

Ecology and the Environment

Chapter 4: Land, Air, and Water Resources

8th Grade

Lesson 1 (Conserving Land and Soil)

How Do People Use Land (soil)?

agriculture:

- Less than ¼ of Earth's surface is dry, ice-free land.
- Less than ⅓ of this surface can be farmed.
- The rest is too dry, too salty, or too mountainous.

mining:

- Strip mining removes a swath of soil to obtain minerals, then replaces the soil.
- This makes the soil very erodible to wind and water as it remains barren for many years.

development:

- People settled in areas that had the best soil and near fresh water.
- As populations grew, settlements became towns and cities that took up (covered) more of the best land.

Soil horizon – a layer parallel to the soil surface, whose characteristics vary from the layers above and beneath

- mainly defined by changes in color and texture

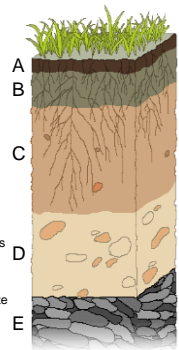
Humus – the organic component of soil, formed by the decomposition of leaves and other plant material by soil microorganisms

Essential Nutrients in Soil:

1. Nitrogen
2. Phosphorous
3. Potassium
4. Magnesium
5. Sulfur
6. Calcium

The Structure of Fertile Soil

- A. **Litter** – top layer of organic material, mainly dead leaves and grass
- B. **Topsoil** – a mixture of rock fragments (mostly clay sized), nutrients, water, and air
- often rich in humus and minerals
 - Most of the absorption of water and nutrients by plant roots takes place in this layer.
- C. **Subsoil** – contains rock fragments (mostly clay), water, air, but contains less nutrients and humus
- D. **Substratum** – the lowest layer that contains soil, but is mostly loose rock and is very poor in nutrients
- contains the water we drink
- E. **Bedrock** – solid rock through which water does not penetrate
- All soil begins as bedrock.
 - As natural processes break down bedrock, organic material builds on top of it, forming different horizons over time.



Because rich topsoil takes so long to form, it is important to protect it.

Soil Management:

1. **Erosion** – the process by which water, ice, wind, or gravity moves weathered particles of rock and soil
 - When plant roots that hold soil in place are no longer present due to tilling the soil, logging, and mining, soil is easily moved.
 - Terracing and leaving unused parts of crops on the land reduces erosion.

2. **Nutrient Depletion** – a reduction of nutrients in the soil that occurs when more nutrients are used than decomposers can supply through the breakdown of wastes and remains of organisms

Preventing Nutrient Depletion:

- Apply fertilizers.
- Leave unused crop parts on the land to decompose.
- Rotate crops.
- Leave fields unplanted.

3. **Desertification** – the advancement of a once-fertile area into one of few nutrients and moisture **caused by:**
- climate change (changes what lives on the land and what puts nutrients into it)
 - extended drought (plants do not survive and good soil easily blows away)
 - overfarming (soil nutrients being removed faster than they are replaced)
 - overgrazing (organic material is not left on the land, reducing soil nutrients)
4. **Land Reclamation** – the process of restoring an area of land to a more natural, productive state
- Reclamation projects are generally more difficult and expensive than it would have been to protect the resources to begin with.

Lesson 2 (Waste Disposal and Recycling)

Municipal solid waste – wastes produced in homes, businesses, schools, and in a community

Handling Solid Wastes:

1. **Incineration** – the burning of solid waste in a facility called an **incinerator**
 - The heat produced by incinerators can be used to produce electricity.
 - They reduce the volume of the waste by 90%, making it much easier to dispose of.
2. **Sanitary Landfill** – a site for the disposal of municipal solid waste, construction, debris, and limited types of agricultural and industrial wastes (chemicals)
 - Dissolved chemicals called **leachates** are collected before they can go into the soil.

Leachate – polluted liquid produced by rainwater passing through and dissolving chemicals from buried wastes in a landfill

3. **Recycling** – the process of reclaiming raw materials and reusing them to create new products

Biodegradable – a term that describes materials that are able to be broken down and recycled by bacteria and other decomposers

Hazardous waste – any material that can be harmful to humans or the environment if it is not properly disposed of

Examples: electronic devices, batteries, paint, solvents, pesticides, herbicides, oil, cleaning chemicals

Lesson 3 (Air Pollution and Solutions)

Emissions – pollutants that are released into the air

- Emissions come from motor vehicles, factories, volcanoes, forest fires, dust storms, and livestock.
- Emissions can be point or nonpoint sources of pollution.

Photochemical smog – a brownish thick haze that is a mixture of ozone and other chemicals formed when pollutants react with sunlight

Ozone – a form of oxygen that has 3 oxygen atoms in each molecule instead of the usual 2 atoms

- It is a toxic gas formed when **hydrocarbons** and **nitrogen oxides** (both from car exhausts) react with sunlight.
- causes lung infections, eye and throat irritation, and damages the body's infection defenses

Temperature inversion – a condition in which a layer of warm air traps polluted air close to Earth's surface

- Normally, air close to the ground is heated by Earth's surface and cool air sinks to push the warmer air upward, carrying pollutants higher into the atmosphere to be dispersed (scattered).
- During a temperature inversion, polluted air is trapped at the surface, becomes more concentrated, and becomes more dangerous.

Acid rain – a form of precipitation that is more acidic than normal (does not have to be rain)

- It is caused by the release of molecules of **sulfur dioxide** and **nitrogen oxide** into the air from the burning of coal and oil
- These gases react with **water vapor** in the air to produce **nitric acid** and **sulfuric acid** that dissolve in precipitation.
- Acid rain changes the pH of lakes and soil, affecting what can live and grow there.
- It also damages statues and stone buildings over time.

Indoor Air Pollution:

- glues
- cigarette smoke
- dust
- cleaning supplies
- pet dander
- carbon monoxide
- radon

Carbon monoxide – colorless, odorless gas produced by the burning of wood, gas, coal, or oil

- Carbon monoxide is absorbed by the blood and takes up space needed by oxygen.

Radon – colorless, odorless gas that is radioactive formed naturally by certain rocks underground

- Radon enters from underground through cracks in basement walls and floors.

- Radon causes lung cancer and other health problems.

Ozone Layer – the layer of the upper atmosphere that contains a higher concentration of ozone than the rest of the atmosphere.

- It protects us from too much ultraviolet radiation.

- Scientists believe ozone has been depleted by **CFCs** and the “ozone hole” has grown, allowing more UV radiation to reach Earth.

Chlorofluorocarbons (CFCs) – human-made gases that contain chlorine and fluorine

- CFCs have been used in air conditioners, refrigerators, aerosol spray cans, and Styrofoam® products.
- CFCs reach high into the atmosphere and react with ozone molecules.
- Most uses of CFCs were banned in 2000, but some are still allowed.
- Although banned, CFC molecules remain in the atmosphere for a long time.
- With fewer CFCs, scientists believe the ozone will recover.

Lesson 4 (Water Pollution and Solutions)**Water on Earth :**

- 97% of Earth’s water is **saltwater** in oceans and salt lakes.
- 2% of Earth’s water is **frozen freshwater** (ice caps and glaciers).
- 1% of Earth’s water is **freshwater** available for use in lakes, streams, and groundwater.

Major Sources of Water Pollution :**1. Agricultural Wastes**

- animal wastes
- fertilizers
- pesticides – chemicals that kill insects and other crop-destroying organisms
- herbicides – chemicals that kill undesirable plants

2. **Sewage** – the water and human wastes that are washed down sinks, toilets, and showers
 - If left untreated, disease-causing organisms quickly multiply, causing water sources to be unsafe for drinking or swimming.

3. Industry (factory) and Mining Wastes

4. **Sediments** – can cover up the food sources, nests, and eggs of organisms in bodies of water
 - can block sunlight, preventing water plants from growing and putting oxygen into the water for other living things
5. **Heat** – Warm water used by factories and power plants to cool equipment is released into some bodies of water, killing organisms (also known as **thermal pollution**).
6. **Oil and Gasoline** – spills from ships, pipes, or drilling platforms
 - Leaks from underground storage tanks can pollute groundwater.

Reducing Water Pollution :

- Clean up oil and gas spills on water before they spread.
- Remove oil / gas-soaked soil as soon as possible.
- Treat wastewater before returning it to the environment.
- Use environmentally friendly cleaning supplies.
- Never pour chemicals such as paints, solvents, motor oil, and garden / yard chemicals down a drain, on the ground, or into the trash. (Most cities have collection days or collection sites for these.)
- Do not pour pills, drugs, or medicines down a drain.
- Reduce the use of pesticides, herbicides, and fertilizers.

Lesson 5 (Ocean Resources)

Ocean Resources Include :

water – Salt water can become freshwater through the process of **desalination**.

- **Desalination** is expensive, requires a lot of energy, and is not practical for most areas.

harvested fish – As technology has allowed us to catch more fish in a shorter period of time, they are being removed faster than they can reproduce on their own, making **aquaculture** more common worldwide.

- As ocean temperatures have changed, species have moved and may not be as accessible to people, increasing the need for **aquaculture**.

algae – an ingredient in many household products.

- detergents
- cosmetics
- toothpaste
- shampoos
- paints
- foods, such as ice cream, cheese, peanut butter, pudding

fuels – When the remains of once-living things sink to the bottom of the ocean, they are buried by sediments.

- As more sediments accumulate, the remains decompose and are transformed into oil and natural gas by the heat and pressure of the overlying layers.

minerals

- **Halite** (rock salt) is left behind when ocean water from ancient seas evaporated.
- **Magnesium** is an important strong and lightweight metal left behind in a similar way.
- **Gravel and sand** from the land and deposited into oceans can be mined.
- **Manganese** (important for making alloys, rubber, and making clear glass) builds up around shells to form **nodules** that can be gathered.

nodule – a lump on the ocean floor that forms when metals such as manganese build up around pieces of shell

Upwelling – the movement of cold water upward from the deep ocean that is caused by wind

1. Strong wind-driven surface currents carry away warmer surface water.
2. Cold water rises to replace the warm water that was moved by the winds.
3. This stirs up nutrients from the seafloor that attract plankton.
4. Plankton attract the small fish that feed on them. Large fish are attracted to the small fish for food.
5. For this reason, the locations of upwellings are important to commercial fishermen.