

2022 GREEN GENERATION – YEAR 1
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 and population growth issues.

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

- A. Aquatic Environment Issues –Water pollution, Ocean Dead Zones, Water Diversion, Overfishing
- B. Air Quality Issues – Acid rain, Air Pollution, Nuclear Pollution
- C. Climate Change Issues – Greenhouse Effect, Ozone Depletion

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



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

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
- 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 bi-products
- **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 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 runoffs, unclean technology, 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



Types of Water Pollution and their Effects

If water pollution is from a single source, it is called **point-source pollution** while pollution coming from many sources is called **nonpoint pollution**.

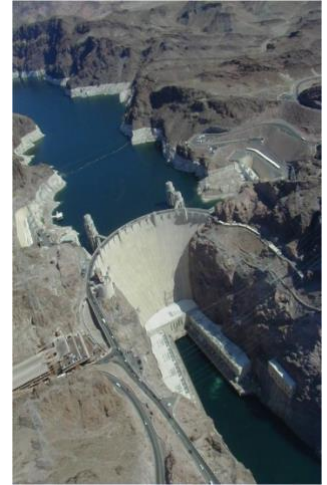
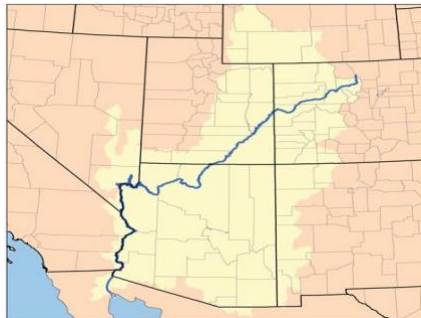
Type of Water Pollution	Cause of Pollution	Symptoms of Pollution	Effect of Pollution	Source of Pollution
Biodegradable waste	Humans and animals	Decreasing numbers of fish and other aquatic life, increasing number of bacteria	Increased number of bacteria, decreased oxygen levels, death of aquatic life	Run-off, improperly treated effluent,
Nutrients	Nitrates and phosphates	Green, cloudy, slimy, stinky water	Algae blooms, eutrophication of water source	Over use of fertilizers, run-off from fields, improper disposal of containers, wastewater treatment
Heat	Increased water temperature	Warmer water, less oxygen, fewer aquatic organisms	Decrease in oxygen levels, death of fish and plants	Industrial run-off, wastewater treatment
Sedimentation	Suspended particles settling out of water	Cloudy water, increased amount of bottom	Warms up water, decreases depth of water source, deposits toxins	Construction sites, farming and livestock operations, logging, flooding, city run-off, dams
Chemicals	Toxic and hazardous chemicals	Water color changes, develops an odor, aquatic life dies out	Kills aquatic life, can enter human food chain, leads to birth defects, infertility, cancer and other diseases in humans and animals	Human-made, improper disposal, run-off, dams, landfill leachate, industrial discharge, acid rain
Radioactive pollutants	Radioactive isotopes	Increased rates of birth defects and cancer in human and animal populations.	Kills aquatic species and leads to cancer and death in humans and other animals	Waste water discharges from factories, hospitals and uranium mines
Medical	Medicines, antibiotics	Infertility in aquatic organisms, and other unknown symptoms	Unknown	Humans dumping medicines into water systems, wastewater treatment

Source: Safe Water Drinking Foundation

AQUATIC ENVIRONMENT ISSUES

Environmental Threats to Freshwater and Ground Water Systems

- The creation of dams and water-diversion systems blocks migration routes for fish and disrupts habitats.
 - Dams are a major factor in water diversion.
 - Dams are built along rivers to produce reservoirs.
 - This affects the ecology of the river and the surrounding environment including Habitat Loss, Habitat Fragmentation, and Loss of Biodiversity
 - The Colorado River is a good example.



- Water withdrawal for human use shrinks and degrades habitats.
- Runoff from agricultural and urban areas hurts water quality.
- Draining of wetlands for development depletes habitats.
- Overexploitation and pollution threaten groundwater supplies.
- Invasion of exotic species can harm native animals and plants.
- Global warming may lead to devastating floods and droughts.



Thermal Pollution and Rising Ocean Temperatures

- Change in the water temperatures of lakes, rivers, and oceans caused by made-man industries or practices
- Water as coolant is warmed returned & to body of water
- Ocean warming from climate changes can lead to problems like coral bleaching



Nutrient Overflows

Nutrients naturally flow through ecosystems as described in the various biogeochemical cycles. Natural or unnatural disruptions of these cycles can lead to elevated levels of nutrients entering a system. Examples include the use of fertilizer and pesticides and the overflow of city sewer systems.

Eutrophication – bodies of water become enriched with nutrients. This can be a problem in marine habitats such as lakes as it can cause algal blooms.

- run-off from fertilizers, into nearby water causing an increase in nutrient levels.
- It causes phytoplankton to grow and reproduce more rapidly, resulting in algal blooms.
- This bloom of algae disrupts normal ecosystem functioning and causes many problems.
- The algae may use up all the oxygen in the water, leaving none for other marine life. This results in the death of many aquatic organisms such as fish, which need the oxygen in the water to live.
- The bloom of algae may also block sunlight from photosynthetic marine plants under the water surface.
- Some algae even produce toxins that are harmful to higher forms of life. This can cause problems along the food chain and affect any animal that feeds on them.

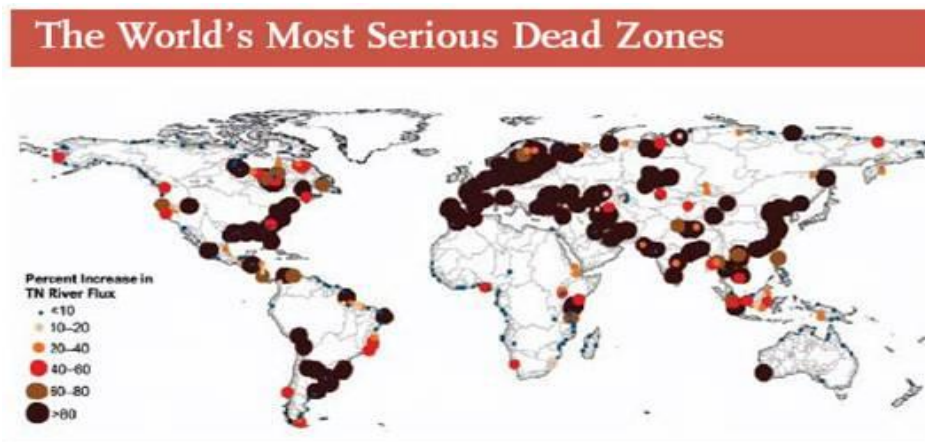


Sewer Overflows

- Can be due to lack of infrastructure, old infrastructure being overwhelmed by increased water loads, combined systems which are both sewer and storm sewers, and/or poor maintenance
- Can result in raw sewage going into source or drinking water
- Increase in rainfall stresses systems

Threats to Marine Environments

- **Ocean Dead Zones**
 - Eutrophication is magnified as rivers lead into larger rivers and eventually into the ocean – as the Mississippi River network.
 - This leads to ocean dead zones or regions where oxygen concentration is very low (hypoxia) to the point where plants and animals either die or leave the zone.
 - The Mississippi River, which is the drainage area for 41% of the continental United States, dumps high-nutrient runoff such as nitrogen and phosphorus into the Gulf of Mexico.
 - The Dead Zone at the mouth of the Mississippi River in the Gulf of Mexico is the largest in the US. In 2010 it was the size of New Jersey.



- **Oil spills and their ecological disasters**

- The BP Oil Rig Explosion in the Gulf of Mexico in 2010
- Chemical spills and dumping of waste in the oceans or near coral reefs and ocean shelf areas causes major environmental problems.



- **Marine dumping of wastes** – plastic and other wastes

- **Climate Change** - is warming the oceans and making them more acidic.

- **Sea Temperature Rise** – warming the oceans is causing problems like coral bleaching

- **Ocean acidification** - caused by excess CO₂ dissolving in the sea to form carbonic acid, has the potential to literally dissolve the skeletons and shells of marine creatures such as corals leading to devastating effects on marine ecosystems

- **Habitat loss** as mangroves and estuary regions causing population displacement

- **Bycatch** – marine wildlife unintentionally caught as sea turtles, porpoises, albatross, crabs, starfish & fish

- **Whaling** is still a problem though strides are being made

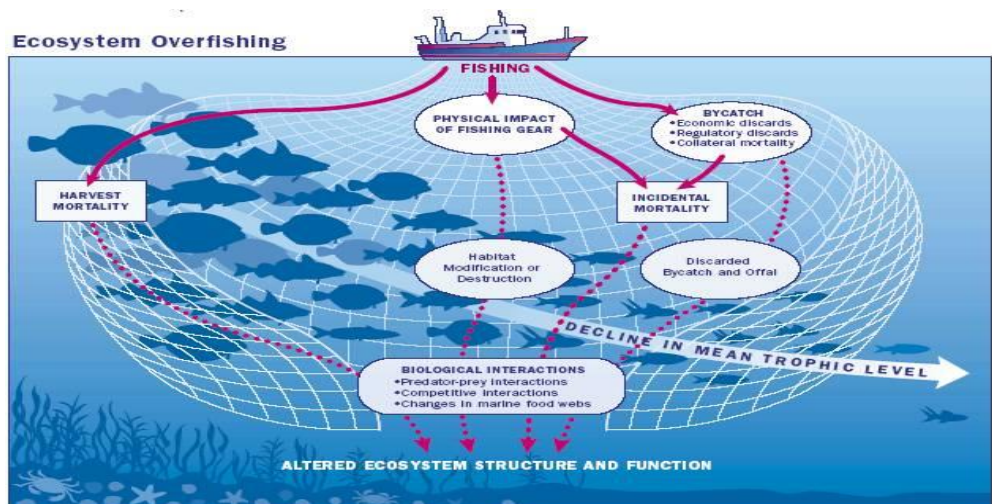
- **Fishery**: an industry devoted to the catching or selling of fish

- **Overfishing and Exploitation** - depletes stocks of fish beyond their ability to recover, disrupting the ecosystem and eliminating a valuable source of food and income.

- Fish catch has risen from 20 million tons/year to over 90 million tons / year
- Original fishing limit – 12 miles out to sea
- In 1960s changed to 200 miles due to lack of fish
- Boats go out even further or rely on more technology-based systems to find huge numbers of fish
- **Driftnets**: dragged through the water indiscriminately catching everything including turtles, dolphins, sharks and whales
- Long-lining: using long lines that have baited hooks that will capture multiple fish
- **Bottom trawling**:

ocean floor is literally scraped by heavy nets for all bottom-dwelling fish – leaving a cared path of destruction.

- 47-50 % of major fish stocks of the world are fully exploited, 20 % are nearly over exploited, 10 % are depleted



Source: Adapted from Pauly et al., 1998; Goñi, 2000.

Art: John Michael Yanson

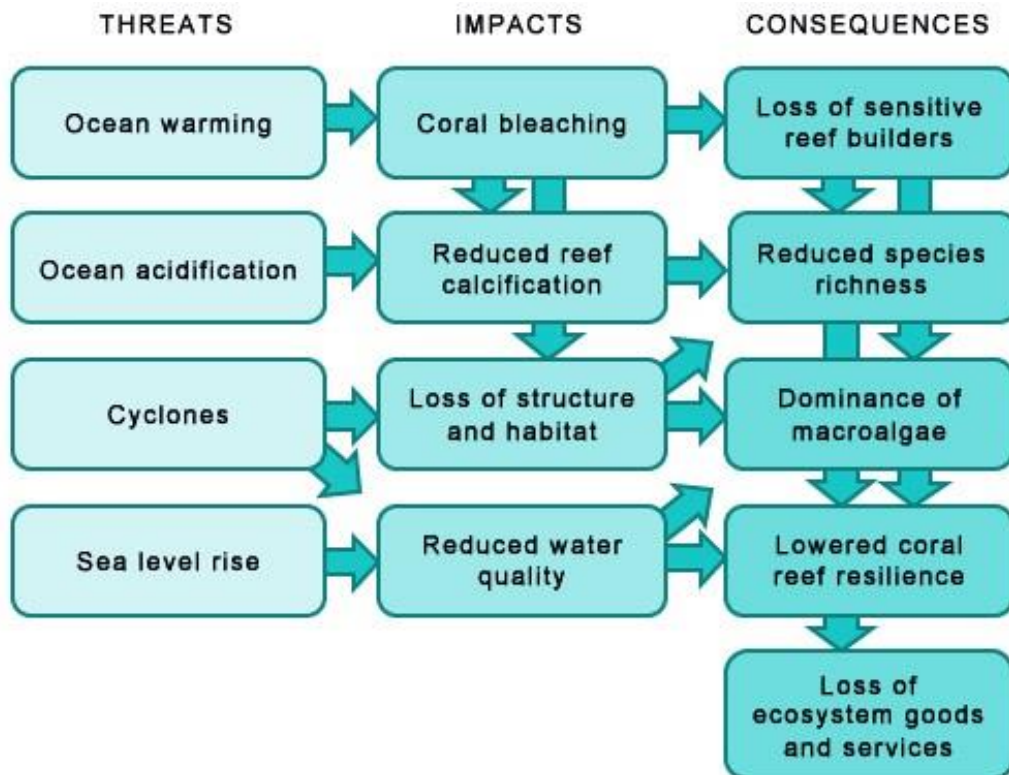
- **Invasive Species** – are disrupting normal food chains and food webs within the ecosystem

Threats to Estuaries

- Estuaries receive the pollutants dumped into the streams and rivers that feed them
- Residential and commercial development not only adds to pollution but eliminates some estuaries due to land filling
- Coastal development, introduction of invasive species, over fishing, dams, and global climate change have led to a decline in the health of estuaries, making them one of the most threatened ecosystems on Earth.
- A majority of pollutants find their way into estuaries from non-point sources

Threats to Coral Reefs

- Chemical pollutants
- Excess nutrients
- Sedimentation
- Coral bleaching
- Coral diseases
- Climate change and ocean acidification
- Overfishing



AIR POLLUTION ISSUES

Climate Changes

- Sea Level Rise
- Temperature
- Precipitation

Health Impacts

- Weather-related Illness and Mortality
- Infectious Diseases
- Air Quality-Respiratory and Cardiac Illnesses

Agriculture Impacts

- Crop yields
- Irrigation demands
- Increased GHG from beef

Water Resource Impacts

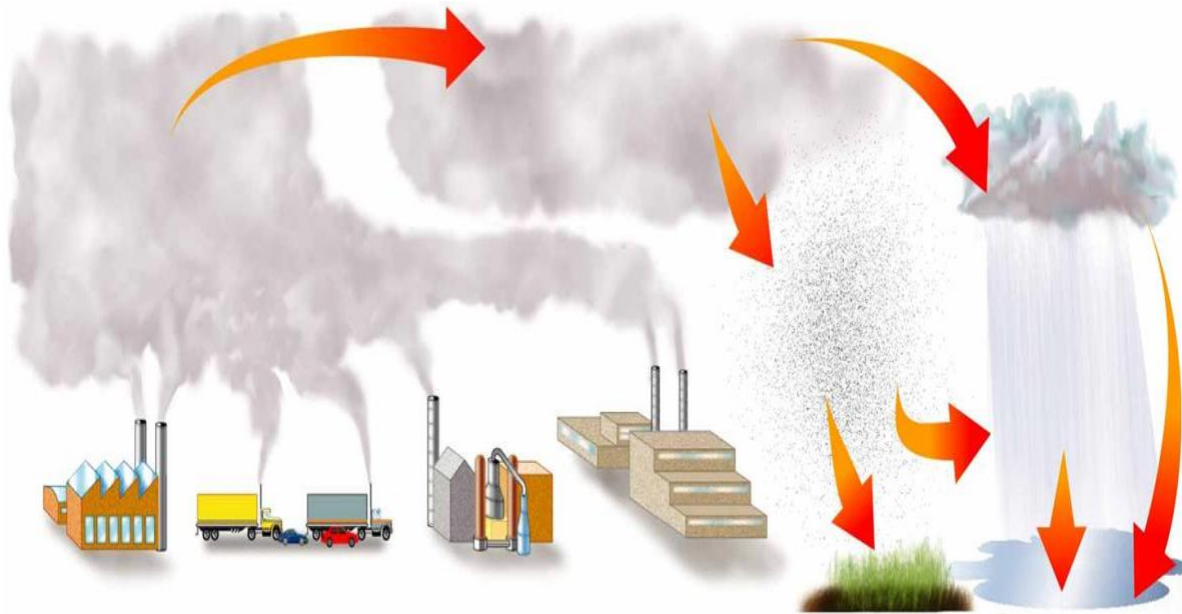
- Changes in water supply
- Water quality
- Increased competition for water

Impacts on Coastal Areas

- Erosion of beaches
- Inundate coastal lands
- Costs to defend coastal communities

Species and Natural Areas

- Shift in ecological zones
- Loss of habitat and species



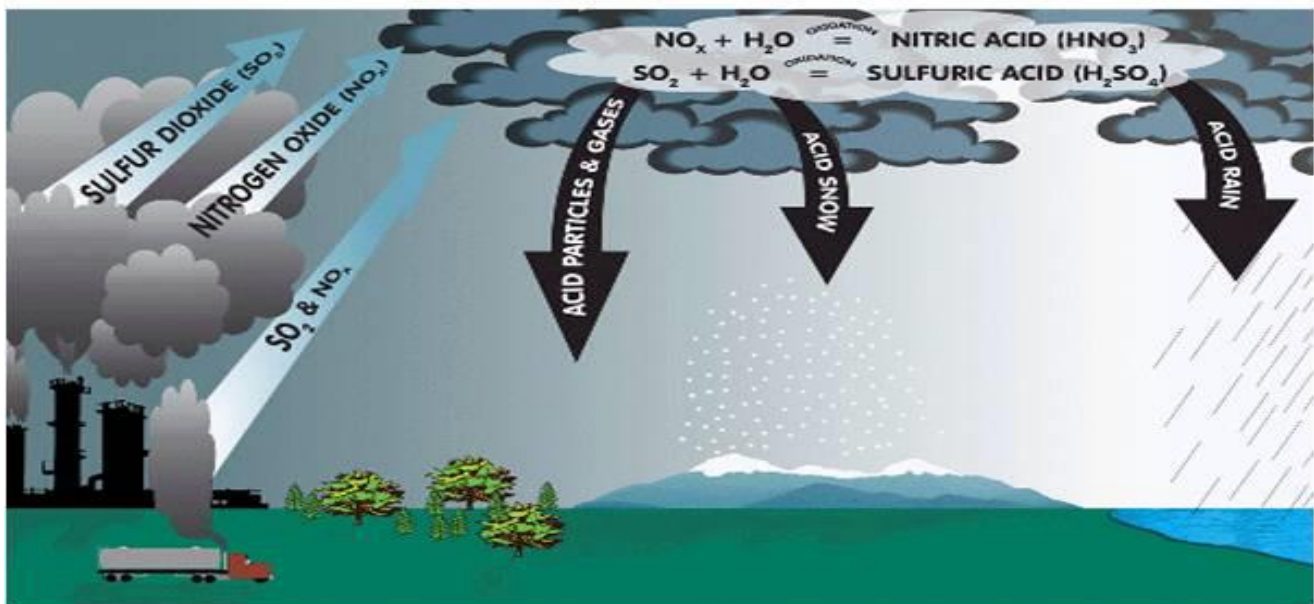
Atmospheric Deposition

The process, whereby precipitation (rain, snow, fog), particles, aerosols, and gases move from the atmosphere to the earth's surface. Materials reaching the earth in precipitation or as dry deposition originate from a variety of air pollution sources and can be harmful to the environment and public health. This includes things such as

- Acid deposition
- Mercury
- Microplastics
- PFAS
- Greenhouse gases

Acid Deposition (formally known as acid rain)

- a mixture of wet and dry deposition (deposited material) from the atmosphere containing higher than normal amounts of nitric and sulfuric acids
- Wet deposition refers to acidic rain, fog, and snow
- Dry deposition occurs where environment is dry and the acid chemicals are incorporated into the dust or smoke sticking to surfaces of buildings, ground, cars and trees. As it is washed off by rain, it leads to acidic runoff
- About half of the acidity in the atmosphere falls back to earth through dry deposition
- pH of acid rain is typically about 5.6
- Effects of Acid Rain
 - Surface water in lakes, rivers, streams become more acid
 - Damages forests at high elevations
 - Damages building materials and paints
 - Affects human health



Nuclear Pollution

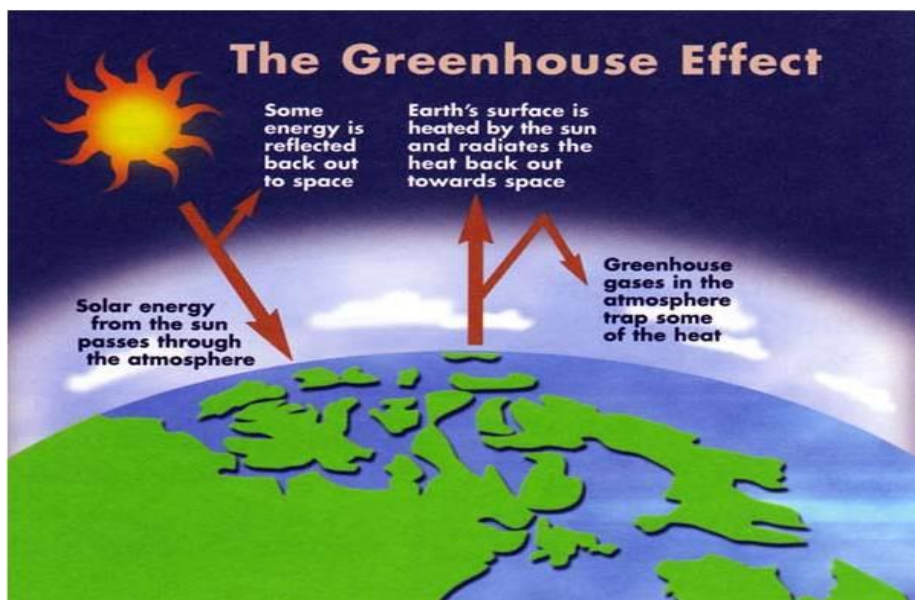
- Nuclear pollution is pollution that is radioactive.
- Fallout can lead to radiation sickness and death.
- Nuclear fallout can destroy environmental features and animal life.
- Fukushima Daiichi Disaster (2011)



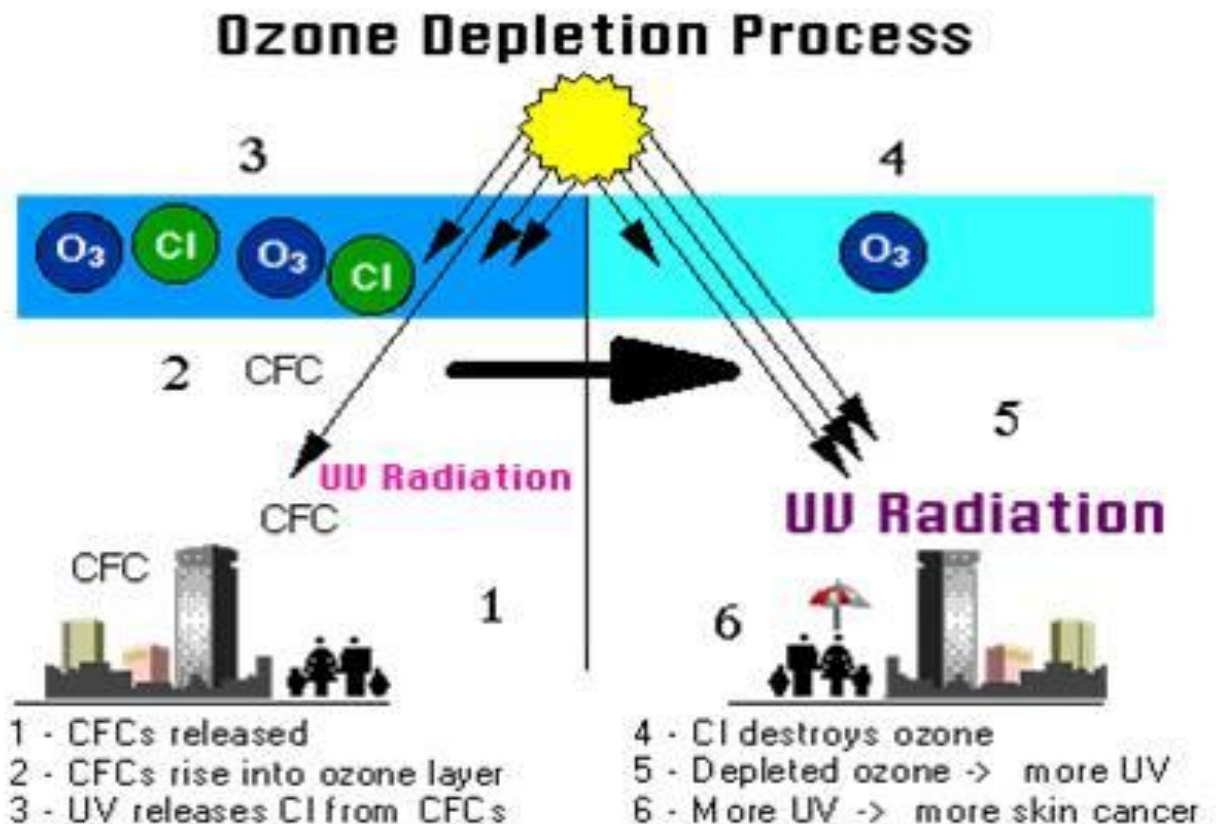
CLIMATE CHANGE ISSUES

Greenhouse Effect - warming that results when the atmosphere traps heat radiating from Earth toward space.

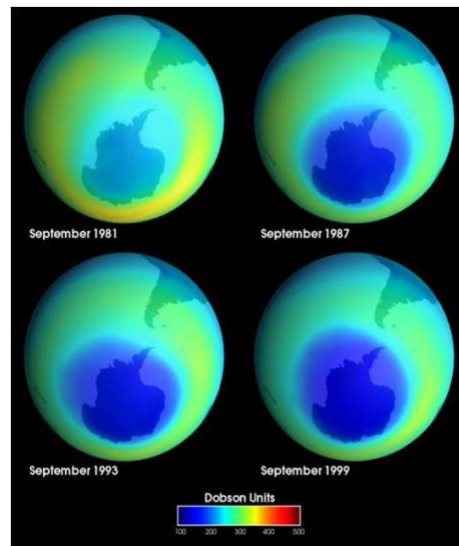
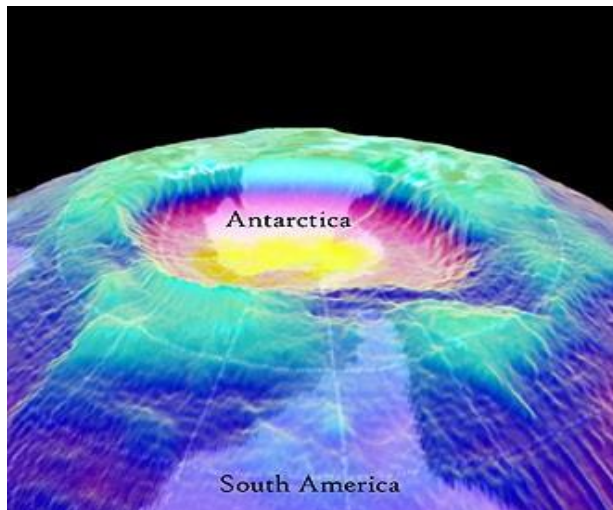
- The Earth gets energy from the sun in the form of sunlight.
- The Earth's surface absorbs some of this energy and heats up.
- That's why the surface of a road can feel hot even after the sun has gone down—because it has absorbed a lot of energy from the sun.
- The Earth cools down by giving off a different form of energy, called infrared radiation.
- But before all this radiation can escape to outer space, greenhouse gases in the atmosphere absorb some of it, which makes the atmosphere warmer.
- As the atmosphere gets warmer, it makes the Earth's surface warmer, too.



- The earth's temperature is dependent upon the greenhouse-like action of the atmosphere, but the amount of heating and cooling are strongly influenced by several factors just as greenhouses are affected by various factors.
 - In the atmospheric greenhouse effect, the type of surface that sunlight first encounters is the most important factor.
 - Forests, grasslands, ocean surfaces, ice caps, deserts, and cities all absorb, reflect, and radiate radiation differently.
 - Sunlight falling on a white glacier surface strongly reflects back into space, resulting in minimal heating of the surface and lower atmosphere.
 - Sunlight falling on a dark desert soil is strongly absorbed, on the other hand, and contributes to significant heating of the surface and lower atmosphere.
 - Cloud cover also affects greenhouse warming by both reducing the amount of solar radiation reaching the earth's surface and by reducing the amount of radiation energy emitted into space
 - Atmospheric gases – water vapor (H_2O), carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), all act as effective global insulators
 - The negative concerns are related to the possible impacts of an **enhanced** greenhouse effect caused by excess pollutants going into the air
- **Ozone Depletion** - ozone layer is deteriorating due to the release of pollution containing the chemicals chlorine and bromine (chlorofluorocarbons or CFCs)



Ozone Hole over Antarctica



Reference List for Images by Page

Page 1

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