negative impacts on ecosystems.

Words to know

- **wastewater** — water that has been used by people
- **water treatment plant** — a facility that cleans wastewater before it is discharged into the environment
- **bacteria** — tiny organisms that break down matter
- **disinfection** — the process of cleaning infection from a material
- **water quality testing** — methods to measure the types and amounts of chemicals in water
- **algal bloom** — rapid growth of microscopic algae in a body of water

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 35–43: the steps, materials and timing for this lesson.

Read

Read Student Reader, Chapter 1: “Water Resources”: PDF pages 7–12. Look at the pictures and maps together.

Talk it over

1. Where does clean water come from?
2. What could happen if you drank water from a river?
3. What happens to water when it is used to clean things such as clothes and dishes?
4. What happens to rainwater when it washes across a parking lot?
5. What happens to water that goes down drains in a street?
6. What kinds of human activities could affect the quality of water?
7. In what ways could water be affected by human activities?
8. How does water get to the faucet?
9. How does water leave the sink?
10. Where does water go after it goes down the sink?
11. What do you notice about the structure of the drain pipes compared to the pipes that lead to the faucet?

12. What is the function of the U-bend in the drain pipe?
13. What are common sources of wastewater from your daily activities?
14. Why must dirt, germs, and chemicals be removed from wastewater?
15. What is the order of steps in wastewater treatment?
16. Why is disinfection used as the last step before release?
17. What chemicals did you use to clean the dishes?
18. How can you ensure that soap used for cleaning is safe?
19. How does phosphate enter water?
20. Why is phosphate bad for the environment?
21. Why is water quality testing necessary?
22. What are the consequences of algal blooms?
23. What are some positive things that bacteria do?
24. What are some negative things that bacteria do?
25. What is an infection?
26. What is a disinfectant?
27. How is wastewater different from wasting water?
28. Why is water quality testing important?
29. What would happen if water were not treated?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: What is water quality? Problem-Based Learning Project: Investigate the effects of human activities on water resources to support determination of recommended actions to reduce negative impacts on ecosystems.
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 2.1: Human Activities and Water — Teacher Guide PDF page 135
- Activity Page 2.2: Cleaning Water — Teacher Guide PDF page 136
- Activity Page 2.3: Check — Teacher Guide PDF page 137

Lesson 3: Water Resources, Problems, and Solutions

THE BIG QUESTION

How can human activities affect the quality of water?
Problem-Based Learning Project: Investigate the effects of human activities on water resources to support determination of recommended actions to reduce negative impacts on ecosystems.

Words to know

- **fresh water** — water that is usable by humans for things such as drinking and cleaning
- **groundwater** — water stored in the spaces between materials beneath Earth's surface
- **surface water** — fresh water found in rivers, streams, and lakes on Earth's surface
- **conserve** — to save or protect
- **pollutant** — an artificial or natural substance that contaminates air, water, or soil
- **water pollution** — the presence of harmful substances or matter in water
- **pathogen** — a microorganism that can cause disease

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 44–51: the steps, materials and timing for this lesson.

Read

Read Student Reader, Chapter 2: "Water Resources, Problems, and Solutions": PDF pages 13–20. Look at the pictures and maps together.

Talk it over

1. What do you use to wash your hands?
2. What happens when you wash your hands?
3. What other human activities could affect the quality of water?
4. Why is water important?
5. How do humans affect Earth's water resources in positive and negative ways?
6. What evidence would show that people affect water in a positive way? In a negative way?
7. How can ecosystems be harmed if people use too much water?
8. How have people used science and technology to help keep water safe?

9. Why are Earth and Mars different colors?
10. What is the result of there being no water on Mars?
11. Why must we protect water resources?
12. What is a place called that has little water?
13. How is groundwater different from surface water?
14. What are some things that people can do to use less water?
15. How can using less water help local ecosystems?
16. Why do farmers apply certain chemicals to their crops?
17. What happens to chemicals used by farmers?
18. What happens when oil spills into water?
19. How can oil be removed from water?
20. Why is it important not to remove the tiny plants and animals when removing plastic from the water?
21. Why should cities have clean-up days?
22. What can people do locally during clean-up days?
23. How can water be treated to remove germs?
24. How could hikers make water from streams safe to drink?
25. What are some things you can conserve?
26. What are some local bodies of water that would be considered fresh water?
27. Why shouldn't people dump waste in water sources?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: How can human activities affect the quality of water? Problem-Based Learning Project: Investigate the effects of human activities on water resources to support determination of recommended actions to reduce negative impacts on ecosystems.
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 3.1: Water Pollution Sources — Teacher Guide PDF page 138
- Activity Page 3.2: Check — Teacher Guide PDF page 139

Lesson 4: Researching Water Stewardship

THE BIG QUESTION

How does water pollution spread? Problem-Based Learning Project: Investigate options for protecting water resources to support determination of recommended actions to reduce negative impacts on ecosystems.

Words to know

- **water pollution** — the presence of harmful substances or matter in water
- **stewardship** — the responsibility of taking care of something

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 52-57: the steps, materials and timing for this lesson.

Talk it over

1. What is affecting the water resource in the picture?
2. How is the ecosystem affected by the use of water in this picture?
3. How does pollution get into the ocean?
4. How does pollution affect plants and animals when it enters the ocean?
5. What does the water represent?
6. What does the food coloring represent?
7. What does the pebble represent?
8. What is the purpose of the ice cubes?
9. What do you observe about the "pollution"?
10. What can good stewards of water do?
11. How does water become polluted in our community?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: How does water pollution spread? Problem-Based Learning Project: Investigate options for protecting water resources to support determination of recommended actions to reduce negative impacts on ecosystems.
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 4.1: Z-Chart — Teacher Guide PDF page 140
- Activity Page 4.2: How Pollution Spreads — Teacher Guide PDF page 141

- Activity Page 4.3: Check — Teacher Guide PDF pages 142–143

Lesson 5: Water Protection Action Plan

THE BIG QUESTION

How can we protect our local water resources?

Problem-Based Learning Project: Recommend actions to reduce negative impacts on water resources.

Words to know

- **water pollution** — the presence of harmful substances or matter in water
- **action plan** — a set of steps needed to complete a successful project

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 58–63: the steps, materials and timing for this lesson.

Talk it over

1. How could an oil spill in a river be prevented?
2. How could a farmer prevent pollution from farm chemicals?
3. How could a city prevent pollution from entering the drinking water?
4. How could a factory prevent pollution caused by releasing toxic chemicals into water?
5. How could a city use less water?
6. What is the basic purpose of a plan?
7. What kinds of goals should a plan help to accomplish?
8. What should a plan begin with?
9. How should a plan address its purpose?
10. How should a plan be organized?
11. What would be on an action plan for stewardship of local water quality?
12. What is the difference between polluted and clean water?
13. What water problem did you describe?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: How can we protect our local water resources? Problem-Based Learning Project: Recommend actions to reduce negative impacts on water resources.
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 5.1: Water Resources Action Plan — Teacher Guide PDF page 144
- Activity Page 5.2: Check — Teacher Guide PDF page 145

Lesson 6: Air Pollution

THE BIG QUESTION

What is air pollution? Problem-Based Learning Project: Investigate the effects of human activities on air quality to support determination of recommended actions to reduce negative impacts on ecosystems.

Words to know

- **air pollution** — any type of substance that is in air and makes it unsafe to breathe
- **smog** — a type of air pollution that results from a mixture of gases from burning fuels, air, and sunlight that makes air look hazy

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 65–70: the steps, materials and timing for this lesson.

Read

Read Student Reader, Chapter 3: “Air Pollution”: PDF pages 21–26. Look at the pictures and maps together.

Talk it over

1. Why do you think the people in the photo are wearing masks?
2. What could be in the air that makes it dangerous for people to breathe?
3. What are some ways that air can become polluted?
4. What are some effects of air pollution on humans?
5. Why might cities have more air pollution than other places?
6. What do the solutions that these cities have used to help reverse air pollution have in common?
7. What do plants need to live?
8. How do plants “clean” air?
9. How does carbon dioxide get into the air?
10. How could deforestation affect air quality?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: What is air pollution? Problem-Based Learning Project: Investigate the effects of human activities on air quality to support determination of recommended actions to reduce negative impacts on ecosystems.
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 6.1: Testing Air Quality — Teacher Guide PDF page 146

Lesson 7: The Need for Clean Air

THE BIG QUESTION

How can human activity affect the quality of air?

Problem-Based Learning Project: Investigate the effects of human activities on air quality to support determination of recommended actions to reduce negative impacts on ecosystems.

Words to know

- **pollutant** — an artificial or natural substance that contaminates air, water, or soil
- **air quality** — a measure of how clean the air is
- **ozone** — a gas found in air
- **clean energy** — an energy resource that does not release pollutants when it is used
- **Air Quality Index** — a tool government agencies use to communicate air quality information to the public

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 71–76: the steps, materials and timing for this lesson.

Read

Read Student Reader, Chapter 4: “The Need for Clean Air”: PDF pages 27–32. Look at the pictures and maps together.

Talk it over

1. What is wind?
2. What are some materials that can be carried in wind?
3. How can air pollution produced in one place affect people living in another place?
4. What body organs help living things get oxygen from air?
5. What system moves oxygen from the lungs to cells and carries carbon dioxide waste out of the body?
6. What living things do you think would be affected the most by polluted air?
7. How does the EPA measure air quality?
8. How does smoke get into the air?
9. How can smoke affect air quality?
10. Why don't plants grow as well when it is hazy?
11. How do plants help prevent air pollution?
12. What materials do plants need to be able to help with air pollution?

13. What type of air quality does an orange rating indicate?
14. How does a scrubber prevent air pollution?
15. Did the cards placed in the same location have similar results?
16. Have you ever seen evidence of clean energy being used near where you live?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: How can human activity affect the quality of air? Problem-Based Learning Project: Investigate the effects of human activities on air quality to support determination of recommended actions to reduce negative impacts on ecosystems.
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 7.1: Air Quality Index — Teacher Guide PDF page 147

Lesson 8: Researching Air Quality Protection

THE BIG QUESTION

How can we protect air quality? Problem-Based Learning Project: Investigate air quality protection measures to support determination of recommended actions to reduce negative impacts on ecosystems.

Words to know

- **Clean Air Act** — a United States federal law enacted in 1970 to protect people and the environment from the effects of air pollution
- **indoor air pollution** — impurities in indoor air

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 77–81: the steps, materials and timing for this lesson.

Talk it over

1. What could cause the AQI to change?
2. How could people improve the AQI in their area?
3. What sort of daily activities contribute to air pollution?
4. Do you think everyone raised their hand at the same time?
5. What did you see when you observed the match burning?
6. What are some pollutants that could be in the indoor air?
7. How is indoor air monitored?
8. Why are these types of detector devices important?
9. How can people protect air quality indoors?
10. How can people protect air quality outdoors?
11. When you check the EPA website to determine the AQI for your area, what type of air pollution does this measure?
12. How can technology help with monitoring indoor air pollution?
13. How does the AQI today compare to the measurement from yesterday?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: How can we protect air quality? Problem-Based Learning Project: Investigate air quality protection measures to support determination of recommended actions to reduce negative impacts on ecosystems.
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 8.1: Indoor and Outdoor Pollution — Teacher Guide PDF page 148
- Activity Page 8.2: Researching Air Pollution — Teacher Guide PDF page 149

Lesson 9: Air Quality Action Plan

THE BIG QUESTION

How can we protect our local air quality? Problem-Based Learning Project: Recommend actions to reduce negative impacts on air quality.

Words to know

- **air pollution** — any type of substance that is in air and makes it unsafe to breathe
- **cyclone** — a rotating wind

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 82–86: the steps, materials and timing for this lesson.

Talk it over

1. What kinds of places did you mark on the map?
2. Are there any places that contribute to air pollution that cannot be marked on the map?
3. Are there any ways that we can prevent air pollution from these places?
4. What air problem did you describe?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: How can we protect our local air quality? Problem-Based Learning Project: Recommend actions to reduce negative impacts on air quality.
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 9.1: How Can a Cyclone Clean Air? — Teacher Guide PDF page 150
- Activity Page 9.2: Air Quality Action Plan — Teacher Guide PDF page 151

Lesson 10: Land Contamination

THE BIG QUESTION

What is land contamination? Problem-Based Learning Project: Investigate the human activities that contaminate land to support determination of recommended actions to reduce negative impacts on ecosystems.

Words to know

- **contaminated land** — land that contains chemicals that are harmful to the environment
- **biodegradable** — describing material that decays through the action of bacteria or other living organisms
- **landfill** — a place where waste is buried underground

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 88–93: the steps, materials and timing for this lesson.

Read

Read Student Reader, Chapter 5: “Land Contamination”: PDF pages 33–36. Look at the pictures and maps together.

Talk it over

1. Why is land important to people?
2. How is land important to animals?
3. How is land important to plants?
4. Are there any ways to reduce the amount of garbage that goes into the landfill?
5. What can you use instead of some of these items?
6. Even though items can be recycled, such as plastic water bottles, why is it important to use less of these too?
7. What would happen if garbage were not disposed of in a landfill?
8. Why is a landfill often built nearby a water treatment plant?
9. How long can it take for a landfill to become full?
10. What happens to a landfill after it is full?
11. What do all of these lunches have in common?
12. Do you think it would take more time or more money to pack a waste-free lunch?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: What is land contamination?
Problem-Based Learning Project: Investigate the human activities that contaminate land to support determination of recommended actions to reduce negative impacts on ecosystems.
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 10.1: Making a Waste-Free Lunch — Teacher Guide PDF page 152
- Activity Page 10.2: Examining Contaminated Land — Teacher Guide PDF page 153

Lesson 11: Living Off the Land

THE BIG QUESTION

How can human activity contaminate land? Problem-Based Learning Project: Investigate the human activities that contaminate land to support determination of recommended actions to reduce negative impacts on ecosystems.

Words to know

- **biodegradable** — describing material that decays through the action of bacteria or other living organisms
- **survey** — a determination of land boundaries
- **crop rotation** — the practice of changing the type of crop grown in a field each season
- **no-till farming** — the practice of harvesting only the part of the plant needed for food and leaving the rest in the soil
- **green space** — land that is set aside and left without buildings

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 94–99: the steps, materials and timing for this lesson.

Read

Read Student Reader, Chapter 6: “Living Off the Land”: PDF pages 37–42. Look at the pictures and maps together.

Talk it over

1. What resources do we get from the land?
2. What types of food do we get from land?
3. Is there any way that frozen land can become contaminated?
4. What do people need to do to land to build a home or apartment?
5. What other animals build their homes underground?
6. What happens to an animal if the land where it lives becomes contaminated?
7. What happens to a plant if the land becomes contaminated?
8. Why is a land survey important?
9. What types of tools help people conduct surveys?
10. How can rotating crops help soil?
11. How can no-till farming keep soil healthy?
12. What can cause soil to erode?

13. How do strip mines contaminate land?
14. When people clear the land, how does it affect the ecosystem?
15. How does the soil change when the trees are removed?
16. How does green space help ecosystems?
17. Are there any green spaces in your community?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: How can human activity contaminate land? Problem-Based Learning Project: Investigate the human activities that contaminate land to support determination of recommended actions to reduce negative impacts on ecosystems.
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 11.1: Ways Humans Contaminate Land — Teacher Guide PDF page 154
- Activity Page 11.2: Modeling Strip Mining — Teacher Guide PDF page 155

Lesson 12: Researching Use of Land Resources

THE BIG QUESTION

How can we find information about contamination?

Problem-Based Learning Project: Investigate best practice uses of land resources to support determination of recommended actions to reduce negative impacts on ecosystems.

Words to know

- **biodegradable** — describing material that decays through the action of bacteria or other living organisms

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 100–104: the steps, materials and timing for this lesson.

Talk it over

1. Which of the items would contaminate the land and why?
2. How could people protect land from contamination from items such as this?
3. Are there any items that can be added to land to help improve it?
4. If there were many little bits of plastic or other contaminants in the soil, how do you think it could be removed?
5. What do biodegradable items have in common?
6. What other words have bio in them?
7. What does bio mean?
8. What does biodegradable mean?
9. How did each of the items change?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: How can we find information about contamination? Problem-Based Learning Project: Investigate best practice uses of land resources to support determination of recommended actions to reduce negative impacts on ecosystems.
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 12.1: Researching Community Land Use — Teacher Guide PDF page 156

Lesson 13: Land Resource Action Plan

THE BIG QUESTION

How can we protect land from contamination?

Problem-Based Learning Project: Recommend actions to reduce negative impacts of human activity on land.

Words to know

- **contaminated land** — land that contains chemicals that are harmful to the environment
- **biodegradable** — describing material that decays through the action of bacteria or other living organisms

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 105–109: the steps, materials and timing for this lesson.

Talk it over

1. What causes land to become contaminated?
2. What things are necessary to use land for?
3. Can you think of some things that people can do once land is contaminated?
4. Why is it important to plan how land should be used before people build on it?
5. How does land use affect ecosystems?
6. Why is green space so important?
7. How could this land be used?
8. What land problem did you describe?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: How can we protect land from contamination? Problem-Based Learning Project: Recommend actions to reduce negative impacts of human activity on land.
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 13.1: Community Planning — Teacher Guide PDF page 157
- Activity Page 13.2: Land Use Action Plan — Teacher Guide PDF page 158

Lesson 14: Sharing the Environment

THE BIG QUESTION

How do human activities that affect water, air, and land impact ecosystems? Problem-Based Learning Project: Investigate effects of human activities on ecosystems to support determination of recommended actions to reduce negative impacts.

Words to know

- **biodiversity** — the variety of species on Earth or in any one environment on Earth
- **ecosystem** — all the living and nonliving things that interact in a given area
- **interaction** — a relationship in a system through which factors affect each other

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 111–115: the steps, materials and timing for this lesson.

Read

Read Student Reader, Chapter 7: “Sharing the Environment”: PDF pages 43–50. Look at the pictures and maps together.

Talk it over

1. What are the resources we have studied?
2. What are ways in which each resource can be contaminated?
3. How is land important to plants?
4. How have birds changed our environment?
5. How do ants affect the geosphere?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: How do human activities that affect water, air, and land impact ecosystems? Problem-Based Learning Project: Investigate effects of human activities on ecosystems to support determination of recommended actions to reduce negative impacts.
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 14.1: Interacting Spheres — Teacher Guide PDF page 159
- Activity Page 14.2: Positive and Negative — Teacher Guide PDF page 160

Lesson 15: Researching Environmental Protection

THE BIG QUESTION

How can we protect land ecosystems from negative consequences of human activities? Problem-Based Learning Project: Investigate effects of human activities on ecosystems to support determination of recommended actions to reduce negative impacts.

Words to know

- **action plan** — a set of steps needed to complete a successful project
- **environmental protection** — the practice of taking care of land, water, air, and living things

Teacher's lesson plan

Follow the Teacher Guide, PDF pages 116–129: the steps, materials and timing for this lesson.

Talk it over

1. What happens to forests when people cut down trees?
2. What happens to deserts when people build houses and shopping malls?
3. What happens to grasslands when the land is used for farming?
4. What happens to tundra when those areas are polluted?
5. How could people prevent declines in wildlife?
6. How could people prevent pollution from plastic trash?
7. How could people prevent air pollution?
8. How could people be encouraged to help protect land ecosystems?
9. What is the basic purpose of a plan?
10. What kinds of goals should a plan help to accomplish?
11. What should a plan begin with?
12. How should a plan address its purpose?
13. How should a plan be organized?
14. How can we distinguish reliable versus unreliable sources?
15. What negative impact will you choose?
16. What local land ecosystem did you choose?
17. What are the specific threats faced by that ecosystem?

Answers are at the back of this pack.

Check for understanding

- Answer the Big Question in a sentence or two: How can we protect land ecosystems from negative consequences of human activities? Problem-Based Learning Project: Investigate effects of human activities on ecosystems to support determination of recommended actions to reduce negative impacts.
- Use one of today's words in a sentence of your own.

Activity pages

- Activity Page 15.1: Positive and Negative Impacts — Teacher Guide PDF page 161
- Activity Page 15.2: Researching Environmental Protection — Teacher Guide PDF page 162
- Activity Page 15.3: Check — Teacher Guide PDF pages 163–164

UNIT REVIEW

Unit review and assessment

- Activity page answer key (for the teacher): Teacher Guide PDF pages 168–172
- Activity Page UC.1 — Teacher Guide PDF page 165
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WORDS QUIZ

Protecting Earth's Resources

Name: _____ Date: _____

Circle the letter of the best answer.

1. Which word means “a relationship in a system through which factors affect each other”?
 - a) fresh water
 - b) crop rotation
 - c) water treatment plant
 - d) interaction
2. Which word means “an artificial or natural substance that contaminates air, water, or soil”?
 - a) surface water
 - b) ozone
 - c) fresh water
 - d) pollutant
3. Which word means “the presence of harmful substances or matter in water”?
 - a) no-till farming
 - b) water pollution
 - c) crop rotation
 - d) bacteria
4. Which word means “land that contains chemicals that are harmful to the environment”?
 - a) interaction
 - b) bacteria
 - c) clean energy
 - d) contaminated land
5. Which word means “rapid growth of microscopic algae in a body of water”?
 - a) bacteria
 - b) fresh water
 - c) surface water
 - d) algal bloom
6. Which word means “materials that occur in nature that can be used by people”?
 - a) natural resource
 - b) water treatment plant
 - c) biodiversity
 - d) wastewater

- 7.** Which word means “tiny organisms that break down matter”?
- a) crop rotation
 - b) clean energy
 - c) green space
 - d) bacteria
- 8.** Which word means “to save or protect”?
- a) biodiversity
 - b) conserve
 - c) algal bloom
 - d) disinfection
- 9.** Which word means “a gas found in air”?
- a) contaminated land
 - b) ozone
 - c) landfill
 - d) algal bloom
- 10.** Which word means “methods to measure the types and amounts of chemicals in water”?
- a) no-till farming
 - b) ozone
 - c) disinfection
 - d) water quality testing
- 11.** Which word means “the practice of harvesting only the part of the plant needed for food and leaving the rest in the soil”?
- a) wastewater
 - b) ecosystem
 - c) no-till farming
 - d) conserve
- 12.** Which word means “fresh water found in rivers, streams, and lakes on Earth’s surface”?
- a) bacteria
 - b) surface water
 - c) groundwater
 - d) no-till farming

Answers

Lesson 1: Developing Solutions for Ecosystem Problems

- 1. What are Earth's interacting systems?**
Hydrosphere, geosphere, atmosphere, biosphere
- 2. How do Earth's systems interact?**
For example, living things in the biosphere depend on the hydrosphere, atmosphere, and geosphere to survive.
- 3. What is a natural resource?**
A stock or supply found in nature
- 4. What are examples of natural resources?**
Air, water, soil, oil, minerals, plants, animals
- 5. Why do people use natural resources?**
To get food, water, shelter, transport
- 6. How might human use of natural resources affect local ecosystems?**
For example, cutting trees and tilling soil can cause animals to relocate.
- 7. What could the difference between a plan and an action plan be?**
An action plan includes the steps you will act on to achieve the goal.
- 8. What is the difference between an ecosystem and a community?**
An ecosystem is all the living and nonliving things in a location that interact with each other. A community is just one species.
- 9. What can people do to protect our environment?**
For example, recycle and reuse materials; conserve energy
- 10. Does every problem have a solution?**
Maybe. Problems must be identified and appropriate solutions explored. Some problems may not have solutions at a given time, or solutions may be too expensive or difficult.
- 11. Why is it important to use reliable source information when solving problems?**
To make sure your solution is fair, accurate, and well-reasoned

Lesson 2: Water Resources

- 1. Where does clean water come from?**
Faucet, bottled water, filtered water
- 2. What could happen if you drank water from a river?**
You could get sick.
- 3. What happens to water when it is used to clean things such as clothes and dishes?**
It gets dirty.

4. **What happens to rainwater when it washes across a parking lot?**
It collects oil and grime and goes down drains.
5. **What happens to water that goes down drains in a street?**
It ends up in streams, lakes, rivers, or the ocean.
6. **What kinds of human activities could affect the quality of water?**
For example, putting garbage into waterways, boating
7. **In what ways could water be affected by human activities?**
For example, tainting water with fuel, disturbing organisms with boat propeller and noise
8. **How does water get to the faucet?**
Pipes under the sink
9. **How does water leave the sink?**
Down the drain
10. **Where does water go after it goes down the sink?**
Through other pipes under the sink
11. **What do you notice about the structure of the drain pipes compared to the pipes that lead to the faucet?**
Drain pipes are wider and have a U-bend.
12. **What is the function of the U-bend in the drain pipe?**
To stop drain water from flowing back up, to prevent bad smells from rising through the drain hole
13. **What are common sources of wastewater from your daily activities?**
Kitchen, toilet, shower, bath
14. **Why must dirt, germs, and chemicals be removed from wastewater?**
These things can harm people, wildlife, and plants.
15. **What is the order of steps in wastewater treatment?**
Filtering, spinning to remove grit, bubbling air and bacteria, disinfection and possible further filtration, release back into the environment
16. **Why is disinfection used as the last step before release?**
It kills all the bacteria.
17. **What chemicals did you use to clean the dishes?**
Soap, detergent
18. **How can you ensure that soap used for cleaning is safe?**
Check the label to ensure that the ingredients are safe for the environment.
19. **How does phosphate enter water?**
Soaps and fertilizers
20. **Why is phosphate bad for the environment?**
It causes algae to grow out of control.
21. **Why is water quality testing necessary?**
To know whether water is safe to drink, swim in, or discharge from a water treatment

plant

22. **What are the consequences of algal blooms?**

Organisms living in water can die from lack of oxygen and sunlight.

23. **What are some positive things that bacteria do?**

They decompose dead organisms.

24. **What are some negative things that bacteria do?**

They can cause disease, such as strep throat, or decay things we want to preserve.

25. **What is an infection?**

An invasion of bacteria or virus that causes disease

26. **What is a disinfectant?**

Something that kills disease-causing bacteria or viruses

27. **How is wastewater different from wasting water?**

If you waste water, you are not conserving it. Wastewater is the water that has been used for washing or sewage.

28. **Why is water quality testing important?**

People get sick and the environment can be damaged if water is not clean or has bacteria in it.

29. **What would happen if water were not treated?**

Bacteria and other organisms could grow in water and spread diseases.

Lesson 3: Water Resources, Problems, and Solutions

1. **What do you use to wash your hands?**

Soap and water

2. **What happens when you wash your hands?**

Soap, dirt, and water go down the drain

3. **What other human activities could affect the quality of water?**

Farming, gardening, etc.

4. **Why is water important?**

Water is essential for life; people use water in many ways; the human body requires water for survival.

5. **How do humans affect Earth's water resources in positive and negative ways?**

By cleaning it and using it wisely; by polluting it

6. **What evidence would show that people affect water in a positive way? In a negative way?**

Water would be clean; water would be polluted, and people or animals may get sick.

7. **How can ecosystems be harmed if people use too much water?**

Water levels in rivers and ponds may drop, and aquatic animals may not have enough water to live in.

8. **How have people used science and technology to help keep water safe?**

Use of water testing, water treatment plants for filtering and disinfection

9. **Why are Earth and Mars different colors?**

Earth is covered in mostly water, which we often see as blue. Mars has very little water, and the surface is covered with dust and rocks containing iron, which has a red hue.

10. **What is the result of there being no water on Mars?**

Mars has no life.

11. **Why must we protect water resources?**

No living thing can survive without water.

12. **What is a place called that has little water?**

Desert

13. **How is groundwater different from surface water?**

Groundwater is found underground in layers of rock called aquifers. Surface water is found in streams, rivers, and lakes.

14. **What are some things that people can do to use less water?**

Turn off the water when brushing your teeth, take quicker showers, put water in the sink when washing dishes instead of letting the water run

15. **How can using less water help local ecosystems?**

Animals and plants that live in water would have more water to live in.

16. **Why do farmers apply certain chemicals to their crops?**

To give crops nutrients to grow faster, to stop weeds and insects

17. **What happens to chemicals used by farmers?**

They can enter surface water and groundwater.

18. **What happens when oil spills into water?**

It kills wildlife, including algae, fish, and birds.

19. **How can oil be removed from water?**

It can be soaked up, removed with chemicals or bacteria, skimmed off the surface, or burned off.

20. **Why is it important not to remove the tiny plants and animals when removing plastic from the water?**

They are an important part of the food chain.

21. **Why should cities have clean-up days?**

To periodically remove plastic and other trash

22. **What can people do locally during clean-up days?**

Participate, encourage others to participate

23. **How can water be treated to remove germs?**

Disinfection

24. **How could hikers make water from streams safe to drink?**

Boil water, use a filter, use iodine

25. **What are some things you can conserve?**

Water, electricity, gasoline

26. **What are some local bodies of water that would be considered fresh water?**
The river on the edge of town, the lake we fish in
27. **Why shouldn't people dump waste in water sources?**
It will pollute the water and make it unsafe.

Lesson 4: Researching Water Stewardship

1. **What is affecting the water resource in the picture?**
Accept plausible student responses.
2. **How is the ecosystem affected by the use of water in this picture?**
Animals and plants are not thriving.
3. **How does pollution get into the ocean?**
It can wash into it when it rains, or it can be dumped there.
4. **How does pollution affect plants and animals when it enters the ocean?**
They can eat it or get caught in it and become injured.
5. **What does the water represent?**
A water body, such as a lake or the ocean
6. **What does the food coloring represent?**
A point source of pollution
7. **What does the pebble represent?**
Land
8. **What is the purpose of the ice cubes?**
To create water currents
9. **What do you observe about the "pollution"?**
The pollution/food coloring spreads away from the land/pebble to all of the water.
10. **What can good stewards of water do?**
Recognize water is a vital resource, test water quality, identify risks to water quality, address threats
11. **How does water become polluted in our community?**
For example, agricultural runoff, factory waste, algal blooms

Lesson 5: Water Protection Action Plan

1. **How could an oil spill in a river be prevented?**
Transport oil by land
2. **How could a farmer prevent pollution from farm chemicals?**
Limit use of chemicals to needs, do not apply on windy days, try organic methods
3. **How could a city prevent pollution from entering the drinking water?**
Build water treatment plants
4. **How could a factory prevent pollution caused by releasing toxic chemicals into water?**
Treat water after using it

5. **How could a city use less water?**
Pass laws to restrict water use
6. **What is the basic purpose of a plan?**
Achieve a goal
7. **What kinds of goals should a plan help to accomplish?**
Solve a problem, answer a question
8. **What should a plan begin with?**
Statement of a problem, asking a question
9. **How should a plan address its purpose?**
Relate solutions to the problem or question
10. **How should a plan be organized?**
Describe the solution, action items, schedule, budget
11. **What would be on an action plan for stewardship of local water quality?**
Identify point and nonpoint water pollution sources, research solutions
12. **What is the difference between polluted and clean water?**
For example, clean water is safe to drink; polluted water is not safe to drink.
13. **What water problem did you describe?**
What are the main challenges to protecting your chosen water resource?

Lesson 6: Air Pollution

1. **Why do you think the people in the photo are wearing masks?**
The air is bad, but they want to be outdoors.
2. **What could be in the air that makes it dangerous for people to breathe?**
Smoke, dust, smog, or chemicals
3. **What are some ways that air can become polluted?**
For example, by people driving cars, by factories, by fires burning
4. **What are some effects of air pollution on humans?**
Burning eyes, breathing problems, and coughing
5. **Why might cities have more air pollution than other places?**
Because there are more people and more car exhaust and factory emissions
6. **What do the solutions that these cities have used to help reverse air pollution have in common?**
They all used plants.
7. **What do plants need to live?**
Sunlight, air, water
8. **How do plants “clean” air?**
Plants use carbon dioxide from air and release oxygen.
9. **How does carbon dioxide get into the air?**
From burning fuels such as wood, oil, gas, and coal

10. **How could deforestation affect air quality?**

In places where forests are being cut down, there are fewer trees, so air quality will begin to suffer.

Lesson 7: The Need for Clean Air

1. **What is wind?**

Moving air

2. **What are some materials that can be carried in wind?**

Smoke, ash, mist

3. **How can air pollution produced in one place affect people living in another place?**

Air pollution can be carried by wind.

4. **What body organs help living things get oxygen from air?**

Lungs, gills

5. **What system moves oxygen from the lungs to cells and carries carbon dioxide waste out of the body?**

The respiratory system

6. **What living things do you think would be affected the most by polluted air?**

Animals that live on land or in the air, such as birds

7. **How does the EPA measure air quality?**

By measuring pollutants in the air

8. **How does smoke get into the air?**

Burning fuels, fireplaces, campfires, and factories

9. **How can smoke affect air quality?**

It can make the sky hazy and create smog.

10. **Why don't plants grow as well when it is hazy?**

They cannot get as much sunlight to make food.

11. **How do plants help prevent air pollution?**

They keep dust and dirt down with their roots; they release oxygen into the air.

12. **What materials do plants need to be able to help with air pollution?**

Plants need water, sunlight, carbon dioxide, and space to grow.

13. **What type of air quality does an orange rating indicate?**

That people should limit outdoor activity

14. **How does a scrubber prevent air pollution?**

It stops most pollutants from reaching the air.

15. **Did the cards placed in the same location have similar results?**

Predict what would happen if the cards were left out for a week.

16. **Have you ever seen evidence of clean energy being used near where you live?**

Would the place where you live be a good candidate for using clean energy resources?

Lesson 8: Researching Air Quality Protection

1. What could cause the AQI to change?

A change in weather, increase or decrease in burning, levels of ozone, or levels of pollen in the air

2. How could people improve the AQI in their area?

Use less fuels and release less smoke and chemicals into the air

3. What sort of daily activities contribute to air pollution?

Driving in cars and buses, using electricity produced from coal or gas, using products made in a factory

4. Do you think everyone raised their hand at the same time?

No, because students closer to the teacher smelled the match first, or it depended on which way the smoke was blowing

5. What did you see when you observed the match burning?

Black smoke, ash, color change of the match

6. What are some pollutants that could be in the indoor air?

Smoke, scents, gases

7. How is indoor air monitored?

With a smoke/radon/carbon monoxide gas detector

8. Why are these types of detector devices important?

Some gases, such as carbon monoxide, are colorless and odorless but very harmful.

9. How can people protect air quality indoors?

Pass laws, do not smoke, use clean energy

10. How can people protect air quality outdoors?

Carpool, walk or bike, use scrubbers on factories

11. When you check the EPA website to determine the AQI for your area, what type of air pollution does this measure?

Outdoor

12. How can technology help with monitoring indoor air pollution?

Devices can measure gases in the air and alert people with an alarm system.

13. How does the AQI today compare to the measurement from yesterday?

What could cause the AQI to change? (a change in weather, increase or decrease in burning, levels of ozone, or levels of pollen in the air)

Lesson 9: Air Quality Action Plan

1. What kinds of places did you mark on the map?

Factories, power plants

2. Are there any places that contribute to air pollution that cannot be marked on the map?

Places with indoor air pollution, places in other cities that release air pollution that blows to this community, nonpoint-source pollution

3. **Are there any ways that we can prevent air pollution from these places?**
Catch pollutants before they enter air, plant trees or other plants
4. **What air problem did you describe?**
What are the main challenges to protecting air?

Lesson 10: Land Contamination

1. **Why is land important to people?**
To grow food in, to live on, to build roads on
2. **How is land important to animals?**
Animals need land for shelter.
3. **How is land important to plants?**
Many plants grow in soil and get the nutrients they need to grow from it.
4. **Are there any ways to reduce the amount of garbage that goes into the landfill?**
Use items that can be reused or recycled instead
5. **What can you use instead of some of these items?**
Do not use straws, take reusable bags to the store, use silverware and plates and cups that can be washed
6. **Even though items can be recycled, such as plastic water bottles, why is it important to use less of these too?**
Because it takes energy and money to produce and recycle these items
7. **What would happen if garbage were not disposed of in a landfill?**
The land would become contaminated.
8. **Why is a landfill often built nearby a water treatment plant?**
Some water is released as the garbage decomposes and needs to be treated before it is recycled into the environment.
9. **How long can it take for a landfill to become full?**
Fifty years or more, depending on the size of the landfill
10. **What happens to a landfill after it is full?**
It is covered with layers of soil and left alone; it can eventually become a park or trail.
11. **What do all of these lunches have in common?**
They have reusable items instead of recyclable or single-use items.
12. **Do you think it would take more time or more money to pack a waste-free lunch?**
It could. Reusable items cost more than the single-use items, and that it takes time to clean these items between uses.

Lesson 11: Living Off the Land

1. **What resources do we get from the land?**
Chemicals, gems, rocks, oil, gas, gold, silver, steel
2. **What types of food do we get from land?**
We get fruits and vegetables from the land. Cattle also need land to graze.

3. **Is there any way that frozen land can become contaminated?**
Companies dig for oil in frozen land, and if it spills, it can cause land to become contaminated.
4. **What do people need to do to land to build a home or apartment?**
Tear down the trees, pour concrete slab, and build the house
5. **What other animals build their homes underground?**
Moles, prairie dogs, toads, ants, sand crabs
6. **What happens to an animal if the land where it lives becomes contaminated?**
It would have to find a new home or could die.
7. **What happens to a plant if the land becomes contaminated?**
It may not be able to grow.
8. **Why is a land survey important?**
So that people can know if it is OK to build there
9. **What types of tools help people conduct surveys?**
Lasers, radar, cameras
10. **How can rotating crops help soil?**
It keeps the nutrients from being depleted from the soil.
11. **How can no-till farming keep soil healthy?**
It keeps it from eroding.
12. **What can cause soil to erode?**
Wind, water
13. **How do strip mines contaminate land?**
They leave behind waste materials that build up over time.
14. **When people clear the land, how does it affect the ecosystem?**
Animals may have to move and plants die; the ecosystem will change.
15. **How does the soil change when the trees are removed?**
It can become blown or washed away easily.
16. **How does green space help ecosystems?**
It protects them and the plants and animals in them.
17. **Are there any green spaces in your community?**
How does green space help ecosystems? (It protects them and the plants and animals in them.)

Lesson 12: Researching Use of Land Resources

1. **Which of the items would contaminate the land and why?**
The plastic would contaminate the land because it would not break down over time.
2. **How could people protect land from contamination from items such as this?**
Do not use plastic items, but if you do, recycle them, and participate in clean-up activities to remove items such as this from the land.

3. **Are there any items that can be added to land to help improve it?**
Biodegradable materials, such as banana peels and banana, can add nutrients to soil.
4. **If there were many little bits of plastic or other contaminants in the soil, how do you think it could be removed?**
Sifting
5. **What do biodegradable items have in common?**
They are made of natural materials or are types of food.
6. **What other words have bio in them?**
Biology, biography, biome, antibiotic
7. **What does bio mean?**
Life
8. **What does biodegradable mean?**
Breaking down of living and nonliving materials into natural materials by decomposers
9. **How did each of the items change?**
Which of the items would contaminate the land and why? (The plastic would contaminate the land because it would not break down over time.)

Lesson 13: Land Resource Action Plan

1. **What causes land to become contaminated?**
Garbage, mines, chemicals
2. **What things are necessary to use land for?**
Houses, schools, hospitals, farms, mines, roads
3. **Can you think of some things that people can do once land is contaminated?**
Remove the contamination by sifting the soil or by adding bacteria or chemicals to the soil
4. **Why is it important to plan how land should be used before people build on it?**
Once an area is designated for a certain type of use, it can take a long time to use it for something else.
5. **How does land use affect ecosystems?**
It disturbs organisms living on the land.
6. **Why is green space so important?**
So that the animals that have been displaced can have a place to live
7. **How could this land be used?**
Did the river and the mountain on the land influence your placement of any of the elements? If so, why?
8. **What land problem did you describe?**
What are the main challenges to protecting land?

Lesson 14: Sharing the Environment

1. **What are the resources we have studied?**
Water, air, and land

2. **What are ways in which each resource can be contaminated?**
Waste materials and erosion pollute water; emissions pollute air; soil deposition and mining can harm land.
3. **How is land important to plants?**
Many plants grow in soil and get the nutrients they need to grow from it.
4. **How have birds changed our environment?**
Migrating birds may inhabit an area for a time and leave their waste.
5. **How do ants affect the geosphere?**
They build hills and change the landscape.

Lesson 15: Researching Environmental Protection

1. **What happens to forests when people cut down trees?**
Wildlife has less food and space to live.
2. **What happens to deserts when people build houses and shopping malls?**
Wildlife has less water and space to live.
3. **What happens to grasslands when the land is used for farming?**
Wildlife has less food and space to live.
4. **What happens to tundra when those areas are polluted?**
Animals can be poisoned, and plants can die.
5. **How could people prevent declines in wildlife?**
Create wildlife protection laws, preserve habitat
6. **How could people prevent pollution from plastic trash?**
Use reusable shopping bags and food storage containers, recycle, donate used items instead of throwing them away
7. **How could people prevent air pollution?**
Use low-emission vehicles, convert to electric heating
8. **How could people be encouraged to help protect land ecosystems?**
Promote education
9. **What is the basic purpose of a plan?**
Achieve a goal
10. **What kinds of goals should a plan help to accomplish?**
Solve a problem, answer a question
11. **What should a plan begin with?**
Statement of a problem, asking a question
12. **How should a plan address its purpose?**
Relate solutions to the problem or question
13. **How should a plan be organized?**
Problem statement, action items, schedule, budget
14. **How can we distinguish reliable versus unreliable sources?**
How can we distinguish positive and negative relationships between human activity and ecosystems?

15. **What negative impact will you choose?**

What do you already know about that negative impact?

16. **What local land ecosystem did you choose?**

What do you already know about that local land ecosystem?

17. **What are the specific threats faced by that ecosystem?**

What are the main challenges to protecting your chosen land ecosystem?

Unit quiz key

1. d 2. d 3. b 4. d 5. d 6. a 7. d 8. b 9. b 10. d 11. c 12. b