KATHRYN HILGENKAMP

ENVIRONMENTAL HEALTH

ECOLOGICAL PERSPECTIVES

Land

Chapter 10

The Importance of Land

- Land quality differs from place to place
- A renewable resource if it is not abused
- Essential to
  - The type of food of food available
  - Nutrient content and quality of food
  - Susceptibility to water pollution
  - Shelter safety
  - Prevent harm from external elements

Land Degradation

- Economic growth depends on productivity of the land
- Population growth and land degradation are related
- 10% of the Earth's surface is moderately degraded
  - Lack of water
  - Desertification
  - Natural disasters
  - Deforestation
  - Depleted soils
  - Pollution or contamination
- People migrate from one area to another because of scarce resources

Susceptibility of Land to Degradation

- Certain ecosystems and biomes are more vulnerable than others
- Tropical rain forests, wetlands, grasslands, and tundra are easily disturbed and take longer to recover
- Primary reasons for land degradation include deforestation, draining of wetlands, overgrazing, and poor agricultural practices

Topography

- Mountains
- Forests
- Wetlands

Mountains

- Susceptible to earthquakes, volcanic eruptions, landslides, avalanches, floods
- Mining practices, power plants, and tourists can be a problem

Forests

- Forests
  - Over half of U.S. forests have been destroyed by logging, road construction, mining, forest fires, ski resorts, off-road vehicles, and other human activities
  - Deforestation is the permanent decline of trees to less than 10% of the original forest

Wetlands

- Also known as marshes, swamps, bayous, fens, bogs, estuaries, and bottomlands
- Saturated by moisture, nutrient-rich
- Highest rate of productivity
  - Nearly 2/3 of fish and shellfish require wetlands to reproduce and grow
  - 60–90% of commercial fisheries depend on coastal wetlands

- Almost every state has wetlands
- A natural reservoir for flood waters
- Wetlands also filter pollutants out of water into less harmful forms
- A buffer for coastlines
- Recreational opportunities

Land Preservation

- 726 million acres are preserved with national forests, national parks, wildlife refuges, wilderness areas, and historic sites
- Federal agencies involved:
  - Department of Interior
  - U.S. Forest Service
  - National Park Service

Effects of Land Usage

- Soil erosion
- Coastal erosion
- Overgrazing
- Mining
- Desertification

Deforestation

- Soil erosion occurs when forests are destroyed
- Erosion occurs with wind, water, and other natural forces
- When soil erodes, sediment fills waterways and water supplies

Coastal Erosion

- Coastal shorelines are dynamic and diverse, shaped by Nature and man
- Ocean waves and storms attack beaches, bluffs, and dunes
- **Littoral drift** stirs up sand and carries it to other beaches
- The problem is very serious
  - 43% of the lower 48 states have serious erosion problems
  - Over 2,600 miles of beachfront have critical erosion problems as the shoreline washes away
- Barrier islands have been retreating inland as much as 2–3 feet per year due to slowly rising sea levels

Coastal Protection

- It is important to protect the natural habitat of beaches
- Dunes are held in place by natural vegetation (sea oats, sea amaranth, and sea grapes are protected species)
- New construction, heavy vehicles, foot traffic from residents and tourists are problems
- Breakwaters, groins, and jetties are man-made methods of reducing beach erosion
- Beach renourishment and discouragement of development are other solutions

Overgrazing

- The activity most devastating to soil degradation
- A major cause of species endangerment
  - Decline of native trout population in Western states
- As too many livestock deplete native vegetation, soil is exposed to wind and rain
- The grassland becomes a desert

Riparian Rights

- The right to use water along the shores or banks by residents
- Cattle grazing along water sources eat or trample vegetation and pollute the water
- Water turbidity harms aquatic life
- Harmful microorganisms like giardia *may* infect the rivers, lakes, and streams

Mining

- A major industry in the U.S.
- The world’s largest producer of clay, copper, gypsum, lithium, magnesium, phosphate, salt, silica, and sulfur
- Second world’s largest producer of coal and gold
- Destructive to land, forests, rivers, plants, and animals

Types of Mines

- Placer
- Hard rock
- Open pit
- Hydraulic (the most harmful to the environment

Placer Mining

- Panning, dredging, sluicing, rocker, and picking techniques

Hard Rock Mining

- Digs into solid rock using picks, shovels, rock drills, dynamite, and other tools
- Digs tunnels or shafts

Open Pit Mining

- Used most often but harmful to land
- Large pits are made by track-mounted electric shovels or diesel-powered front end loaders
- Diesel-powered front end loaders are generally used at smaller

Hydraulic Mining

- Quick and covers a large area
- Water is carried to the mining site via canals and ditches, then go into a hose with a pipe attached to it, forcing the water out with great pressure
- The water runs over the hillside washing dirt and gravel into a sluice box

The Aftermath of Mining

- Heavy metals, acids, and other materials are left behind
- Sometimes the ore is piled up on the ground and sprayed with cyanide and water or acid
  - The slurry runs over the ground and seeps into the ground and surface waters
- Organic matter, nutrients, and water is either acidic or alkaline killing fish and plant life
- Tailings can contain radioactive materials and harmful toxins

Desertification

- Heavy rainfall caused by global warming causes flooding and soil erosion
- Overgrazing livestock and mining operations change the productivity and livability of the land
- If there is a drought, grasslands dry up

Effects on Wildlife

- Humans are not the only ones to leave the area
- Wildlife search for food when drought, flooding, or soil erosion removes their food source

Soil Composition

- Soil consists of inorganic and organic matter
- Inorganic materials are released when broken down by heat, water, explosions, or weathering
  - Includes carbon, hydrogen, oxygen, nitrogen, phosphorus, potassium, calcium, magnesium, and sulfur
- Organic matter often includes decaying plant and animals and their waste products

Nutrients in Soil

- Found in topsoil (the top 6–8 inches of soil)
- Decreased substantially with soil erosion
- 25% of U.S. soil is highly erodible
- The loss of topsoil has a negative affect on agricultural productivity
- It takes 200–1,000 to form an inch of topsoil

Soil Conservation

- The Soil Conservation Service was formed after the “Dust Bowl” in the Midwest in the 1930s
- SCS officials encouraged farmers to stop soil erosion by
  - Planting trees for windbreaks
  - Creating terraces on tilled land
  - Contour strip-cropping
  - Developing waterways

Incentives for Farmers

- The SCS also encouraged farmers to use different methods to tend crops
- Financial incentives were provided for
  - Rotating crops from one year to the next
  - Leave old crop vegetation to decompose
  - Till crops with less plowing, using techniques like “no till,” “ridge till,” and “mulch till”
  - “Diverting” land by leaving it alone or using it for pastureland or woodlands

Fertilizers: Agricultural Pollution

- Used to increase crop production and food production
- The use of chemicals does not replace nutrients lost through erosion
- Common nutrients include nitrogen, phosphorus, and potassium
- Nitrogen and phosphorus pollution trigger **eutrophication**, killing aquatic species

The “Green Revolution”

- Began in the 1970s with new hybrid seeds, new fertilizers, and new pesticides to boost farm production
- This was considered necessary to feed populations overseas
- Many farmers converted unproductive land to farmland
- Crop production increased dramatically but still does not keep up with population growth
- The best solution is to stabilize population growth and reverse land degradation

Land Pollution

- Brownfields
- Human waste discharges (biosolids)

Brownfields

- Former industrial, commercial, or military sites
- Polluted with hazardous substances or contaminants, covered with trash, polluted, or left idle
- Owners and property managers are required to cover the cost of cleanup
- Some cities have reclamation projects

Biosolids

- In the U.S. 60% of wastewater treatment biosolids are discharged onto land
- Treated sewage is discharged to “drying beds”
- Some feel it provides nutrients like nitrogen and phosphorus that promote crop growth using an “organic” fertilizer
- In the U.S. the EPA limits public access to drying fields, grazing of cattle, and planting of crops

Biosolids: A Public Health Issue?

- Resident complain about the smell
- Potential health hazards include harmful pathogens that might be in the sewage
- Most scientists say the pathogens are unable to survive in the soil
- Some say the soil filters the bacteria and absorbs viruses

Public Health Remedies

- Biosolids must be classified
  - Class A have undetectable pathogens
  - Class B have detectable levels of pathogens
- When workers handle biosolids, they must use protective equipment and good hygienic practices
- The use of biosolids in the U.S., Canada, and other countries continues

Natural Disasters

- Citizens should be aware of the risk from natural disasters before moving to a new area, including:
  - Forest and wild fires
  - Earthquakes
  - Tornados
  - Floods
  - Hurricanes
  - Subsidence and “sinkholes”
  - Landslides and avalanches

Forest and Wild Fires

- The highest risk is in areas experiencing drought
- Sometimes fires are set deliberately by forest authorities (known as “controlled” or “prescribed” fires)
- The fires are necessary to burn leftover logging materials, clear brush, control undergrowth, get rid of diseased trees, reduce insect populations, and encourage new growth
- Soil erosion can occur after forest or wild fires

Earthquakes

- Can occur almost anywhere at any time
- Can be anticipated, but not predicted
- Eastern and Western areas of the U.S. are most at risk
- After an earthquakes, landslides and liquefaction pose additional risks
- When an earthquake occurs under the ocean, a tsunami occurs

Tornados

- A violently rotating column of air
- Can be up to 1 mile wide and 50 miles long with wind speeds 250 mph or more
- Usually occurs with a thunderstorm
- There may be two or more at one time
- When it occurs over warm water, a waterspout occurs

Floods

- One of the most destructive of all geologic hazards in the U.S.
- Areas more susceptible to flooding are called floodplains
- Governmental officials assess and document floodplains
- A 100-year floodplain has a 1% chance of flooding every year

Hurricanes

- Also known as cyclones because winds rotate around an “eye”
- Occur on the Atlantic coast
- The storm surge increases the sea level by 15 feet or more
- The water is pushed toward the shore
- Strong winds cause great damage on the coast and inland
- Flying debris produces an additional hazard
- The primary concern is the damage from flooding

Tropical Storms or Depressions

- These are less harmful than hurricanes
- Heavy rains persist and cause flooding

Subsidence

- When soil becomes weakened from mining, droughts, or caves, the soil may collapse or sink
- Sinkholes develop when water moves through soluble rock underground
- Most are less than 10 feet in diameter

Landslides and Avalanches

- A landslide is the rapid downward and outward movement of rock, soil, and vegetation
- Not all are sudden
- Most are triggered by weaknesses in the rock and soil, earthquake activity, heavy rainfall, snowmelt, or construction on a slope

- An avalanche is the rapid downward and outward movement of snow and ice

Buying and Selling Land

- Sellers should inform buyers of known geological hazards or contaminated land
  - Most contaminants are pesticides, gasoline, manure, or underground storage
- Buyers should inquire about the land on which a home is built especially when odors, holes, pits, and unusual soil colors are noticed

Buying and Selling Land (continued)

- Buyers should always inspect adjoining property for possible hazards
- Buyers should always bid on the property with a contingency clause that states the property must be free of potential problems and pass an inspection
- Other considerations include riparian rights, setbacks, and easements
- A survey of the land is always a good idea
- Homeowners can ask the Soil Conservation Service (now known as the Soil Survey Section) to help test the soil