



ANALYZING ENVIRONMENTAL HEALTH AND POLLUTIONS

School of Engineering and Architecture

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Environmental Pollution

- Environmental pollution is defined as "the contamination of the physical and biological components of the earth/atmosphere system to such an extent that normal environmental processes are adversely affected."
- From: [Environmental Management, 2017](#)

ENVIRONMENTAL HEALTH AND POLLUTIONS

- Environmental pollutants are chemicals that have ended up in the environment as the result of human activities and that are hazardous to health.
- As the world gets hotter and more crowded, our engines continue to pump out dirty emissions, and half the world has no access to clean fuels or technologies (e.g. stoves, lamps), the very air we breathe is growing dangerously polluted: [nine out of ten people now breathe polluted air](#), which kills 7 million people every year.
- The health effects of air and pollution in general are serious – one third of deaths from stroke, lung cancer and heart disease are due to air pollution. This is having an equivalent effect to that of smoking tobacco, and much higher than, say, the effects of eating too much salt.

ENVIRONMENTAL HEALTH AND POLLUTIONS

- To put it bluntly: Water pollution kills. In fact, it caused 1.8 million deaths in 2015, according to a study published in [The Lancet](#). Contaminated water can also make you ill. Every year, unsafe water sickens about 1 billion people. And low-income communities are disproportionately at risk because their homes are often closest to the most polluting industries.

Measuring the Amount of Pollution

Root Causes of Environmental Problems

- Overpopulation
 - Current world population is at 7B, with addition of 85M every year or total of 8B to 10B by 2050
- Resource Consumption
 - Availability of natural resources, both materials and energy , renewable or nonrenewable for production of food and other consumer goods
 - Food scarcity, fuel shortage (especially fossil fuels)
 - Man's Activities (anthropogenic)
 - Industrial Activities

SECOND LAW OF THERMODYNAMICS

- The tendency of all natural systems to go from a state of order toward a state of increasing disorder

➤ Law of Entropy

General Effects of Pollutants

- Environmental pollution is currently the biggest challenge facing the world today.
- One-third of the topsoil in the world is already degraded, and with the current rate of soil degradation caused by improper agricultural and industrial practices, and deforestation, most of the world's topsoil could be gone within the next 60 years.
- The Great Smog in 1952 killed 8000 people in London. This event was caused by a period of cold weather combined with windless conditions that formed a dense layer of airborne pollutants, mostly from coal plants, over the city.

General Effects of Pollutants

- In the United States 40% of rivers and 46% of lakes are too polluted for fishing, swimming, and aquatic life. Not surprising though when 1.2 trillion gallons of untreated storm water, industrial waste, and untreated sewage are being discharge annually into American waters.

Effects of Air Pollution

- High levels of air pollution can cause an increased risk of heart attack, wheezing, coughing, and breathing problems, and irritation of the eyes, nose, and throat. Air pollution can also cause worsening of existing heart problems, asthma, and other lung complications.
- Like humans, animals can suffer from a number of health problems due to air pollution, including birth defects, reproductive failure, and diseases.

Effects of Air Pollution

- Air pollution causes a number of environmental effects in addition to the effects on humans and animals.
- Acid rain contains high levels of nitric and sulfuric acids that are created by oxides and sulfur oxides released into the air by the burning of fossil fuels. Acid rain damages trees and acidifies soils and water bodies, making the water too acidic for fish and other aquatic life.
- Nitrogen oxides released into the air by the burning of fossil fuels also contribute to the nitrogen responsible for toxic algae blooms.

Effects of Air Pollution

- The release of man-made compounds including hydrochlorofluorocarbons, chlorofluorocarbons, and halons formerly used as coolants, foaming agents, pesticides, solvents, aerosol propellants, and fire-extinguishers are depleting the ozone. The ozone layer in the stratosphere forms a protective layer that reflects harmful ultraviolet rays back into space that would otherwise destroy animal and plant life.

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Effects of Water Pollution

- Water pollution is a serious threat to humans, animals, and aquatic life.
- The effects of water pollution depend on which chemicals are being dumped where. Bodies of water that are near urbanized areas tend to be heavily polluted by dumping of garbage and chemicals, both legally and illegally, by industrial plants, health centers, and individuals.

Effects of Water Pollution

- By far the biggest consequence of water pollution is the death of aquatic creatures, which can disrupt the entire food chain. Pollutants such as cadmium, mercury, and lead are eaten by tiny aquatic organisms that are then eaten by fish and shell fish, becoming more concentrated with each step up the food chain and causing serious problems in humans and wildlife.
- Nutrient pollution can cause toxic algal blooms in drinking water sources that create toxins that kill fish and other aquatic animals. Direct exposure to this toxic alga causes serious health problems in humans including neurological effects, respiratory problems, stomach and liver illness, and rashes.

Effects of Water Pollution

- A consequential problem is created when disinfectants used to treat drinking water reach water polluted with toxic algae, they react creating dioxins. Dioxins are extremely harmful chemical compounds that have been linked with reproductive and development problems, and even cancer.
- Nitrates, caused by fertilizers, also contaminate drinking water and according to the [Environmental Protection Agency](#), babies who consume water that is high in nitrates can become seriously ill with blue-baby syndrome, which causes shortness of breath and blue-tinted skin, and can lead to death if not treated early.

Effects of Land & Soil Pollution

- Land and soil pollution has substantial consequences for humans, animals, microorganisms and aquatic life.
Contaminated land and soil can cause various problems on the skin, respiratory problems, and even different kinds of cancers.
- These toxic substances come into contact with the human body directly through [eating fruits and vegetables](#) that have been grown in polluted soils, being consumed through drinking water that has been contaminated, direct contact with the skin, and breathing in air polluted with particles and dust.

Effects of Land & Soil Pollution

- Deforestation is the biggest concern when it comes to land degradation and soil erosion. Clear cutting of vegetation and tree cover creates harsh conditions that destroy ecosystems and habitats.
- Deforestation also creates an imbalance in atmospheric conditions, reducing the amount of carbon that is naturally taken out of the atmosphere. This is a serious problem considering that most pollution created by people is carbon based.

Effects of Noise & Light Pollution

- Noise pollution can cause stress, anxiety, headaches, irritability, hearing loss, and sleep loss resulting in decreased productivity.
- Oil drills, submarines, and other vessels on and in the ocean can cause excessive noise that has resulted in the injury or death of marine animals, especially whales.
- Too much light causes eye strain and stress, harming our eyes and decreasing our quality of life. Light pollution also causes a decrease in the hormone melatonin that helps us to fall asleep, resulting in restlessness and fatigue.

Effects of Noise & Light Pollution

- Many mammals, insects, birds, and reptiles are photoperiodic meaning their movement, mating, growth and development, and eating cycles are regulated by natural light patterns. Light pollution can interfere with these natural behaviors and cycles, causing a decrease in wildlife populations.

Conclusion

- Pollution needs to be dramatically reduced because it is destroying the environment we live in, contaminating our food and water, causing diseases and cancers in humans and wildlife, and destroying the air we breathe and the atmosphere that protects us from harmful ultra-violet radiation.
- It is the responsibility of every living person to protect the environment, and with the population ever increasing, pollution problems are only going to get worse unless we do something about it.

Conclusion

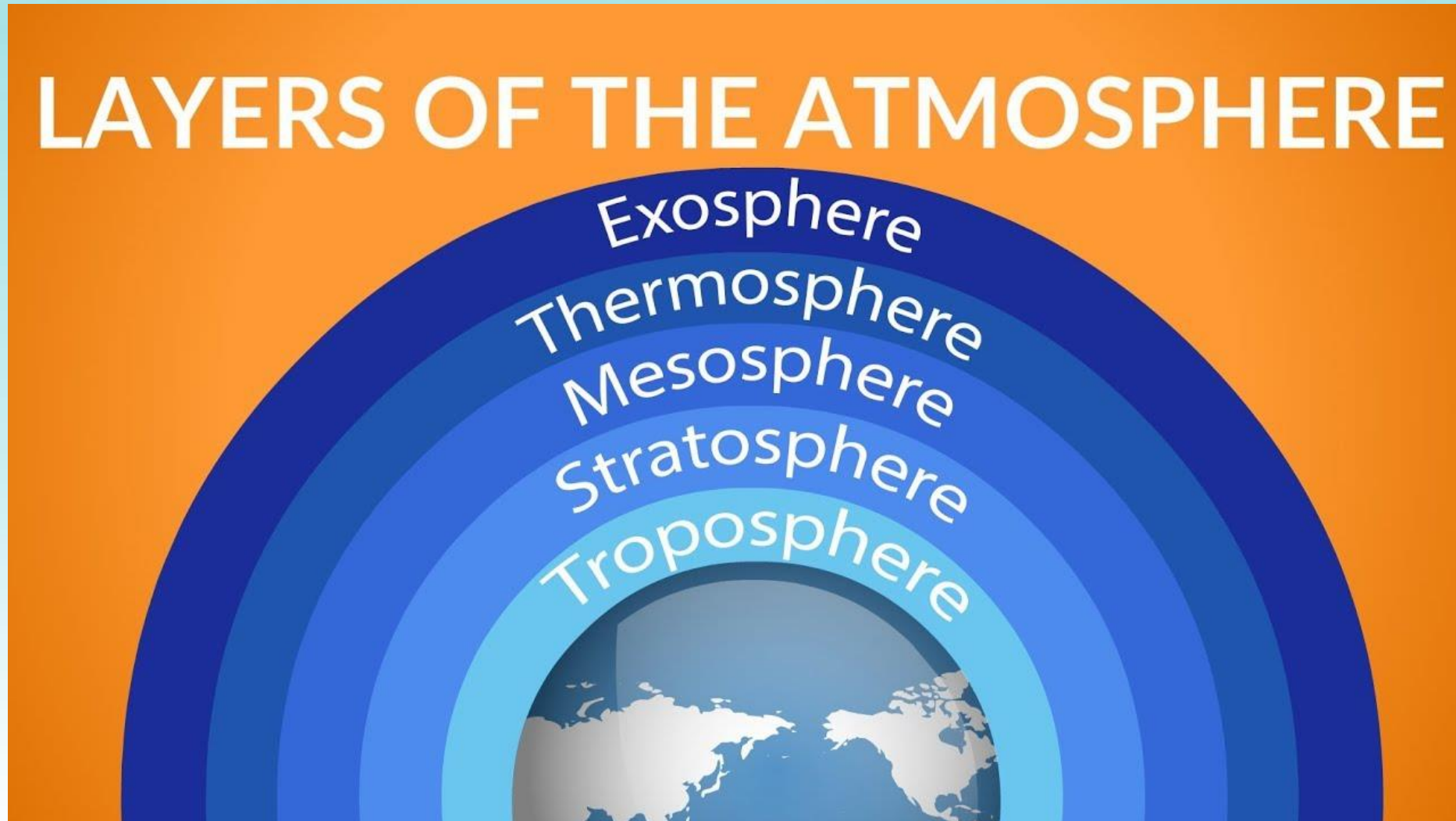
- Protecting the environment is a long and daunting task, requiring continuous planning, governmental policies, and public and industrial participation. However the result of ignoring the problem will be catastrophic and life as we know it will begin to end.
- By decreasing waste, implementing recycling policies, banning dangerous agricultural chemicals, and developing safe renewable energy we can significantly reduce the amount of pollution going into the environment annually and increase our quality of living.
- Everyone is entitled to clean air to breathe, water to drink, and public lands to enjoy. If you have any ideas on how to reduce pollution, please drop a comment and share your thoughts

The Atmosphere, Climate, and Global Warming

Atmosphere

- We live at the bottom of an invisible ocean called the atmosphere, a layer of gases surrounding our planet. Nitrogen and oxygen account for 99 percent of the gases in dry air, with argon, carbon dioxide, helium, neon, and other gases making up minute portions.
- The composition of the atmosphere has changed since the Earth was formed 4.5 billion years ago. Natural processes and human activity have changed the atmosphere, and continue to change it today

Please watch
<https://www.youtube.com/watch?v=LPHF323XIWw>



Climate

- The composite or generally prevailing weather conditions of a region, as temperature, air pressure, humidity, precipitation, sunshine, cloudiness, and winds, throughout the year, averaged over a series of years.

Climate Change

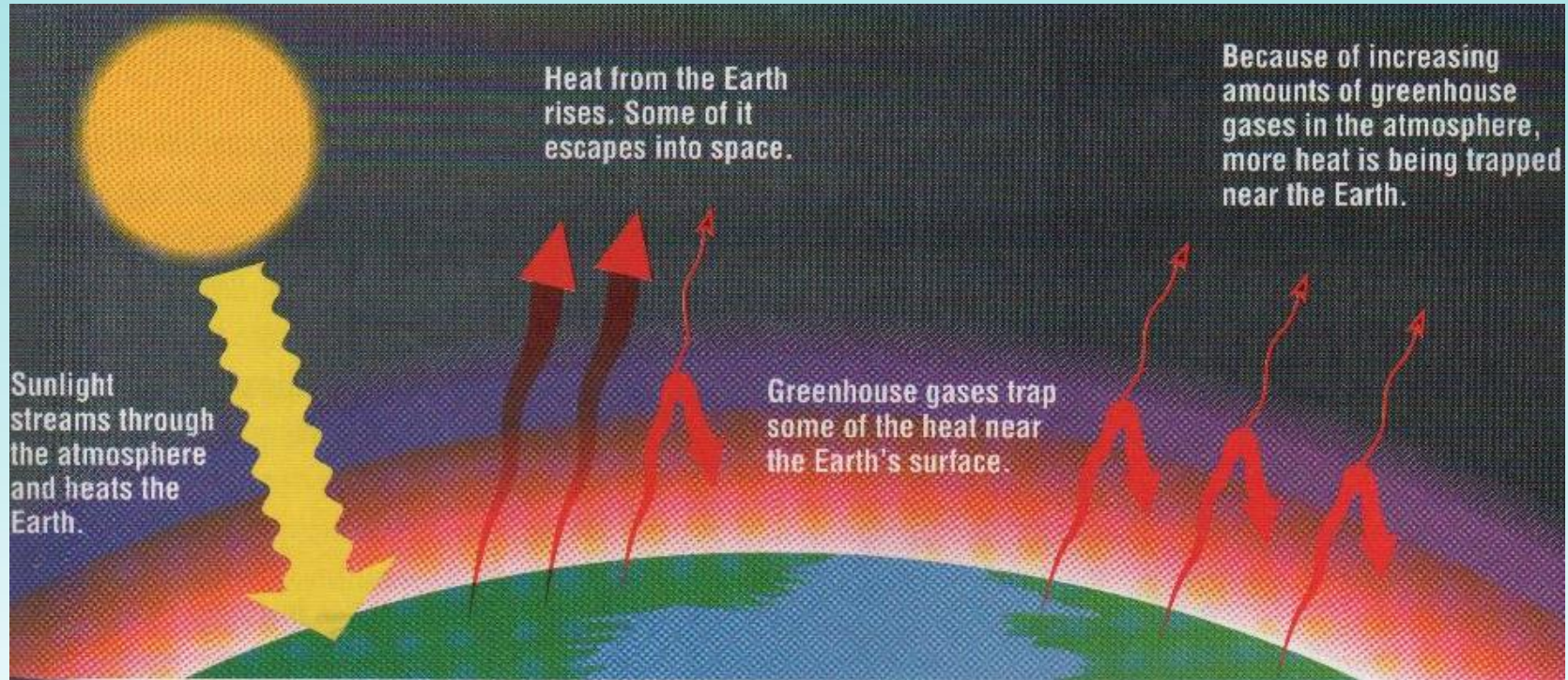
- Climate change is a long-term shift in global or regional climate patterns. Often climate change refers specifically to the rise in global temperatures from the mid-20th century to present.
- Climate is sometimes mistaken for weather. But climate is different from weather because it is measured over a long period of time, whereas weather can change from day to day, or from year to year. The climate of an area includes seasonal temperature and rainfall averages, and wind patterns.

Climate Change



GLOBAL WARMING

Greenhouse Effect



Greenhouse Gases and Contribution (Proportion) to Global Warming –Cunningham, 2006

| Gas | % |
|-----------------------------------|-----|
| Carbon Dioxide (CO ₂) | 64 |
| Methane (CH ₄) | 19 |
| Chlorofluorocarbons (CFCs) | 11 |
| Nitrous Oxide (N ₂ O) | 6 |
| Sulfur Hexafluoride | 0.4 |

Global Warming and Climate Change

- Records show that global temperatures rise as atmospheric concentrations of CO₂ increase
- Concern about the possibility of the world getting warmer
- United Nations Environment Programme (UNEP) established the Intergovernmental Panel on Climate Change (IPCC) to make a study

IPCC Conclusions

- The average temperature of the Earth has increased $0.3 - 0.6^{\circ} \text{C}$ (1997 the warmest) and sea level has risen 10-25 cm in the last 100 years
- There is a strong correlation between the increase in temperature and the amount of greenhouse gases present in the atmosphere
- Human activity greatly increases the amounts of greenhouse gases

Effects of Global Warming

- Worsening health effects
 - Mortality from heat stress (heat wave)
 - Poor air quality (smog, increase levels of airborne pollen and spores, and aggravate respiratory disease, asthma and allergic disorders)

Effects of Global Warming

- Rising Sea Level
 - Erodes beaches and coastal wetlands, inundates low-lying areas, increase vulnerability of coastal flooding from storm surges and intense rainfall
 - A 50 cm sea level rise will double global population at risk while a 100 cm rise would triple the number

Effects of Global Warming

- Disruption of Water Cycle and Other Cycles
 - Droughts and floods and water quality and quantity are a major concern
 - Damages to life and property
 - Water scarcity could increase international tension among countries that depend on water supplies originating outside their borders

Effects of Global Warming

- Changes Forests and Natural Areas
 - Dramatically alter geographic distribution of vegetation types
 - Reduction in biological diversity
 - Reduction in benefits provided by ecosystems like clean water and recreation

Effects of Global Warming

- Challenges in agriculture and food supply
 - Increase/decrease crop yields depending on local weather and climate

Effects of Global Warming

- Ozone depletion
 - The presence of ozone in the outer layers of the atmosphere (12-25 km from earth's surface) shields the earth from the harmful effects of ultraviolet radiation
 - Thinning of ozone layer would result in more UV light which causes skin cancers and cataracts in humans and increase mutations in living things
 - Chlorofluorocarbons are strongly implicated in ozone reduction such that their use (in refrigerators and as propellants), manufacture and release is now being controlled (Kyoto Protocol)

Sustainability Issues

- Population – demand for more goods, energy, land, housing
- Global atmosphere – emissions of CO₂ and other green house gases like methane may result in global warming and lead to changes in climate and rise in sea level
- Air Quality – pollution from vehicles and industry affect air quality
- Fresh water – increased consumer and industry demand

Sustainability Issues

- The Sea – marine issues include water quality, dumping of waste at sea, over-fishing or methods that destroy species
- Soil – erosion, loss of organic matter, increase acidity, contamination
- Land Use – lack of planning
- Minerals (including fossil fuels) – increasing demand, efficient utilization

Other Related Environmental Problems

- Acid Rain
 - The extra acidity in rain comes from the reaction of air pollutants, primarily sulfur oxides and nitrogen oxides, with water in the air to form strong acids (like sulfuric and nitric acid). The main sources of these pollutants are vehicles and industrial and power-generating plants.
 - Effect on vegetation and physical structures (buildings, art works)

Other Related Environmental Problems

- **Eutrophication**

- Eutrophication is a syndrome of ecosystem responses to human activities that fertilize water bodies with nitrogen (N) and phosphorus (P), often leading to changes in animal and plant populations and degradation of water and habitat quality.
- Eutrophication is frequently a result of nutrient pollution such as the release of sewage effluent and run-off from lawn fertilizers into natural waters (rivers or coasts)
- Eutrophication decreases the resource value of rivers, lakes, and estuaries such that recreation, fishing, hunting, and aesthetic enjoyment are hindered. Health-related problems can occur where eutrophic conditions interfere with drinking

Other Related Environmental Problems

- Algae blooms are the result of an excess of nutrients (particularly phosphorus and nitrogen) into waters and higher concentrations of these nutrients in water cause increased growth of algae and green plants. As more algae and plants grow, others die. This dead organic matter becomes food for bacteria that decomposes it. With more food available, the bacteria increase in number and use up the dissolved oxygen in the water. When the dissolved oxygen content decreases, many fish and aquatic insects cannot survive. This results in a dead area.
 - Red tide - effect of harmful algal blooms (HAB)

International Laws on Environment

- Basel Convention
- Montreal Protocol
- Kyoto Protocol

Basel Convention

- The Basel Convention (Basel Convention on the Control of Trans-boundary Movements of Hazardous Wastes and Their Disposal) is an international treaty that was designed to reduce the movements of hazardous waste between nations, and specifically to prevent transfer of hazardous waste from developed to less developed countries (LDCs).
- It does not, however, address the movement of radioactive waste.

Basel Convention

- The Convention is also intended to minimize the amount and toxicity of wastes generated, to ensure their environmentally sound management as closely as possible to the source of generation, and to assist LDCs in environmentally sound management of the hazardous and other wastes they generate.
- *Hazardous: contain a characteristic such as being explosive, flammable, toxic, or corrosive.*

Montreal Protocol

- The Montreal Protocol on Substances That Deplete the Ozone Layer - a landmark international agreement designed to protect the stratospheric ozone layer. The treaty was originally signed in 1987 and substantially amended in 1990 and 1992.
- The Montreal Protocol stipulates that the production and consumption of compounds that deplete ozone in the stratosphere--chlorofluorocarbons (CFCs), halons, carbon tetrachloride, and methyl chloroform--are to be phased out by 2000 (2005 for methyl chloroform).

Kyoto Protocol

- Kyoto Protocol : an international agreement that aims to reduce carbon dioxide emissions and the presence of greenhouse gases. Countries that ratify the Kyoto Protocol are assigned maximum carbon emission levels and can participate in carbon credit trading. Emitting more than the assigned limit will cause the violating country to be penalized by lowering its emission limitation in the following period.

Kyoto Protocol

- The Kyoto Protocol separates countries into two groups. Annex I includes developed nations, while Non-Annex I refers to developing countries. Emission limitations are only placed on Annex I countries. Non-Annex I nations participate by investing in projects that lower emissions in their own countries. For these projects, they earn carbon credits. These credits can be traded or sold to Annex I countries, which allow them a higher level of maximum carbon emissions for that period.

Carbon Trading is a market based mechanism for helping mitigate the increase of CO₂ in the atmosphere. Carbon trading markets are developing that bring buyers and sellers of carbon credits together with standardized rules of trade.

- **Who are potential buyers for carbon credits?**
 - > Any entity, typically a business, that emits CO₂ to the atmosphere may have an interest or may be required by law to balance their emissions through mechanism of Carbon sequestration. These businesses may include power generating facilities or many kinds of manufacturers.

- **Who are potential sellers of carbon credits?**
 - > Entities that manage forest or agricultural land might sell carbon credits based on the accumulation of carbon in their forest trees or agricultural soils. Similarly, business entities that reduce their carbon emission may be able to sell their reductions to other emitters.