

2023 GREEN GENERATION – YEAR 2
PART TWO – PROBLEMS RESULTING FROM HUMAN IMPACT

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Green Generation is designed for a two-year rotation – the first year will cover aquatic issues, air quality issues and climate change while the second year will cover terrestrial issues, population growth issues, and climate change.

Part 2: Problems resulting from human impacts on the quality of our environment

- A. Terrestrial Environment Issues – Desertification, Deforestation, Soil pollution, Waste Disposal, Mining
- B. Population Growth Issues – Habitat Destruction, Farming Practices, Fertilizers & Pesticides
- C. Climate Change – Effects on Plants, Animals, and Ecosystems

ENVIRONMENTAL ISSUES

Major Environmental Issues – Worldwide

- Pollution of Air, Water and Land
- Hazardous Chemicals and Wastes
- Land Degradation
- Loss of Biodiversity
- Ozone Depletion
- Climate Change
- Loss of natural and cultural resources
- **Habitat loss and fragmentation**
- Invasive species (both terrestrial and aquatic)
- **Improper management and use of water resources**



Major Causes of Environmental Issues

- Rapid population growth and the effects of urbanization, industry and harvesting practices on the ecosystem
- Rapid and wasteful use of resources
- Degradation of the earth's environmental systems
- Inadequate environmental regulations

Environmental Impact (I) (depends on three factors) - Paul Ehrlich

1. The number of people (population size, **P**)
2. The average number of units of resource each person uses (per capita consumption or affluence, **A**)
3. The amount of environmental degradation and pollution produced for each unit of resource used (destructiveness of the technologies used to provide and consume resources, **T**)

$$I = P \times A \times T \text{ (environmental impact)}$$

Sustaining the Earth— Learning as much as we can about how Earth sustains itself and adapts to ever-changing environmental conditions and integrating such lessons from nature into the ways we think and act

The basic **environmental** beliefs of the world:

- Nature exists for all of Earth’s species, not just for people
- There is not always more
- Some forms of economic growth are environmentally beneficial and should be encouraged, but some are environmentally harmful and should be discouraged
- Our success depends on learning to cooperate with one another and with the rest of nature to learn how to work with the Earth
- **This is the key to creating a sustainable society.**

Pollution - when harmful materials enter the environment

Sources of pollution usually fall into four main categories – industrial, residential, commercial, and environmental. Pollutants enter the environment through natural (volcanic eruption) or human activities

Sources of pollution may include

- **point source pollution** from a clearly identifiable location
- **nonpoint source pollution** that comes from many different places

Sources of pollution may include

- **organic pollution** – decomposition of living organisms and their byproducts
- **inorganic pollution** – dissolved and suspended solids as silt, salts, and minerals
- **toxic pollution** – heavy metals and other chemical compounds that are lethal to organisms
- **thermal pollution** – waste heat (or cold) from industrial and power generation processes
- **nuclear pollution** – radioactive materials

Harmful Impacts of Pollution – three factors determine the severity of the harmful effects

1. **Chemical nature** – how active and harmful the pollutant is to living organisms
2. **Concentration** – the amount of pollutant per unit of volume
3. **Persistence (degradability)** – how long the pollutant stays in the air, water, soil, or body of the organisms

Pollution can affect all areas of the environment and it is divided into the following:

- **Air Pollution** - the emission of any impurity into the air, such as smoke (including tobacco smoke), dust, cinders, solid particles, gases, mists, fumes, odors and radioactive substances
- **Water Pollution** – pollutants being added to ground water, surface water environments, and marine water environments
- **Thermal Pollution** – changes in water temperature due to additions of hot or cold water to a natural water system – often heated water from cooling at power plants
- **Soil Pollution** – pollutants being added to soil by agricultural runoff, waste disposal
- **Noise Pollution** – excess noise from industrial and urbanization activities
- **Light Pollution** – excess night lighting around urban areas which can impact life cycles or organisms
- **Radioactive Pollution** – radioactive waste and nuclear accidents

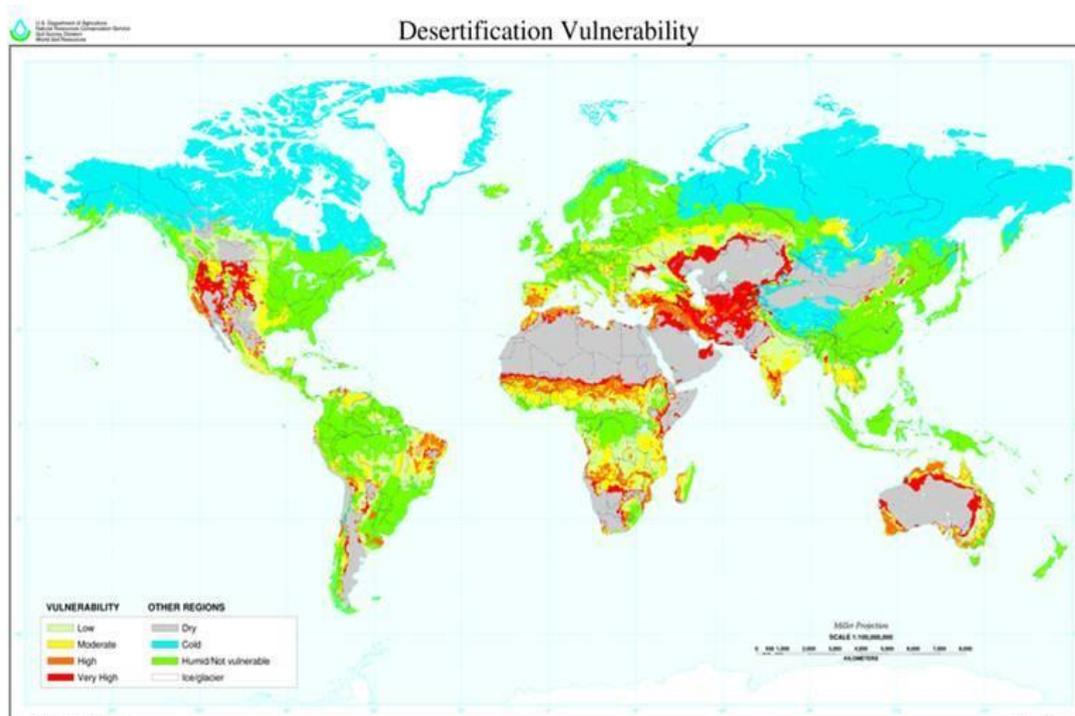


Terrestrial Issues

- *Desertification*
- *Deforestation*
- *Land use change*
- *Soil pollution*
- *Waste Disposal*
- *Mining*

Desertification

- **Desertification** is an expansion of arid conditions into a non-arid environment.
- **Major causes** of desertification include
 - Overgrazing & poor grazing management
 - Cultivation of marginal lands
 - Deforestation
 - Destruction of vegetation in arid regions
 - Expanding human population
 - Urbanization
 - Incorrect irrigation practices leading to salinization
 - Environmental protection as a low priority
- **Most endangered regions** are near the world's five main deserts
 - Sonoran Desert which lies in Northwest Mexico and the Southwest United States
 - Atacama Desert in South America
 - Kalahari Desert in Southern Africa
 - Most of Australia
 - The large desert mass made up by the Sahara, Arabian, Great Indian, Taklimakan, Gobi and the deserts of Iran and the former Soviet Union



Deforestation

Deforestation – the permanent destruction of indigenous forests and woodlands for agricultural use or exportation

Causes include

- Conversion of forests to agricultural land to feed people, **sometimes using fire**
- Development of cash crops and cattle raising esp. in tropical countries
- Commercial logging that is not regulated
- Poor soils in humid tropics do not support agriculture for long so more clearing becomes necessary



Forest Terminology

- **Old Growth Forest:** one that has **never** been cut down
- **Second Growth:** area previously harvested
- **Plantations or Tree Farms:** remaining forests
- **Silviculture:** management of forest plantations to harvest lumber
- **Clear-Cutting:** removal of all trees in an area – significant environmental problems
- **Selective-Cutting:** removal of selected trees leaving majority of habitat in place
- **Shelter-Wood Cutting:** cutting only mature trees and leaving younger trees to reseed the forest
- **Agroforest:** trees and crops are planted together for symbiotic relationships
- **Green-Belts:** open forested areas where no one is permitted to build

Types of Forest Fires

- **Surface Fires:** burn only forests' underbrush but don't damage trees
- **Crown Fires:** damage canopies of trees and spread quickly
- **Ground Fires:** smoldering fires that take place in bogs or swamps and can burn under ground for days

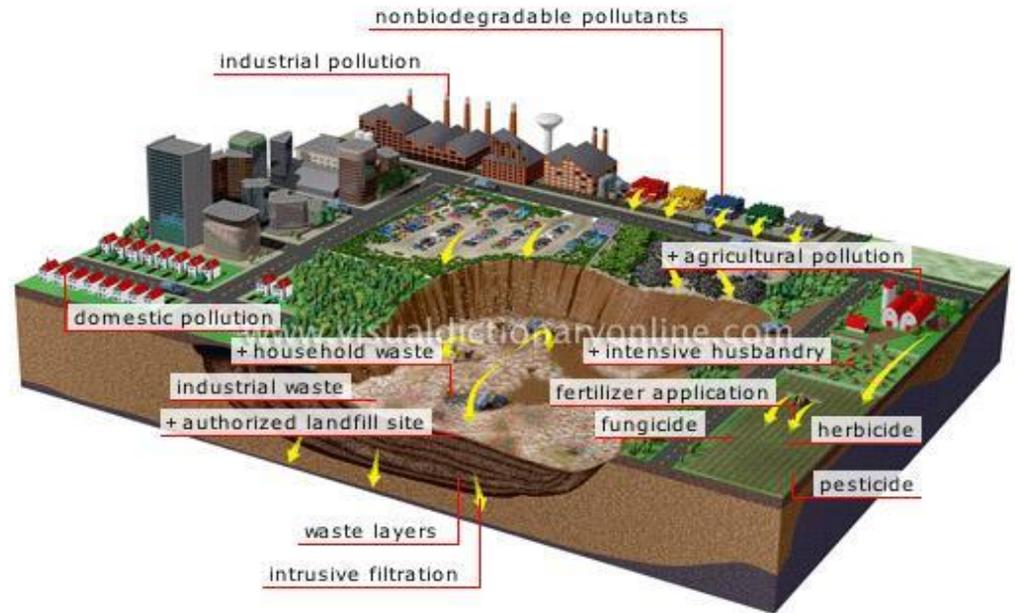
Deforestation Rates in the US – *US Forest Service*

- The United States lost an average of 384,350 hectares (949,750 acres) of forest each year between 1990 and 2010 **since forests regenerated more slowly than timber was being harvested.**
- A total of almost 4 million hectares (10 million acres) of timber is harvested each year, but most of that timber regenerates and remains classified as forested land, albeit at a different successional stage.
- The deforestation here refers to lands that are converted from forest to some other purpose.
- Deforestation could increase in the future because tree pests and diseases such as bark beetles are becoming more prevalent in the face of climate change.



Bark Beetle Damage

Soil Pollution



Ways that soil can become polluted, such as:

- Seepage from a landfill
- Discharge of industrial waste into the soil
- Percolation of contaminated water into the soil
- Rupture **and/or leaking** of underground storage tanks
- Excess application of pesticides, herbicides **and/or** fertilizer
- Solid waste seepage

Most common chemicals involved in causing soil pollution are:

- Petroleum hydrocarbons
- Heavy metals
- Pesticides
- Solvents

Effects of Soil Pollution

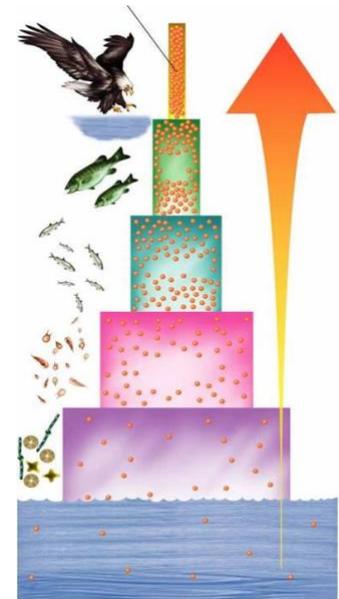
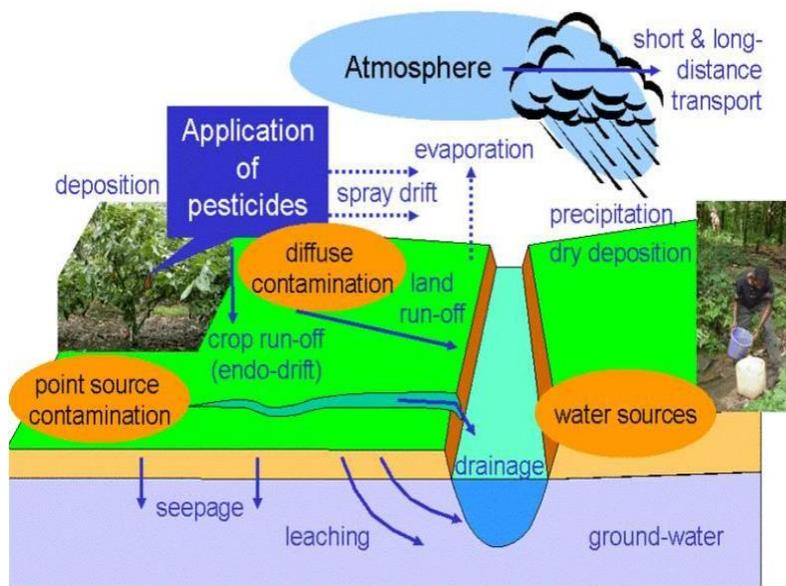
- Negative Effects on Human Health
- Effects on Growth of Plants
 - Ecological Balance is affected
 - Soil Chemistry changes
 - Fungi and bacteria found in soil decline
 - Nitrogen fixing bacteria decline
- Decreased soil fertility and decreased soil yield
- Toxic Dust from landfills pollute the environment
- Changes in Soil Structure – death of soil organisms **such** as earthworms lead to alteration in soil structure

Farming Practices

Negative environmental impacts from unsustainable farming practices include:

- Land conversion & habitat loss
- Wasteful water consumption
- Soil erosion and degradation
- Contamination from herbicides, pesticides and fertilizers
- Climate change
- Genetic erosion

Fertilizers and Pesticides



DDT Magnification

- Insects, weeds, and plant diseases are serious threats that destroy crops
- Drainage of fertilizers and pesticides into water supplies has negative environmental effects
- Run off from phosphorus and nitrogen-containing fertilizers in lakes and oceans causes eutrophication and “dead zones”
- Use of artificial fertilizers can eventually deplete soil of organic matter reducing their ability to hold water and making them subject to erosion
- Pesticides can have negative effects on human health from over-exposure
- Effects of pesticides can be compounded as you go up the food chain (i.e. DDT)
- Herbicides used in agriculture can be highly toxic to wildlife
- Organic methods of farming do not use chemical pesticides and fertilizers
- There are plants which remove the pollutants from the soil
- There are organisms which can control pests

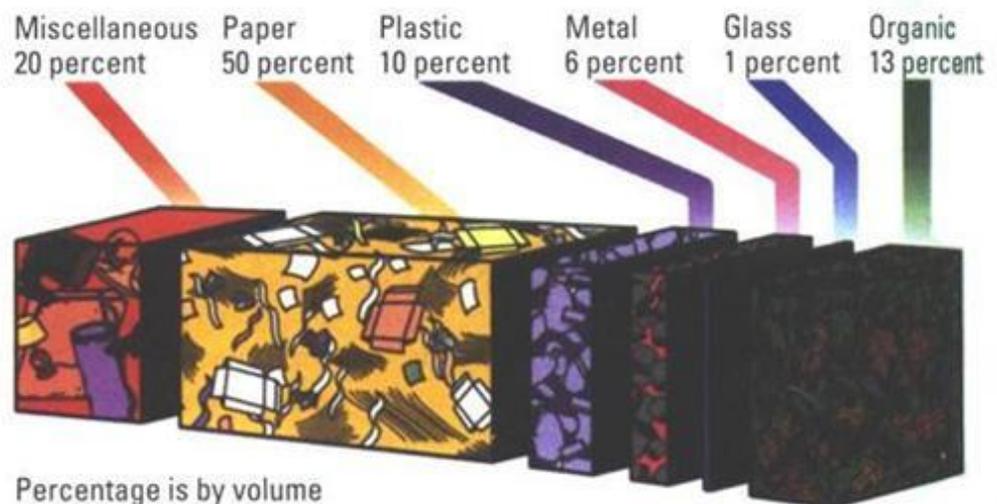
Waste Disposal

- Waste, or rubbish, trash, junk, garbage is an unwanted or undesired material or substance.
- It may consist of the unwanted materials left over from a manufacturing process (industrial, commercial, mining or agricultural operations) or from community and household activities.
- The material may be discarded or accumulated, stored, or treated (physically, chemically, or biologically), prior to being discarded or recycled.
- **Waste Categories**
 - *Solid Waste or Municipal Waste* commonly known as trash
 - *Regulated Medical Waste (RMW)* – potentially infectious or biohazardous waste
 - *RCRA Hazardous Waste* - hazardous pharmaceuticals, bulk chemotherapeutic agents, mercury, xylene and other solvents, some paints, aerosol cans etc
 - *Nuclear Waste* – radioactive materials
 - *Universal Waste* – batteries, pesticides, mercury-containing equipment, bulbs or lamps
 - *Recyclables* – paper, cardboard, beverage and food containers, metal and glass
 - *Construction and Demolition Debris* as ceiling tiles, plumbing fixtures, carpeting, concrete, bricks, fill dirt, etc.
 - *Composting material* – as grass, weed clippings, tree limbs, branches, waste from vegetable produce, bread and grains, and paper products as napkins and paper plates



- **Methods of Waste Disposal**
 - Landfill
 - Incineration
 - Recycling Methods
 - Biological Processing
 - Energy Recovery
 - Avoidance and Reduction Methods

- Landfill makeup



Mining - Environmental Risks

Mining: excavation of the Earth for the purpose of extracting ore or minerals

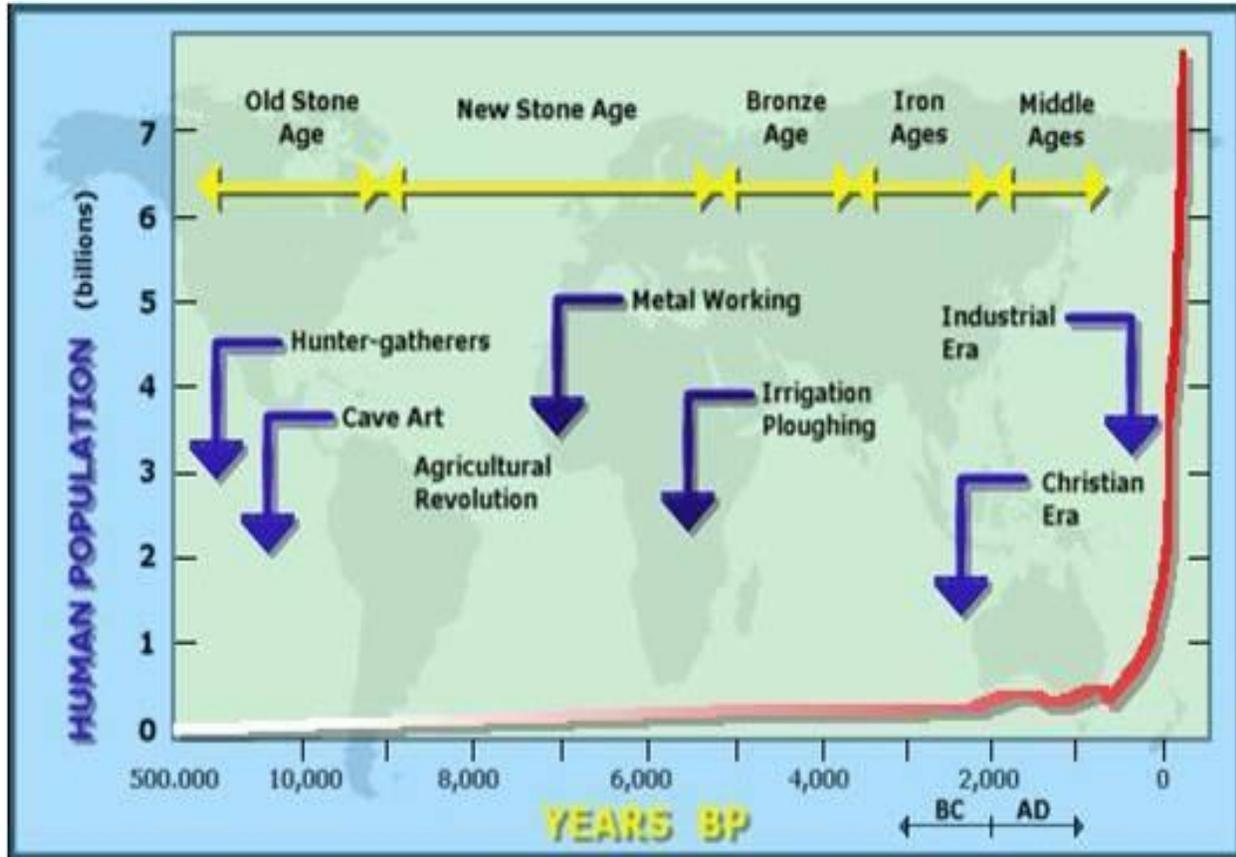
- **Metallic minerals:** zinc, copper
- **Non-Metallic minerals:** salt, precious gems
- **Mineral Deposit:** where a particular mineral is concentrated
- **Surface Mining:** starting from the top down and mining for minerals or oil deposits – results in permanent scarring of the land and changing land features
- **Tailings:** waste created from mining operations (usually consists of acids, sulfur compounds)

Risk	Affected compartments	Relevant toxic compounds
Overtopping of tailings dam	groundwater, surface water, soil	Water emissions: <ul style="list-style-type: none"> • in most cases radionuclides, mainly thorium and uranium; • heavy metals; • acids; • fluorides; Air emissions: <ul style="list-style-type: none"> • in most cases radionuclides, mainly thorium and uranium; • heavy metals; • HF, HCl, SO₂ etc.
Collapse of tailings dam by poor construction	groundwater, surface water, soil	
Collapse of tailing dam by seismic event	groundwater, surface water, soil	
Pipe leakage	groundwater, surface water, soil	
Ground of tailing pond not leak-proof	groundwater	
Waste rock stockpiles exposed to rainwater	groundwater, surface water, soil	
Dusts from waste rock and tailings	air, soil	
No site-rehabilitation after cease of mining operation	land-use, long-term contaminated land	
Processing without flue gas filters	air, soil	
Processing without waste water treatment	surface water	

Population Growth Issues

- Urbanization
- Habitat Destruction
- Farming Practices
- Fertilizers & Pesticides
- Water shortages

Human Population Growth



Urbanization

Concerns:

- Public Health
- Food Supply
- Safe water (potable, recreational)
- Coastlands and Oceans
- Forests
- Biodiversity and Habitat Destruction
- Global Climate Change



Habitat Fragmentation & Destruction

Habitat destruction and **fragmentation** is a process that describes the emergences of discontinuities (fragmentation) or the loss (destruction) of the environment inhabited by an organism.

Causes include:

- *conversion* to human-made uses: urbanization, deforestation, etc.
- *fragmentation*—natural geographic ranges are “cut up” due to construction, farming, etc
- *simplification*—clearing and cleaning up land areas of natural debris; stream channelization, etc.
- *intrusion*—interference with species: telecommunication lighted towers attracting migrating birds, causing collisions and entanglement in wires, etc.

It results in

- Loss of resident species
- Loss of food sources
- Loss of ecosystem functions provided by the habitat



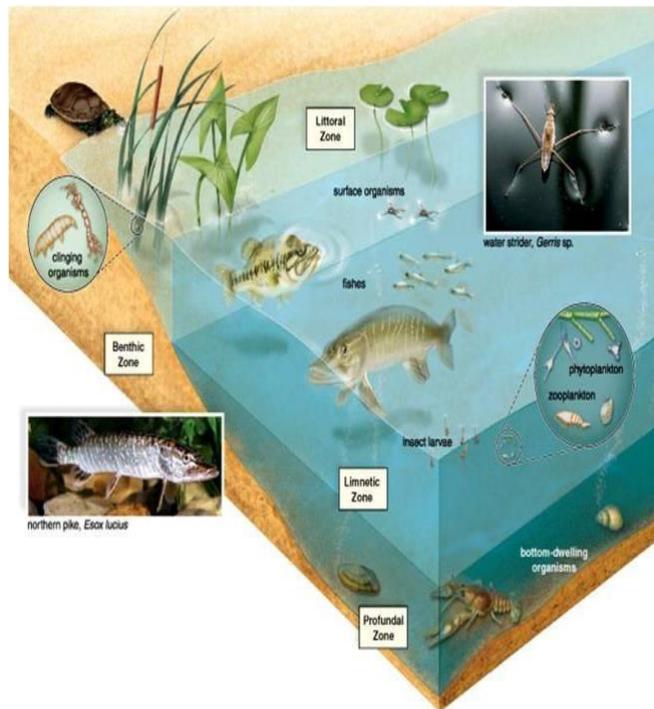
Biodiversity Threats

Types of Biodiversity:

- **Genetic diversity** – varies in the genetic make-up among individuals within a single species
- **Species diversity** – variety among the species or distinct types of living organisms found in different habitats of the planet
- **Ecological diversity** – variety of forests, deserts, grasslands, streams, lakes, oceans, wetlands, and other biological communities

Causes:

- **Habitat loss & Fragmentation**
- **Climate Change**
- **Overuse and exploitation**
 - deforestation
 - unsustainable agricultural practices: over-cultivation, slash and burn agriculture, etc.
 - overfishing
 - excessive hunting
 - illegal poaching
 - illegal exotic species trade
- **Construction, farming, etc.**
 - simplification—clearing and cleaning up land areas of natural debris; stream channelization, etc.
 - intrusion—interference with species: telecommunication lighted towers attracting migrating birds, causing collisions and entanglement in wires, etc.
- **Human population explosion**
- **Pollution**
 - **land and water pollution**: pesticides, toxic waste, oil spills, eutrophication of water, pathogens from human waste, **atmospheric deposition of pollutants**
 - air pollution and related issues: NO₂, SO₂, acid deposition; ozone depletion, GHG (Greenhouse gases)
- **Invasive species** introduction can be accidental or deliberate (ornamentation, horticulture, aquaculture) can take over an area, **competing with native species for resources and changing the entire ecosystem functioning, i.e., zebra mussels and food web collapse in the Great Lakes.**



Effects of Climate Ecosystems

Topics could include:

- Shifting
- Timing of
- Timing of flowering and pollination
- Rate of decomposition
- Biogeochemical cycling
- Availability of food and water
- “Ghost forests” being replaced by marshes
- Increasing extinction rates
- Timing and intensity of natural disasters
- Spread of invasive species

Change on Plants, Animals, and

habitat ranges
hibernation

Reference List for Images by Page

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Image 1 is no longer available on web except in previous SO material.

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Yashas Anur. “Industrial Pollution.” SlideShare, www.slideshare.net/yashaspanur/industrial-pollution-15671227.

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Image 1 is no longer available on web except in previous SO material.

Image 2: Vulnerabilities: Desertification. [Vulnerabilities: Desertification - ClimateChangeForkClimateChangeFork \(brooklyn.edu\)](http://Vulnerabilities: Desertification - ClimateChangeForkClimateChangeFork (brooklyn.edu))

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Image 1: Rennie, J. 2009. 7 Answers to Climate Contrarian Nonsense. [7 Answers to Climate Contrarian Nonsense - Scientific American](#)

Image 2: Bateman, M. 2012. Insect Outbreaks Kill Forests and Release Carbon. [Insect Outbreaks Kill Forests and Release Carbon | Live Science](#)

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Land Pollution. 2010. [Global Warming: land pollution \(glbwg.blogspot.com\)](#)

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Image 1: Hetzler, P. 2018. Is your well water actually well? [Is your well water actually well? « All In \(northcountrypublicradio.org\)](#)

Image 2: DDT the Environmental Assassin. 2013. [DDT the Environmental Assassin](#)

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Image 1: Types & Effects of Pollution. [Types and Effects of Pollution - POLLUTION \(weebly.com\)](#)

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Image 1: Welcome to the Tense Charged Electrifying City, Tokyo. [Welcome to the Tense Charged Electrifying City, Tokyo – Love-Hate Relationship](#)

Image 2: North American Wildlife Crossing Structure Design Competition. 2009. [The Happy Pontist: North American Wildlife Crossing Structure Design Competition](#)

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