

# Lesson Outline for Teaching

## Lesson 1: People and the Environment

### A. Population and Carrying Capacity

1. The population of a town is the number of people who live there.
2. When scientists use the term population, they mean all the members of a species living in a given area.
3. Earth used to have a relatively small population of humans.
  - a. Today, about 6.7 billion people live on Earth.
  - b. The greatest increase in human population occurs during the last few centuries.
4. The term population explosion describes the sudden rise in human population that has happened in recent history.
  - a. Some things that have caused this rapid population growth include improved health care and clean water.
  - b. These and other technological advancements have allowed more people to live longer and to reproduce.
5. People need certain things, such as food, clean water, and shelter, to survive.
  - a. All the things people need come from resources found on Earth.
  - b. Earth has limited resources.
  - c. The largest number of individuals of a given species that Earth's resources can support and maintain for a long period of time is Earth's carrying capacity for that species.
  - d. If the human population continues to grow beyond its carrying capacity, eventually, there will not be enough resources to support it.

### B. Impact of Daily Actions

1. How people use resources affects the environment.
2. When you take a shower, you use many resources.
  - a. Many water pipes are made of metal. Obtaining the metal from the ground by mining can destroy habitats and pollute soil and water.
  - b. Most towels are made of cotton, which comes from a plant. Growing plants often involves the use of fertilizers and other chemicals that pollute the environment.
  - c. The water you use while showering is a scarce resource in some places.
  - d. Fossil fuels are often used to heat the water in showers.
  - e. Fossil fuels are nonrenewable resources because they are used up faster than they can be replaced by natural processes.
  - f. Burning fossil fuels releases pollution into the atmosphere.

## Lesson Outline continued

3. Over the course of your lifetime, your potential impact on the environment is great.
4. Because we use many resources and because our resource use can have a(n) negative impact on the environment, it is important that we use resources wisely.
  - a. Not all human activities have a(n) negative impact on the environment.
  - b. People can clean up litter and do other things that have a(n) positive impact on the environment or help reduce the impact of human actions on the environment.

## Discussion Question

Which factors would affect the carrying capacity of each of the following populations of animals: squirrels in a town, wolves in a national park?

The following factors could affect the carrying capacity of squirrels in a town: the number of trees (for shelter), the types of trees (for food), the availability of clean water and clean air, the presence of predators.

The following factors could affect the carrying capacity of wolves in a national park: the availability of prey species such as small mammals, which would depend on the availability of plants (for food); the availability of undisturbed natural places (for shelter); the availability of clean water and clean air; the presence of humans (predators).

# Lesson Outline for Teaching

## Lesson 2: Impacts on the Land

### A. Using Land Resources

1. People use land for timber production, agriculture, and mining.
2. Trees are cut down to make wood and paper products, for fuel, and to clear land for agriculture, grazing, or building homes or highways.
  - a. The removal of large areas of forest for human purposes is called deforestation.
  - b. Deforestation destroys the habitat of many living things and can also affect air quality.
3. To grow large amounts of food, farmers sometimes add fertilizers that contain the element nitrogen to the soil.
  - a. Some bacteria that live on plant roots can convert nitrogen to a form that plants can use.
  - b. The excess nitrogen from human activities can kill plants and affect the organisms that depend on them.
4. Overfarming and overgrazing the land can cause the soil to erode. Increased rates of erosion can lead to desertification, which is the development of desertlike conditions due to human activities and/or climate change.
5. Mining includes the processes people use to remove useful rocks and minerals from the ground. Digging mines can disturb habitats and can pollute water.

### B. Construction and Development

1. Land is a(n) resource because people use the land for their living space.
2. Building suburbs on open land can lead to urban sprawl, which is the development of land for houses and other buildings near a city.
3. Urban sprawl causes three main kinds of problems: habitat destruction, loss of farmland, and water pollution from increased runoff.
4. Paved roadways cause the same problems that urban sprawl causes, which are habitat destruction and increased runoff.
5. In urban areas, using land for parks helps decrease runoff.

### C. Waste Management

1. People use land to dispose of some wastes, which they bury in a(n) landfill.
2. Trash that contains substances that will harm soil, water, and air is called hazardous waste. It cannot safely be buried in a(n) landfill.

## Lesson Outline continued

### D. Positive Actions

1. Governments can protect land by setting aside wild areas for preservation. There are laws about whether and how the resources there can be removed.
2. Forests are complex, but they can be managed to preserve the ecosystem.
  - a. Trees can be select-cut, meaning only certain trees in one area are cut down rather than lots of trees or all the trees.
  - b. People can practice reforestation, meaning that they replant trees that have been cut or burned down.
  - c. Land that has been disturbed due mining can be restored through the process of reclamation.
3. Cities use green spaces to create natural environments in urban settings.
  - a. Green spaces provide places for recreation for people and habitat for wildlife.
  - b. Green spaces also reduce runoff and improve air quality as plants take up extra carbon dioxide gas.
4. People can have a positive effect on the land by reusing, reducing, and recycling
5. Another way to reduce the amount of trash that ends up in landfills is composting, which involves mixing food scraps, leaves, and grass clippings and adding the decayed product to the soil.

### Discussion Question

What are some things that you can do to have a positive effect on the land in your area?

Student answers should include specific examples of how they can reduce, reuse, recycle, and compost materials.

# Lesson Outline for Teaching

## Lesson 3: Impacts on Water

### A. Water as a Resource

1. Most of Earth's surface is covered with water, and living things on Earth are made mostly of water.
2. Like other organisms, humans need water to survive.
3. Humans also use water in ways that other organisms do not—washing cars, doing laundry, and using water for recreation and transportation.
  - a. Most water in the United States is used by power plants.
  - b. Water is used to generate electricity and to cool equipment.

### B. Sources of Water Pollution

1. Water continually moves from the surface of Earth, into the atmosphere, and back again in the water cycle.
  - a. Thermal energy from the Sun powers the water cycle.
  - b. Water at Earth's surface evaporates and rises into the atmosphere.
  - c. As it rises, water vapor cools and condenses, forming clouds.
  - d. Water returns to Earth's surface as precipitation, falling from the clouds.
  - e. Runoff reenters the lakes, rivers, and other bodies of water or it can seep into the ground.
2. Pollution from a single source that can be identified is called point-source pollution.
  - a. A factory's discharge pipe releasing industrial waste directly into a river is an example of point-source pollution.
  - b. Other examples of point-source pollution are the oil spilling from a tanker and the runoff from a mining operation.
3. Nonpoint-source pollution is pollution from several widespread sources that cannot be traced back to one specific place.
  - a. Some common examples of nonpoint-source pollution include runoff from farms and urban developments.
  - b. Runoff from construction sites, which can contain excess amounts of sediment, is another example of nonpoint-source pollution.
  - c. Most of the pollution in the United States comes from nonpoint sources.
  - d. Nonpoint sources of pollution are harder to pinpoint and control.

## Lesson Outline continued

### C. Positive Actions

1. After pollution enters water, it is difficult to remove.
  - a. It can take decades to clean polluted groundwater.
  - b. Most efforts to reduce water pollution focus on preventing it from entering the environment, rather than cleaning it up.
2. In the 1960s, the Great Lakes, which are located along the border of the United States and Canada, were very polluted. Both countries formed agreements to clean up the Great Lakes and set goals toward pollution prevention and research.
3. The United States has two main laws to help keep water clean throughout this country.
  - a. The Clean Water Act regulates sources of water pollution, including sewage systems.
  - b. The Clean Drinking Water Act protects our drinking water supplies.
4. Individuals can take simple actions to have a(n) positive impact.
  - a. People can help protect the water supply by using alternative household products that do not contain toxins, or harmful chemicals.
  - b. People can reduce their use of artificial fertilizers on gardens or lawns and use compost instead.
  - c. People can dispose of any hazardous substances safely by following their local laws.
  - d. People can use less water when they do laundry, clean, and bathe to help conserve our water supply.

### Discussion Question

What are some examples of point-source and nonpoint-source pollution that you have observed where you live or in other places you have visited?

Common examples of point-source pollution include pipes, usually from industry, leading directly into a body of water, and chemical spills (as reported in the news). Common examples of nonpoint-source pollution include runoff flowing down the street, down a hill, or into a flooded area in a field.

# Lesson Outline for Teaching

## Lesson 4: Impacts on the Atmosphere

### A. Importance of Clean Air

1. Humans and many other organisms need oxygen from the air.
2. Air that is not clean can harm the health of living things.

### B. Types of Air Pollution

1. Brownish haze in the air is called photochemical smog, which is caused when nitrogen and carbon compounds in the air react in sunlight.
  - a. Burning fossil fuels releases nitrogen and carbon compounds into the air.
  - b. Nitrogen and carbon compounds react in sunlight to form other harmful substances, including ozone.
2. Rain or snow that has a lower pH than normal rainwater is called acid precipitation. If the pH of the water or the soil becomes too low, living organisms in the water and soil cannot survive.
3. Particulate matter is the mix of solid and liquid particles in the air.
4. Using products that contain CFCs, such as air conditioners and refrigerators made before 1996, affects the ozone layer. CFCs react with sunlight and destroy ozone molecules.
5. The gas carbon monoxide is released by vehicles, industries, and forest fires

### C. Global Warming and the Carbon Cycle

1. An increased concentration of carbon dioxide in the atmosphere can lead to global warming, an increase in Earth's average surface temperature.
2. Earth's average temperature has increased in the past century, and scientists estimate that it will increase even more in the next century.
3. Warmer temperatures can cause ice to melt, making sea levels rise. Higher sea levels can cause flooding along coastal areas.
4. Higher temperatures can affect ecosystems because living things that do not thrive in warm environments might begin to die off.
5. The natural process that occurs when certain gases in the atmosphere absorb and then reradiate thermal energy from the Sun is called the greenhouse effect.
  - a. Without the greenhouse effect, Earth would be too cold for life as it exists now.
  - b. An increase in greenhouse gases in the atmosphere causes more heat to be trapped, leading to global warming.

### D. Health Disorders

1. Air pollution can cause respiratory problems, including asthma attacks, in which the passageways in the lungs become narrower and breathing becomes difficult.

## Lesson Outline continued

2. The government measures and reports air quality using the Air Quality Index, which is a scale that ranks the level of ozone and other pollutants.

### E. Positive Actions

1. Countries around the world have agreed to the Montreal Protocol to phase out CFCs and to lower emissions of greenhouse gases to help reduce some problems due to air pollution.
2. Since the Clean Air Act was passed in 1970, we have seen a 50 percent reduction in pollutants that cause acid rain and a 90 percent reduction in air pollutants from factories.
3. Using renewable energy resources such as solar (or wind) power, wind (or solar) power, and geothermal energy helps reduce air pollution.
4. Using less energy is one way everyone can help reduce pollution and improve the quality of all our important resources: water, air, and soil.

### Discussion Question

What are some air pollutants you can see? When and where have you seen these air pollutants being released? What are some air pollutants that you cannot see? What are ways that you might notice high levels of these pollutants in the air you breathe?

Visible air pollutants include dirt, dust, smoke, and haze. Dirt and dust can be seen near unpaved roads and construction sites. Smoke can be seen near open fires or coming from chimneys or factory smokestacks. Haze can be seen usually on warm or sunny days near cities or other places where there are many automobiles or factories and little wind.

Some air pollutants that people cannot see include acid precipitation, carbon monoxide, ozone, and other invisible gases. Possible ways of noticing high levels include a high reading of the Air Quality Index or health problems, including irritation to eyes, nose, and throat, coughing, difficulty breathing, fatigue, nausea, and an increase in asthma attacks.