Academic Year

2020-2021

GE Environmental Science Engineering

Module 3 – Environmental Problems and Issues

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LLEGE OF TECHNOLOGY

TOPIC: Module 3 – Environmental Problems / Issues
TIME FRAME: 12 hours

INTRODUCTION

Studying environment science is all about learning the way we should live and how we can develop sustainable strategies to protect the environment. It helps every student to develop an understanding of living and physical environment and how to resolve challenging environmental issues affecting nature. In addition to studying the physical aspects of the environment, it also emphasizes the need to conserve biodiversity and adopt a more sustainable lifestyle and utilize resources in a responsible way. The inclusion in the curriculum is a way to increase public awareness about environmental issues, explore possible solutions, and to lay the foundations for a fully informed and active participation of individual in the protection of environment and the prudent and rational use of natural resources.

With natural resources such as air, water, oil, minerals are getting depleted rapidly, the environmental studies course can help students understand the importance of these resources and how we can improve the situation by taking appropriate actions in our regular lives to preserve these resources.

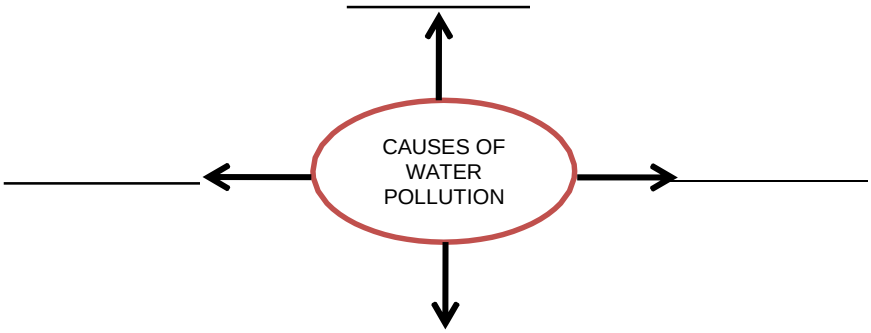
OBJECTIVES

- To discuss how human activities result in environmental problems.
- To describe the nature of environmental problems / issues, their causes, risks, and effects.

PRE-TEST

1. In one word, describe the picture below. Discuss your answer.

2. What do you think are the causes of water pollution? Write your answers on the space provided.



LEARNING ACTIVITIES

Land pollution, solid and hazardous wastes

Land pollution – the deposition of solid or liquid waste materials on land or underground in a manner that can contaminate the soil and groundwater, threaten public health, and cause unsightly conditions and nuisances.

Causes of land pollution

- Improper waste disposal
- Urbanization
- Deforestation/Soil erosion
- Agricultural activities
- Mining activities
- Overcrowded landfill
- Industrialization

Effects of Land Pollution

- **Chemical effects on life:** chemical contamination is one of the biggest threats to the land. Chemicals like plastics, toxins and wastes seep into the ground and poison it. This leads to loss of plants that grow in the soil, animal life and create long-term health problems such as cancer.
- **Effects on human health:** The land when contaminated with toxic chemicals and pesticides lead to problem of skin cancer and human respiratory system. The toxic chemicals can reach our body through food and vegetables that we eat as they are grown in polluted soil.
- **Environmental impact:** When land pollution is bad enough, it leads to a steep imbalance in the rain cycle which affects a lot of factors. Trees and plants help balance the atmosphere and without them we are subjected to various concern like; global warming the greenhouse effect, irregular rainfall and flash floods among other imbalances.
- **Destruction of Habitat:** when the land which is the natural habitat of plant and animal is polluted, it affect them which lead to loss of biodiversity.
- **Decrease Food Production:** When land is polluted it affects the fertility of the soil which lead to reduction in food production

What can we do?

- People should be educated and made aware of the harmful effects of littering in the environment.
- Proper disposal of waste (in the industries, and in our communities): Creates dumping ground away from residential areas.
- Reduce the use of chemicals in agricultural activities: farmers should be encouraged to use animal manure (organic manure) instead of inorganic manure/fertilizer .Farmers should be advised to use biological means to control pests instead of using pesticides and insecticides.
- Reduce, Re-use and Recycle waste: Reuse any items that you can. Items like clothing, bottles wrapping papers and shopping bags can be used over and over again, rather than buying new ones.
- Mining industries should reclaim or restore the land after they have finished working.
- Re-afforestation (plant trees)

Water Pollution

Water Pollution – any alteration of the physical, chemical, biological, or radiological properties of a water body resulting in the impairment of its purity or quality.

Sources of Water Pollutants

- Point source - any identifiable source of pollution with specific point of discharge into a particular water body.
- Nonpoint source - any source of pollution not identifiable as point source to include, but not be limited to, runoff from irrigation or rainwater, which picks up pollutants from farms and urban areas.

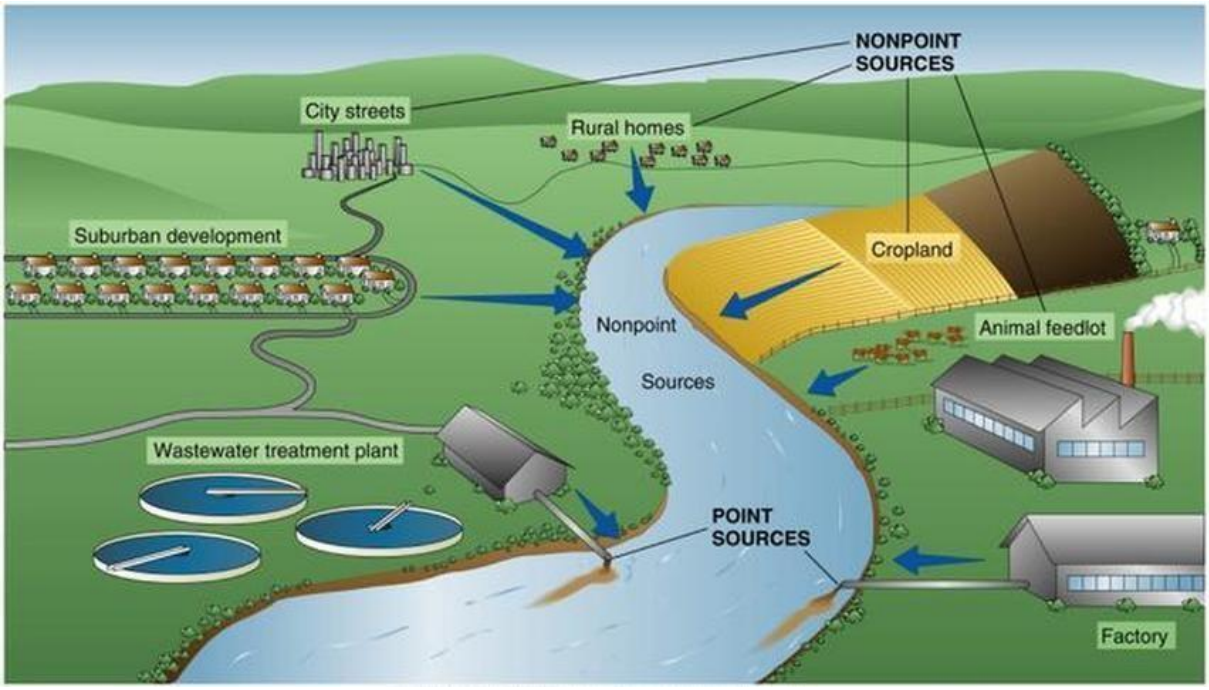
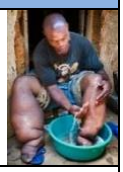


Figure 1. Point and Nonpoint Source of Water Pollutants

Eight (8) Classes of Water Pollutants and its Effects

Water Pollutants	Effects
1. **Infectious agents** (bacteria, viruses & parasitic worms from human & animal waste)	Sickness and death   
2. Oxygen-depleting wastes (Animal manure & farm runoff, plant debris, industrial discharge, & urban sewage) - Consumed by aerobic bacteria	• Depletion of oxygen • Eutrophication • Death of oxygen-consuming aquatic life 
3. Inorganic chemical wastes Mineral acids, toxic metals (Pb, Cd, Hg, & hexavalent chromium) & mineral salts found in industrial discharge, chemicals in household	• Renders water undrinkable • Cancer • Birth defects • Death of fishes and other aquatic life • Plant damage and lower crop yields

wastewater & seepage from municipal dumps & landfills	• Corrosion of metals
4. Organic chemical wastes A wide variety of compounds including petroleum products (oil, gasoline), pesticides & organic solvents from industrial discharge & runoff from farm & urban areas	• Cancer • Damage to the central nervous system • Birth defects
5. Plant nutrient pollutants found mainly in urban sewage, runoff from farms & gardens, & household water chemicals include nitrates ($NO3^-$), phosphates (PO_4^{3-}) & ammonium (NH^{4+}) salts commonly found in fertilizers and detergents	• Excessive algae growth in lakes and ponds • Eutrophication
6. Sediments/Silts From erosion of soils	• Reduction of available sunlight to plants (reduced photosynthesis) • Clogged gills • Smothered eggs of fish and other aquatic organisms • Disruption of local ecosystem • Fills up or clogs water bodies & waterways
7. Radioactive materials Iodine-131 and strontium-90 found in nuclear power plant effluents and fallout from atmospheric nuclear testing	• can be introduced into the food chain through plants and become incorporated in body tissues of humans and animals • Their ionizing radiation can produce cancers, especially in the thyroid and bone where they tend to concentrate.
8. Thermal pollution Discharged water from industrial discharges that is significantly warmer than the ambient environment	• Depletion of dissolved oxygen • Increased temperature may exceed the range of tolerance of some aquatic species and lead to disruption of local ecosystem

Air pollution, global warming, climate change, ozone layer depletion

Air Pollution - any alteration of the physical, chemical and biological properties of the atmospheric air, or any discharge thereto of any liquid, gaseous or solid substances that will or is likely to create or to render the air resources of the country harmful, detrimental, or injurious to public health, safety or welfare or which will adversely affect their utilization for domestic, commercial, industrial, agricultural, recreational, or other legitimate purposes.

Types of Air Pollution

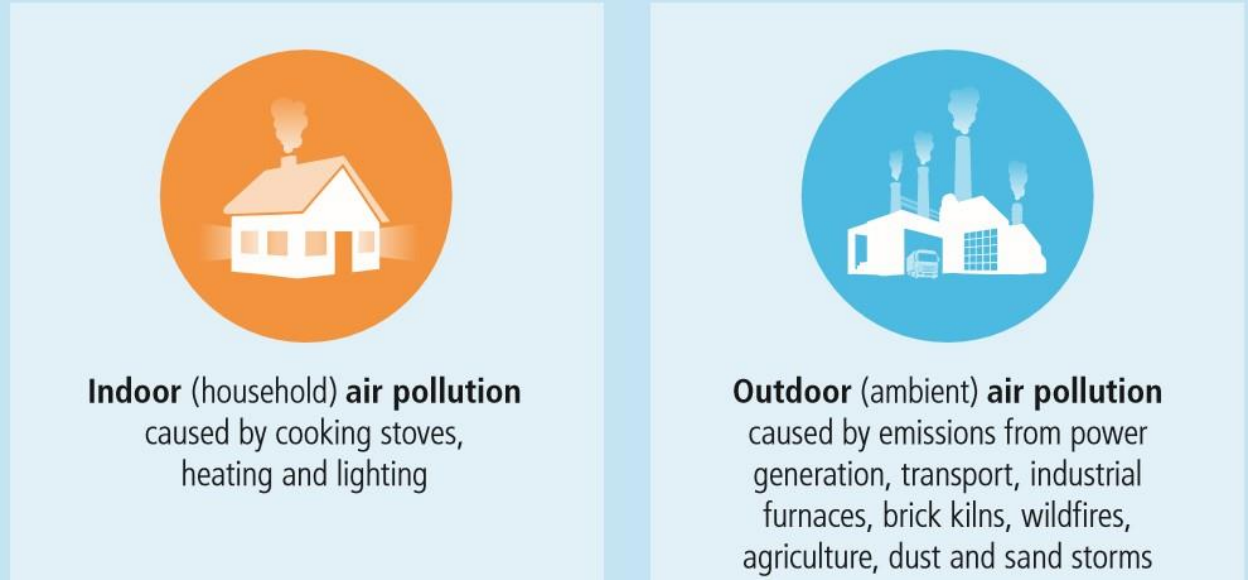


Figure 2. Types of Air Pollution

Sources of Air Pollution

- **Natural sources –** caused by nature
  - *Example*: dust storms, volcanic eruptions, wildfires
- **Human sources –** caused by human
  - Stationary source - any building or immobile structure, facility or installation which emits or may emit any air pollutant
  - Mobile source - any vehicle propelled by or through combustion of carbon-based or other fuel, constructed and operated principally for the conveyance of persons or the transportation of property goods

Major Outdoor Air Pollutants

Air Pollutant	Source	Health Effects
Carbon Oxides (CO) • Colorless • Odorless • Highly Toxic	• Motor vehicle exhaust • Burning of forests & grasslands • Tobacco smoke • Open fires • Inefficient stoves used for cooking	Chronic exposure: • Heart attacks • Lung diseases (asthma, emphysema) At high levels: • Headache, nausea, drowsiness, mental impairment, collapse, coma, death
Carbon dioxides (CO_2) • Colorless • Odorless • Classified as an air pollutant in 2009 by the USEPA due to effects of climate change on human health	• 93% from the natural carbon cycle The rest: • Burning of fossil fuels • Clearing of CO2 -absorbing forests and grasslands	Effects of climate change: • Heat stroke • Malnutrition and starvation • Tropical infectious diseases (dengue fever, yellow fever, malaria) • Diarrhea

Nitrogen Oxide (NOx) • Colorless • Plays a role in the formation of photochemical smog	• Lightning & certain bacteria in soil & water (nitrogen cycle) • Automobile engines • Coal-burning power and industrial plants	• Irritation of the eyes, nose and throat • Aggravation of lung ailments (asthma, bronchitis)
Nitrogen dioxide (NO_2) • Reddish brown gas • Plays a role in the formation of photochemical smog	• NO reaction with oxygen	• Irritation of the eyes, nose and throat • Aggravation of lung ailments (asthma, bronchitis)
NOx: HNO3 (nitric acid), NO3- (nitrate salts) • Components of acid deposition	• NO2 reaction with water vapor in the air	• Irritation of the eyes, nose and throat • Aggravation of lung ailments (asthma, bronchitis)
NOx: N2O (nitrous oxide) • A greenhouse gas	• Fertilizers • Animal wastes • Burning of fossil fuels	• Irritation of the eyes, nose and throat • Aggravation of lung ailments (asthma, bronchitis)
SOx: SO2 (sulfur dioxide), H2SO4 (sulfuric acid) SO42- (sulfate salts) • Colorless gas • Irritating odor • Component of acid deposition • Major component of the Asian Brown Cloud	• 1/3 of SO_2 in the atmosphere comes from natural sources as part of the sulfur cycle • 2/3 from human sources (combustion of sulfur-containing coal in electric power and industrial plants and oil refining and smelting of sulfide ores	• Aggravation of breathing problems
Particulates (Suspended Particulate Matter): PM10, PM2.5 • Fine (PM10) or ultrafine (PM2.5) • Major component of the Asian Brown Cloud	• About 62% comes from natural sources such as dust, wildfires, and sea salt • 38% from human sources (coal-burning power and industrial plants, motor vehicles, road construction, tobacco smoke)	• Irritation of nose and throat • Lung damage • Aggravation of asthma and bronchitis • Shortens life
Particulates (SPM): Pb, Cd, PCBs (polychlorinated biphenyls) • Toxic particulates	• Human sources (coal-burning power and industrial plants, motor vehicles, road construction, tobacco smoke)	• Mutations • Reproductive problems • Cancer
O3 (ozone) • Colorless • Highly reactive gas • A major ingredient of photochemical smog	• Vehicles • industries	• Coughing and breathing problems • Aggravation of lung and heart diseases

		• Reduced resistance to colds and pneumonia • Irritation of the eyes, nose and throat
VOCs: HCs (hydrocarbons), CH4 (methane), benzene, & other liquids • Emitted as gases from certain solids or liquids	• 1/3 of global methane emissions come from natural sources (plants, wetlands, termites) • 2/3 from human sources (rice paddies, landfills, oil and natural gas wells, belching of cows) • Household products, fuels	• Eye, nose and throat irritation • Headaches, loss of coordination, nausea • Damage to liver, kidney and central nervous system • Cancer

Global Warming and Climate Change

Global warming – refers to the increase in the earth's mean temperature due to the so-called enhanced greenhouse effect.

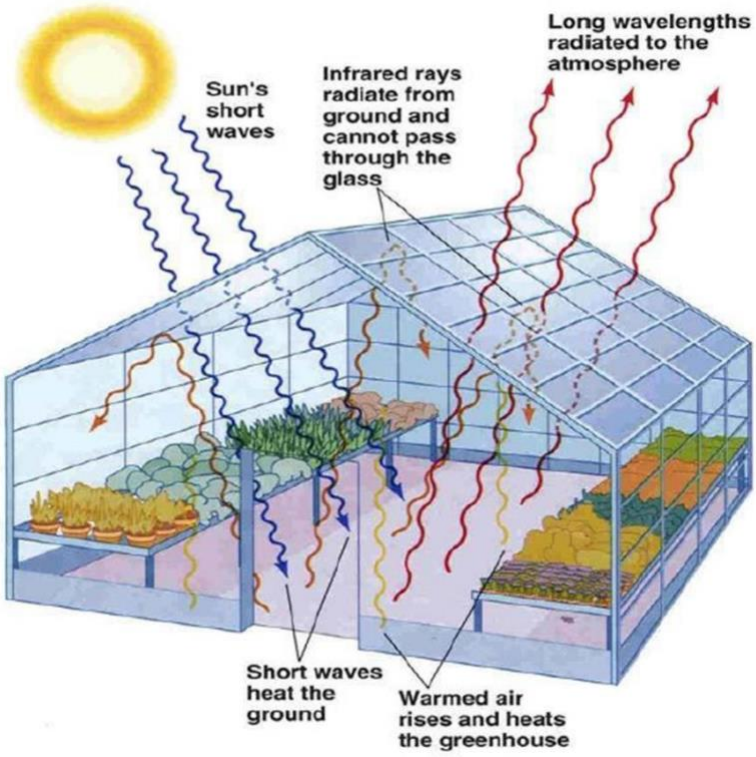


Figure 3. A Greenhouse

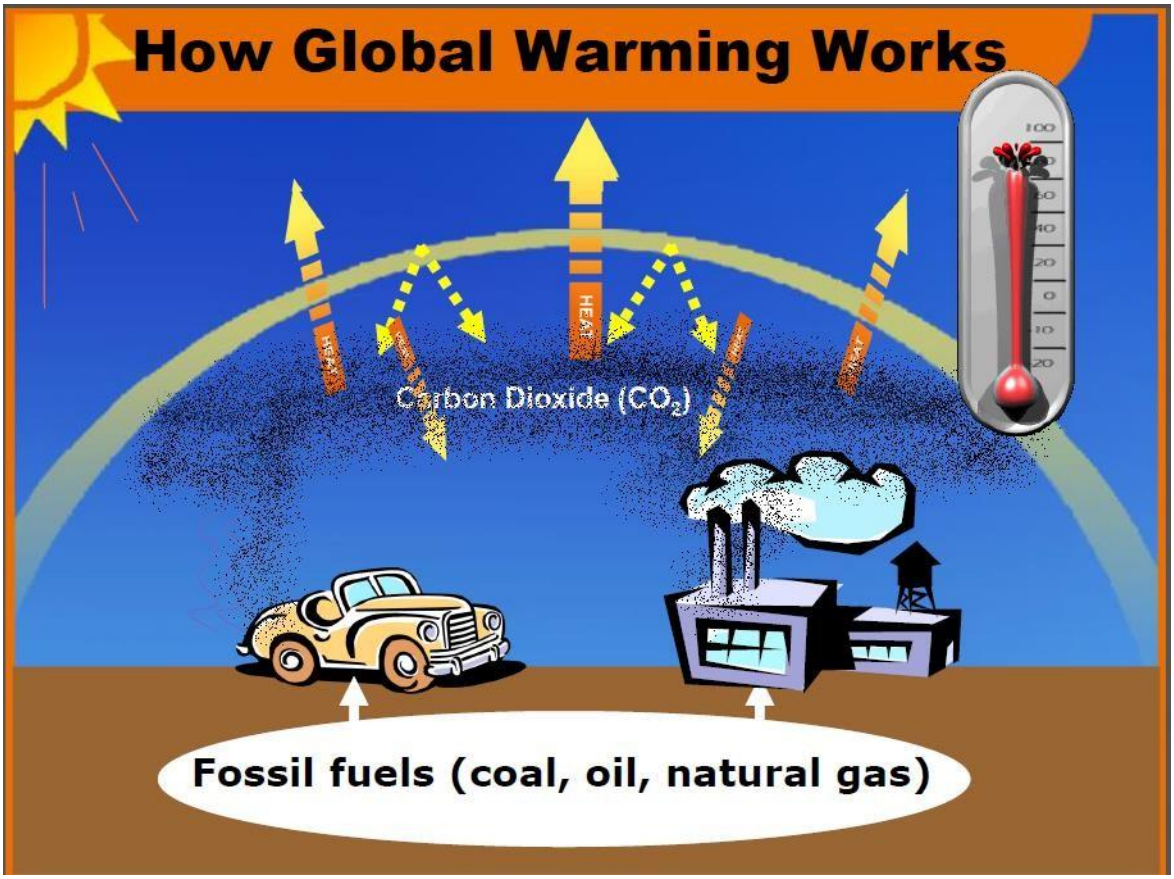


Figure 4. Global Warming Schematic

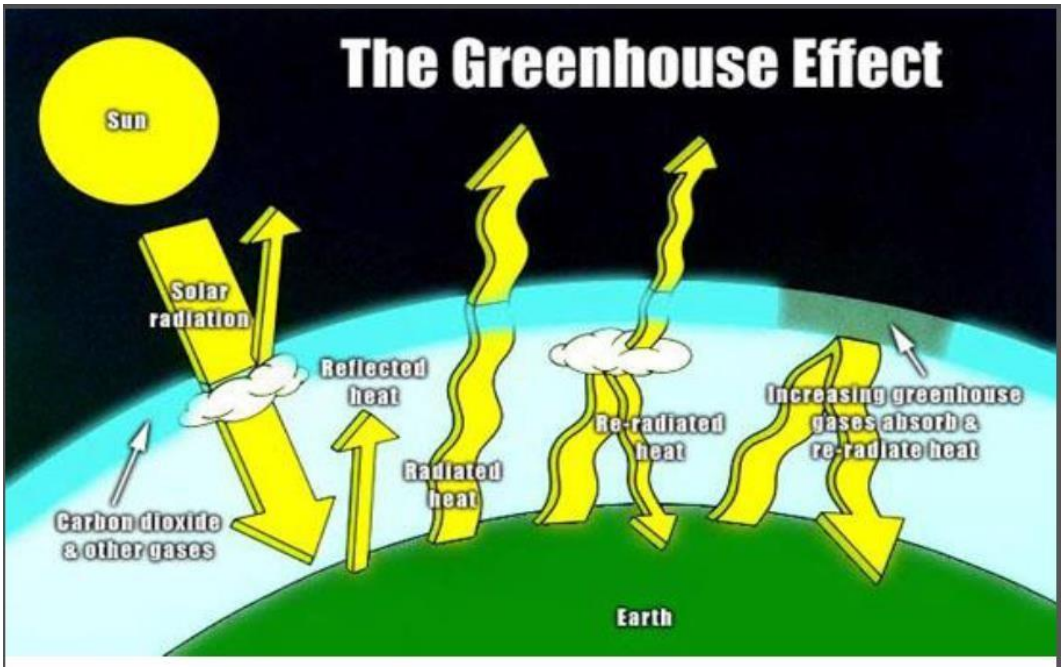


Figure 5. The Greenhouse Effect

Climate Change – refers to noticeable changes in the global climate, attributed directly/indirectly to human activities.

- Increase in the global temperatures
- Increase/decrease in rainfall
- Increase in severity/frequency of tropical cyclones

Human activities that produce greenhouse gases

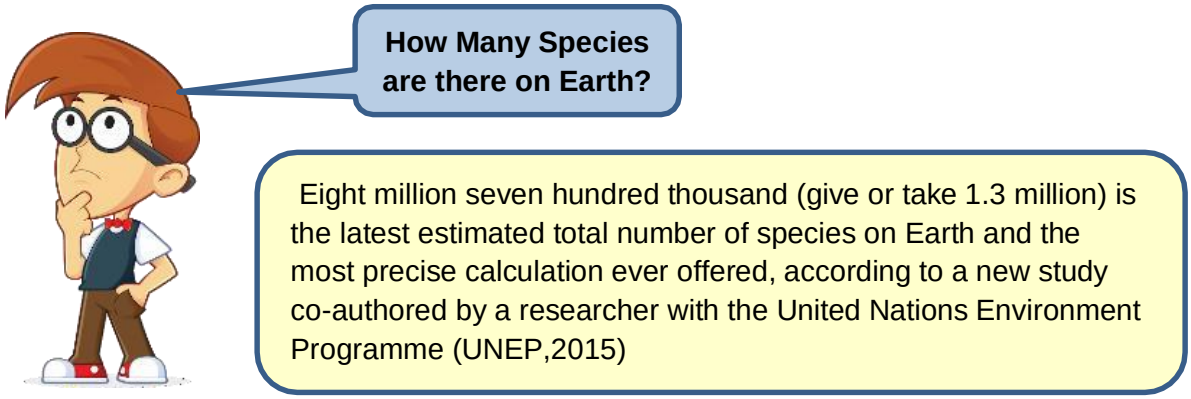
- Agricultural activity
- Deforestation
- Industries
- Transportation (mobile vehicles)
- Burning wastes

Video viewing on Climate Change

Species extinction, ecological disturbance

Species extinction – the end d of an organism, or group of an organism normally a species.

- Extinctions occur when the last individual of a species dies out.
- Functional Extinctions occur when individuals remain but the odds of sustainable reproduction are low
  - i.e. the species is effectively extinct even though individuals remain.



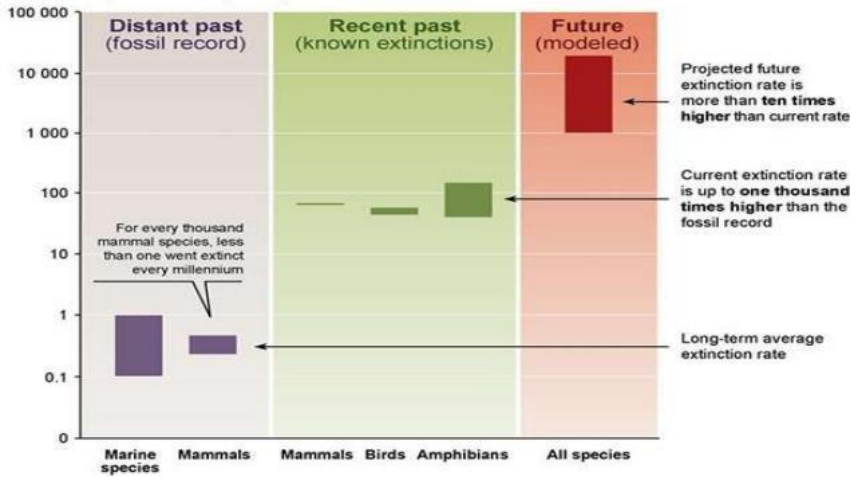


Figure 6. Extinction per thousand species per millennium

When do extinctions occur?

- Extinctions occur when the environment of a species changes faster than the species can adapt.
  - In other words, a species' adaptations are no longer sufficient in allowing that species to acquire and compete for resources.
- Extinctions can be local, widespread, or global.
  - For example, the timber wolf was until recently extinct in Wisconsin but not in Minnesota
  - Wild elk and woodland caribou are now extinct in Wisconsin but may be found on game farms.

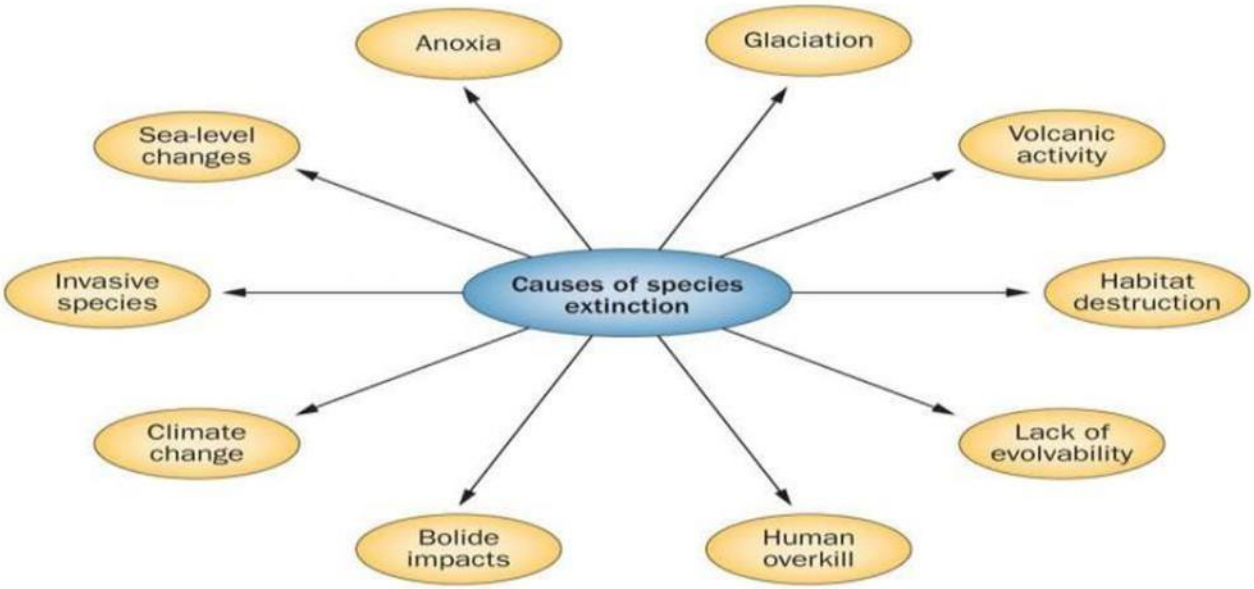


Figure 7. Causes of Species Extinction

Causes of species extinction

- Natural Causes of species Extinction
  - Climatic heating and cooling
  - Changes in Sea Level or Currents
  - Acid rain
  - Invasive species
- Human Causes of species Extinction
  - pollution
  - Increased human population
  - Destruction/fragmentation of habitat
  - Wildlife hunting
  - Overfishing

Easy Things You Can Do to Save Endangered Species and stop species extinction

- Learn about endangered species in your area
- Visit a national wildlife refuge, park or other open space
- Make your home wildlife friendly
- Native plants provide food and shelter for native wildlife
- Herbicides and pesticides may keep yards looking nice but they are in fact hazardous pollutants that affect wildlife at many levels
- Slow down when driving
- Recycle and buy sustainable products
- Never purchase products made from threatened or endangered species

- Harassing wildlife is cruel and illegal
- Protect wildlife habitat

Principal Pressures of Biodiversity Loss in the Philippines

The DENR identified five (5) major pressures of biodiversity in the Philippines (Figure 8).

a. Habitat Loss and Degradation
   - Deforestation
   - Mining
   - Degradation of Marine Ecosystems

b. Overexploitation
   - Fisheries
   - Illegal Wildlife Trading

c. Pollution
d. Climate Change
e. Invasive Alien Species

Basic Causes of Environmental Problems

To deal with environmental problems we face we must understand their causes. According to a significant number of environment and social scientists, the major causes of today's environmental problems are:

- Population growth
- Wasteful and unsustainable resource use
- Poverty
- Omission of the harmful environmental and health costs of goods and services in the market
- Increasing isolation from nature
- Competing environmental worldviews

SELF-EVALUATION

1. What are the sources of air pollution and how this pollution affects the human health?

2. Is the ozone hole causing climate change?

3. What are some effective ways to clean-up polluted water? Support your answer.

REVIEW OF CONCEPTS

- Can you discuss how human activities result in environmental problems?
- Can you describe the nature of environmental problems / issues, their causes, risks, and effects?

POST-TEST

- Synthesize journal articles (at least 5 articles - local) related to species extinction (by group).
  Criteria:
  - Composition- 13
  - Organization- 5
  - Originality/Citation- 5
  - Grammar- 2

REFERENCES

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