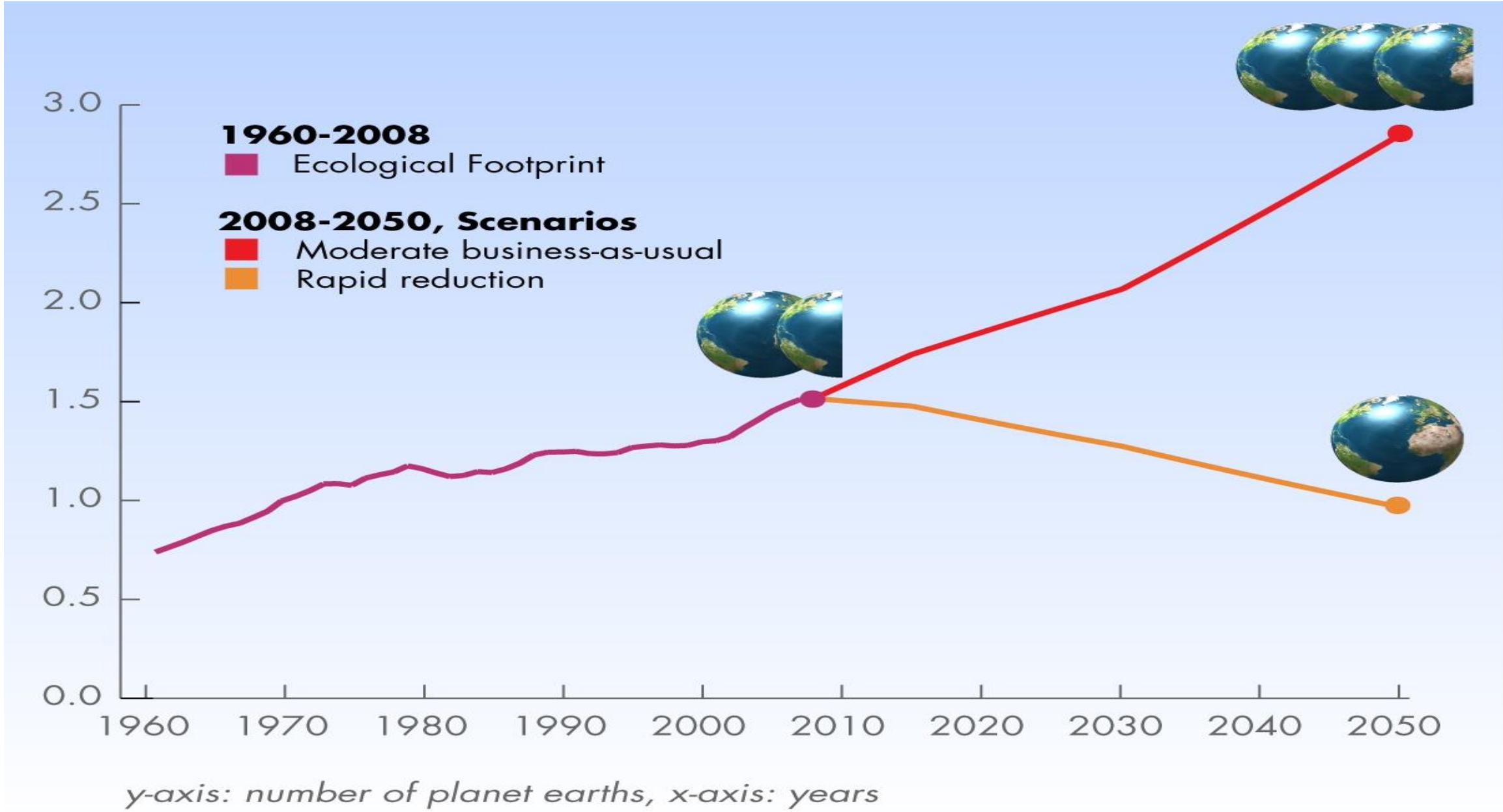
Unit 1:- Social Issues and Environment

- **Ecological footprint and Carrying Capacity**
- **Depleting nature of Environmental resources such as soil, water minerals and forests**
- **Carbon emissions and Global Warming**

Ecological Footprint and Carrying Capacity

- **Ecological Footprint** – is the amount of resources needed by a single individual to survive. By inputting a wide range of data scientists have calculated the current human population's ecological footprint as equal to 1.5 Earths.


1960-2008
Ecological Footprint
2008-2050, Scenarios
Moderate business-as-usual
Rapid reduction
3.0
2.5
2.0
1.5
1.0
0.5
0.0
1960
1970
1980
1990
2000
2010
2020
2030
2040
2050
y-axis: number of planet earths, x-axis: years

- Those who measure the ecological footprint include Mathis Wackernagel, currently President of the Global Footprint Network, and William Rees, a researcher at University of British Columbia in Canada.
- They first defined the term and attempted to calculate what would be the equivalent unit of area needed by each human to maintain that individual's current style of life.
- They called these units global hectares.
- A global hectare takes into consideration cropland, grazing area, forest lands, fish habitat, carbon output and urban space requirements to sustain a human.

Country/Region	Population (millions)	Ecological Footprint (Global Hectares/person)	Country/Region	Population (millions)	Ecological Footprint (Global Hectares/person)
High-Income Countries	**1,037.0**	**5.6**	**South America**	**390.1**	**2.7**
Middle-Income Countries	**4,394.1**	**1.9**	Brazil	191.5	2.9
Low-Income Countries	**1,297.5**	**1.1**	Central America/Caribbean	66.8	1.7
Africa	938.4	1.4	Cuba	11.3	2.5
Nigeria	150.7	1.4	Haiti	9.7	0.6
Republic of South Africa	49.3	2.6	**North America**	**448.9**	**6.2**
Middle East/Central Asia	**382.6**	**2.5**	Canada	33.3	6.4
Afghanistan	29.8	0.5	Mexico	110.6	3.3
Israel	7.1	4.0	United States	305.0	7.2
United Arab Emirates	8.1	8.4	**Europe**	**733.2**	**4.4**
Asia-Pacific	**3,725.2**	**1.6**	Albania	3.2	1.8
Australia	21.5	6.7	Bulgaria	7.6	3.6
Bangladesh	145.5	0.7	Germany	82.5	4.6
China	1,358.8	2.1	Netherlands	16.5	6.3

- The totals in the right-hand column may surprise you in the case of some countries.
- For example compare Germany to the United States. Both countries enjoy very high living standards but Germans consume far fewer resources to sustain their lifestyle than Americans.
- In Africa, South Africans use almost twice the resources of Nigerians.
- In Asia-Pacific, Australians use more than seven times the resources of people in India and nine times of those living in Bangladesh.

Our ecological footprint combines food, water, habitation, energy and biodiversity to come up with a calculation measured in global hectares.

- ***How Does Ecological Footprint Relate to Carrying Capacity?***

What is carrying capacity?

- **Carrying Capacity** – is the maximum population that the planet can sustain taking into consideration availability of food sources, water, and all the other necessities to sustain life.
- You can calculate it by figuring out how many calories the planet can produce from all sources, agricultural and natural, crops, fish and fowl.

- The following exercise is for illustration.
- We choose rice to do our calculations. Why?
- Because it is grown by half the world's population and accounts today for 20% of the total human caloric intake.
- So let's begin by starting with the number of calories an average human needs for daily survival.
- **2,000 calories**
- We multiply that by 365 days per year and the total comes to:-
- **730,000 calories**

- Now we determine the total amount of fertile land that can be planted in rice. For this exercise we are going to use the total inventory of arable land on the planet. That number is:-
- **38,488,090 square kilometers**
- Rice produces 1,250 calories per square meter. There are 1,000,000 square meters in a kilometer. So the rice calorie yield rate per square kilometer amounts to:-
- **1,250,000,000 calories**
- Multiply that by the number of square kilometers and you get the optimal number of calories that we can produce annually growing rice. And the number is:-
- **48,110,112,500,000,000 calories**

- Now divide this last number by 730,000, the number of calories one human needs to survive over a year, and you have the theoretical carrying capacity of the planet.
- Based on our calculation the number of humans this planet would support eating rice daily each year amounts to:-
- **65,904,263,698**
- That’s almost 66 billion of us. Currently there are 8 billion humans on the planet so theoretically we still have a way to go before we max out on population, that is, if all we want to do is eat rice.

- Of course there are lots of factors that reduce this potential carrying capacity number. These include:
- Continued population growth in areas of the world currently already suffering from population stress
- Freshwater stress including water usage competition between urban and rural environments
- Reduced agricultural land from poor farming practices
- Deforestation
- Desertification
- Climate change
- Rising sea levels
- And war, disease, pestilence and plague.

- For humans in the 21st century it is clear that we cannot continue to have one part of the planet consuming at an unsustainable level while other human populations subsist on very little but it is also true that there remains some wiggle room to give us time to fix the problem.
- All it takes is global leadership focused on sustainability. But if the Rio+20 conference of 2012 is an example of what our leaders are capable of doing then we need to find others to provide us with guidance to achieve our common planetary goal.
- National self-interest cannot continue to impede all of humanity. We are a global society and we need to make global decisions about managing our ecological footprint.
- That way we can find a sustainable medium for all in the remainder of the 21st century and beyond.

Questions

- **What is the Ecological Footprint?**
- **What does the Ecological Footprint measure?**
- **What is bio capacity?**
- **What is overshoot?**
- **Is the Ecological Footprint a measure of carrying capacity?**
- **What is a global hectare?**

What is the Ecological Footprint?

- The Ecological Footprint is a resource accounting tool that measures how much biologically productive land and sea is used by a given population or activity, and compares this to how much land and sea is available.
- Productive land and sea areas support human demands for food, fiber, timber, energy, and space for infrastructure.
- These areas also absorb the waste products from the human economy.
- The Ecological Footprint measures the sum of these areas, wherever they physically occur on the planet.
- The Ecological Footprint is used widely as a management and communication tool by governments, businesses, educational institutions, and non-governmental organizations.

What does the Ecological Footprint measure?

- The Ecological Footprint measures the amount of biologically productive land and water area an individual, a city, a country, a region, or all of humanity uses to produce the resources it consumes and to absorb the waste it generates with today's technology and resource management practices.
- This demand on the biosphere can be compared to bio capacity, a measure of the amount of biologically productive land and water available for human use.
- Biologically productive land includes areas such as cropland, forest, and fishing grounds, and excludes deserts, glaciers, and the open ocean.
- Global hectares are hectares with world-average productivity for all productive land and water areas in a given year.
- Studies that are compliant with current Ecological Footprint Standards use global hectares as a measurement unit.
- This makes Ecological Footprint results globally comparable, just as financial assessments use one currency, such as dollars or Euros, to compare transactions and financial flows throughout the world.

What is bio capacity?

- Bio capacity represents the ability of ecosystems to produce useful biological materials and to absorb wastes generated by humans, using current management and extraction technologies.
- Useful biological materials are defined as those materials that the human economy actually demanded in a given year.
- The Ecological Footprint measures demand on this productive capacity.

What is overshoot?

- Ecological overshoot at any scale occurs when a population's demand on an ecosystem exceeds the capacity of that ecosystem to regenerate the resources it consumes and absorb its wastes.
- The Ecological Footprint is often used to calculate global overshoot; which occurs when humanity's demand on the biosphere exceeds the available biological capacity of the planet.
- By definition, overshoot leads to a depletion of the planet's life supporting biological capital and/or to an accumulation of waste products.

Is the Ecological Footprint a measure of carrying capacity?

- Carrying capacity is a technical term that refers to the maximum population of a species that a given land or marine area could support.
- Many species have easily defined and consistent consumption needs, making carrying capacity relatively easy to define and calculate.
- For humans, however, carrying capacity estimates require assumptions about future per-person resource consumption, standards of living and “wants” (as distinct from “needs”), productivity of the biosphere, and advances in technology.
- An area’s carrying capacity for humans is thus inherently speculative, and difficult to define.

- Ecological Footprints are not speculative estimates about a potential state, but rather are an accounting of the past. Instead of asking how many people could be supported on the planet, the Ecological Footprint asks the question in reverse and considers only present and past years.
- The Footprint asks how many planets were actually necessary to support all of the people that lived on the planet in a given year, under that year's standard of living, biological production, and technology.
- This is a scientific research and accounting question that can be answered through the analysis of documented, historical data sets.

What is a global hectare?

- To allow different types of land to be compared using a common denominator, equivalence factors are used to convert physical hectares of different types of land, such as cropland and pasture, into the common unit of global hectares.
- The use of global hectares recognizes that different types of land have a different ability to produce useful goods and services for humans.
- One hectare of cropland can produce a greater quantity of useful and valuable food products than a single hectare of grazing land, for example.
- By converting both cropland and pasture into global hectares, they can be compared on an equal basis.

- A global hectare is defined as a hectare with world-average productivity for all biologically productive land and water in a given year.
- Biologically productive land includes areas such as cropland, forest, and fishing grounds, and excludes deserts, glaciers, and the open ocean.
- Global hectares are the common, standardized unit used for reporting Ecological Footprint and bio capacity across time and for areas throughout the world.
- Because total global production changes over time, the amount of physical material produced by a single global hectare also changes over time. Global hectares can also be converted into global acres.

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Depleting nature of Environmental resources such as soil, water minerals and forests

- The depletion of natural resources occurs when resources are consumed at a faster rate than their replacement.
- Natural resources are those resources that are in existence without human actions, and they can either be renewable or non-renewable.
- When it gets down to the discussion of natural resource depletion, it is a term used in reference to water usage, farming, fossil fuel consumption, fishing, and mining.
- And above all, natural resource depletion is defined on the premise that the value of a resource is measured in terms of its availability in nature.

What is Resource Depletion?

- Resource depletion happens when the consumption of renewable or non-renewable resources becomes scarce, as they are consumed at a faster rate than they can be replenished.
- The term resource deletion is most commonly used with fossil fuels, water usage, fishing, mining, logging etc.
- Resource depletion is the consumption of a resource faster than it can be replenished.
- Natural resources are commonly divided between renewable resources and non-renewable resources.
- Use of either of these forms of resources beyond their rate of replacement is considered to be resource depletion.

- A resource that is rare on earth due to depletion has a higher value than a natural resource that is in abundance.
- Due to the increasing global population, the levels of natural resource degradation are also increasing.
- Consequently, the world's eco-footprint is estimated to be one and a half times the ability of the earth to sustainably provide each individual with enough resources that meet their consumption levels.

Causes of Depletion of Natural Resources

- **1. Overpopulation**
- The total global population is more than seven billion people. Still, there is a consistent increase in the overall earth populace and this has been a critical factor in accelerating the depletion of natural resources. An increase in the populace expands the need for resources and conditions necessary to sustain it.
- Even if everyone tried to adopt a correspondingly low material standard of living, with the population approaching eight billion, it would still cause the depletion of natural resources.
- In addition, it contributes to increased ecological contamination. Research further indicates that developing countries are using more and more resources to industrialize and support their ever-increasing population. Hence, the depletion of natural resources will continue as long as the world population increases.

- **2. Poor Farming Practices**
- Humans are causing a lot of stress on land resources due to the over-reliance on food production for daily nutritional requirements. Poor irrigation practices, for example, are a key contributing factor to the salinization and alkalization of the soil that sustains plant growth.
- Poor soil management practices and the use of heavy machinery and farming equipment also destroy the soil structure, making it unsuitable for plant growth.
- Due to the drastic soil vibrations and destruction, the fertile material vital to life is being destroyed.
- Some farming practices, such as excessive use of pesticides, fungicides, and herbicides, equally kill important soil micro-organisms that are essential in replenishing nutrients in the soil.
- Furthermore, irresponsible farming leaves the soil vulnerable to soil erosion, which could further result to soil degradation.

- **3. Logging**
- The World Bank reported that the net loss of global forest between 1990 and 2016 was 1.3 million square kilometers. The gross loss every year that followed was around 13 million hectares, and by July 2022, the net loss of global forest was around 17 million hectares.
- On the same note, tropical deforestation is estimated to occur at a rate of one percent annually, especially in the Latin American regions. People are clearing forests primarily for agricultural reasons due to the increase in population pressure.
- Humans are also cutting down trees to make space for residential complexes and multiplexes. Through deforestation, the planet loses not only trees but also thousands of animals and great plant biodiversity due to the destruction of their natural habitats.
- A lot of flora and fauna species have become rare, endangered or extinct over the years due to the said practice. Moreover, increased logging activities also lead to soil erosion that degrades natural soil minerals.

- **4. Overconsumption of Natural Resources**
- The 1760 industrial revolution saw large-scale mineral and oil exploration, and the practice has been gradually growing, leading to more and more natural oil and mineral depletion.
- Together with the advancements in technology, development, and research in the contemporary era; exploitation of minerals has become easier and humans are digging deeper to access different ores. The increased exploitation of different minerals has led to some of them entering into a production decline.
- For example, minerals such as gasoline, copper, and zinc production are estimated to decline in the next 20 years. Plus, oil mining continues to rise due to the upsurge in the number of engines that use petroleum, thereby magnifying its depletion.
- The peak oil theory supports this fact by putting forward that there will come a time when the globe will experience uncertainties about alternative means of fuel owing to the over-harvesting of petroleum. When the peak of petroleum production is passed, an irreversible decline on the production rates will be faced.

- **5. Pollution**
- An increase in population and modern anthropogenic activities is a major contributor to the disposal of pollutants into the natural environment, and as such, the value of the natural environment is gradually exposed to degradation.
- The soil, air, lakes, and seas are being contaminated with sewage, radioactive materials, and toxic chemicals, among other pollutants.
- Pollution can directly kill plants and animals, destroy the environment and cause further dilemmas, thus leading to natural resource depletion.
- Uncontrolled releases of carbon monoxide, nitrous oxide, sulfur oxide, and carbon dioxide, for example, have resulted in the degradation of the ozone layer and global warming — environmental changes with their resultant depletive impacts on different natural habitats.
- Millions of different animal and plant species have thus lost their natural habitats and are on the verge of extinction.

- **6. Industrial and Technological Development**
- The present-day world is incessantly becoming industrialized as more and more countries make major technological breakthroughs. But as technological advancements continue, there is also a considerable growth in industries that release toxins and chemical by-products which are eventually deposited in lakes, oceans, soils, and lands.
- Some of the industrial by-products are organic compounds, metals, radioactive materials, and other destructive wastes. As a result, the by-products and toxic materials alter natural habits such as aquatic systems and wildlife.
- Examples of the impacts include acidic lakes, dead zones, and the death of wildlife as well as aquatic life. Industrial and technological advancements have also driven the demand for virgin materials for research, development, and production.
- More resources are hence being used to satisfy industrial demands, increasing the rate of natural resource depletion. As the production of industrial materials and toxic waste increases, more habitats are being disturbed and destroyed, leading to a higher natural resource depletion rate.

- https://youtu.be/TPrXUTXikJs

Effects of Depletion of Natural Resources

- **1. Water shortages**
- Poor farming practices, deforestation, and pollution are major causes of water resource depletion due to contamination, wastage, and the destruction of natural water catchment areas.
- As of today, approximately two billion people lack access to clean water because of the effects of deforestation and contamination of water sources and groundwater. Water shortages further contribute to famine and food insecurity.
- Due to the lack of clean water access, there are around two billion cases of diarrhea among children younger than five years old, three million cases of cholera, and 11 million cases of typhoid fever. Moreover, a lot of water-related diseases and deaths are continuously occurring.
- The growing water use of people globally at more than twice the rate of population increase is calling for heavy pressure and solutions to avoid further global problems.

- **2. Oil depletion**
- Oil is a nonrenewable resource that accounts for roughly 40 percent of the total global energy consumption. Oil is used for plenty of purposes, and together with technological advancements, it is being more frequently used than ever.
- Research by EIA's International Energy Outlook had shown that due to the high rate of oil exploitation, the amount of oil remaining would last for only 25 years. Moreover, EIA's research stated that by 2030, oil consumption will be at 118 million barrels per day.
- The energy consumption of humans is increasing rapidly while replacing the resources being used in energy production is still at a slow pace. Oil is an essential commodity in manufacturing, planting, mining, and transportation among many activities, and its depletion would be devastating.
- The adverse effects of oil depletion include the fall of businesses, the high cost of living in developing countries, and uncertainty in the transport sector. Moreover, oil depletion could cause international tensions as everyone would want access to the remaining oil supply.

- **3. Loss of forest cover**
- Approximately 18 million acres of forest cover are destroyed annually. This means that half of the world's natural forest cover has already been cleared and millions of animal and plant habitats are destructed.
- Furthermore, studies indicate an increase in deforestation in the past three decades has resulted in a 12% to 17% rise in greenhouse gases globally. Due to the lack of trees to absorb carbon dioxide, global warming is becoming more severe.
- Other devastating effects of deforestation include soil erosion, an increase in greenhouse gases leading to global warming, loss of biodiversity, increased flooding, and drought.

- **4. Depletion of minerals**
- There has been an increase in the exploitation of minerals such as phosphorus, gasoline, copper, and zinc, among others, to sustain the seven billion people on earth.
- Studies by the Global Phosphorus Research Institute, for example, show that the earth could run out of phosphorus—an essential element for plant growth—in the next 50 to 100 years.
- Studies by the United States Geological Survey also indicate that there is an increase in non-renewable resource consumption of natural minerals and construction materials such as copper, sand, gravel, and stone.
- As the consumption of natural minerals increases, the cost of the materials also increases, while economic returns are shrinking. The economic impact of mineral depletion is likely to outweigh the drastic global warming.

- **5. Extinction of Species**
- Due to the changes in the living conditions of animals as a result of resource overexploitation and habitat degradation, some species may go extinct. Habitat destruction is one of the primary reasons why species of plants and animals are being endangered, or worse, extinct.
- Forested regions are known to be habitats for thousands of animals, but deforestation is progressively destroying forest habitats. Practices such as overfishing and pollution have similarly led to a drastic reduction in the number of marine species such as tuna fish.
- Some of the animals that have become extinct recently are the ivory-billed woodpecker, splendid poison frog, Lake Lanao freshwater fish, smooth hand fish, bramble cay melomys, spix's macaw, baiji, and western black rhinoceros. In the flora area, 32 orchid species and 65 North American plants became extinct.

Table 15.1. Few Endangered Species of Birds, Reptiles and Mammals

Birds	Reptiles	Mammals
Great Indian Bustard	Gharial	Black Buck
Great Indian Hornbill	Green Sea Turtle	Lion-tailed Macaque
Brown Headed Gull	Pythons	Wild Ass
Mountain Quail	Tortoise	Sloth Bear
Peacock		Hyaena
Peafowl		Sambar
Pelican		Cheetal
Siberian White Crane		Tiger

Solutions to Depletion of Natural Resources

- **1. Controlling Deforestation**
- Programs aimed at checking against deforestation, such as REDD (Reducing Emissions from Deforestation and Forest Degradation), created by the World Bank, the New York Declaration on Forests, and the United Nations, are initiatives that could help reduce the depletion of natural resources.
- The initiatives may also act as incentives for encouraging the general public to conserve forests as these are the habitat and protectors of some of the world's unique plant and animal species and water sources, respectively.
- Sustainability programs that aim to educate people about the importance of conserving natural resources should also be enacted as a way of focusing on the long-term risks associated with environmental degradation.

- **2. Reducing oil, mineral, and material consumption**
- Oil-rich countries, together with the World Bank, state, and consumables' regulatory bodies, should join hands towards a common international objective of discussing how oil and mineral consumption, as well as exploitation, can be reduced.
- Manufactures can, for instance, be trained on lean manufacturing (recycling, re-use, and reducing wastage) while consumers are sensitized on how to adopt re-use, reducing wastage, and recycling techniques.

- **3. More exploration and use of renewable sources of energy**
- Renewable sources of energy such as solar and wind power can be explored more and utilized to reduce the dependency on fossil fuel, which is a major cause of environmental pollution, climate change, global warming, and the destruction of natural habitats.
- Through the exploration of different renewable sources of energy, a lot of technological innovations can be developed, which in turn could help reduce the use of natural nonrenewable resources.

- **4. Protecting wetlands and coastal ecosystems**
- Wetlands are regions saturated with groundwater that play a significant role in sustaining vegetation cover.
- The coastal and wetland ecosystems are thus vital in sustaining the food chain as they replenish water sources and avail minerals and nutrients for primary producers (green and flowering plants), essential for maintaining plant and animal biodiversity.
- Also, when coastal ecosystems are protected, they aid in controlling marine overfishing and protect coral reefs.

- **5. Sensitization and awareness creation**
- People must be educated on how their daily practices put a strain on scarce natural resources, as well as their individual contributions to resource depletion. The main purpose of creating awareness would be to encourage people to preserve and restore the natural environment by getting involved in conservation efforts.
- Awareness education may be in the form of a symposium, creating videos for people to watch, writing articles and blog posts for people to read, or many other ways to educate everyone across the globe.

Questions

- What is resource depletion?
- What are the causes of depletion of natural resources?
- What are the effects of depletion of natural resources?
- What are the solutions to depletion of natural resources?

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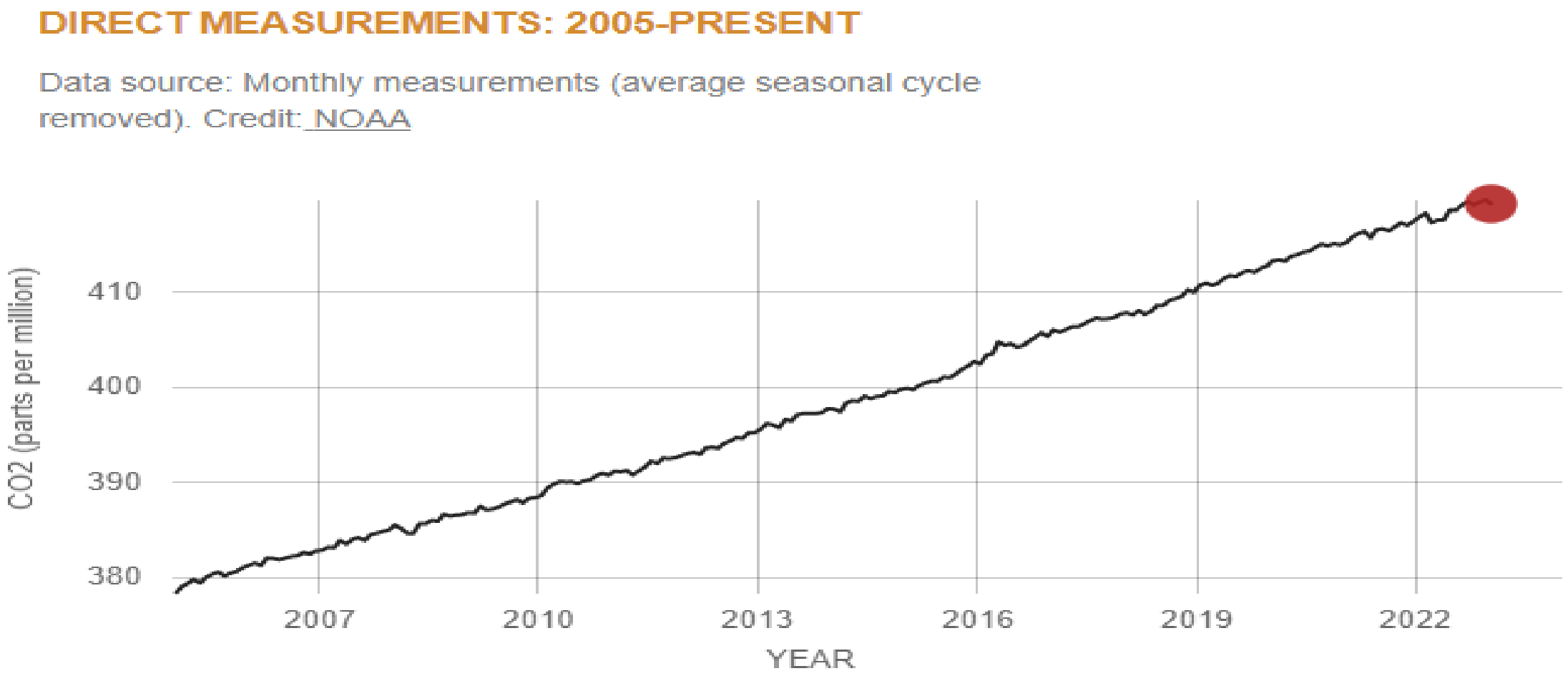
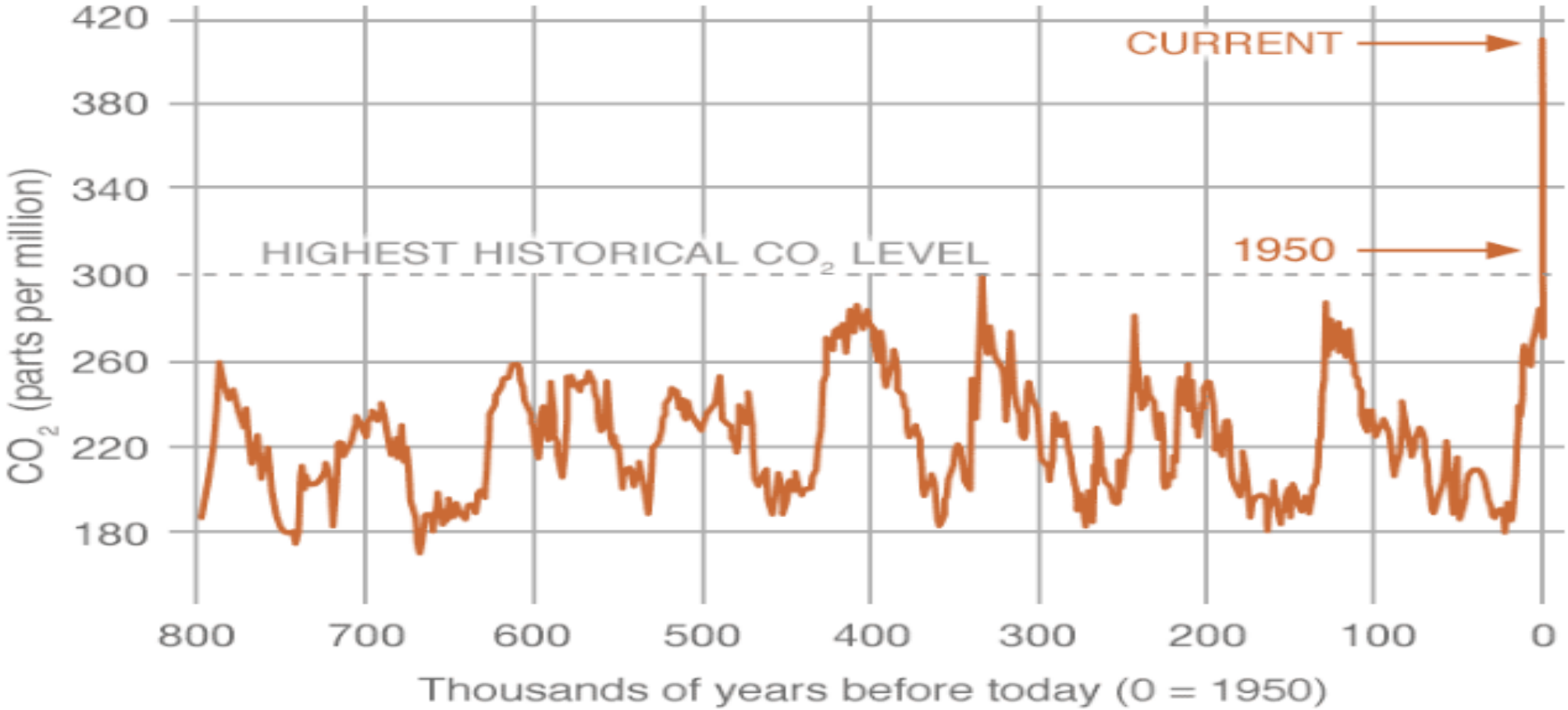
Carbon emissions and Global Warming



PROXY (INDIRECT) MEASUREMENTS

Data source: Reconstruction from ice cores.
Credit: NOAA

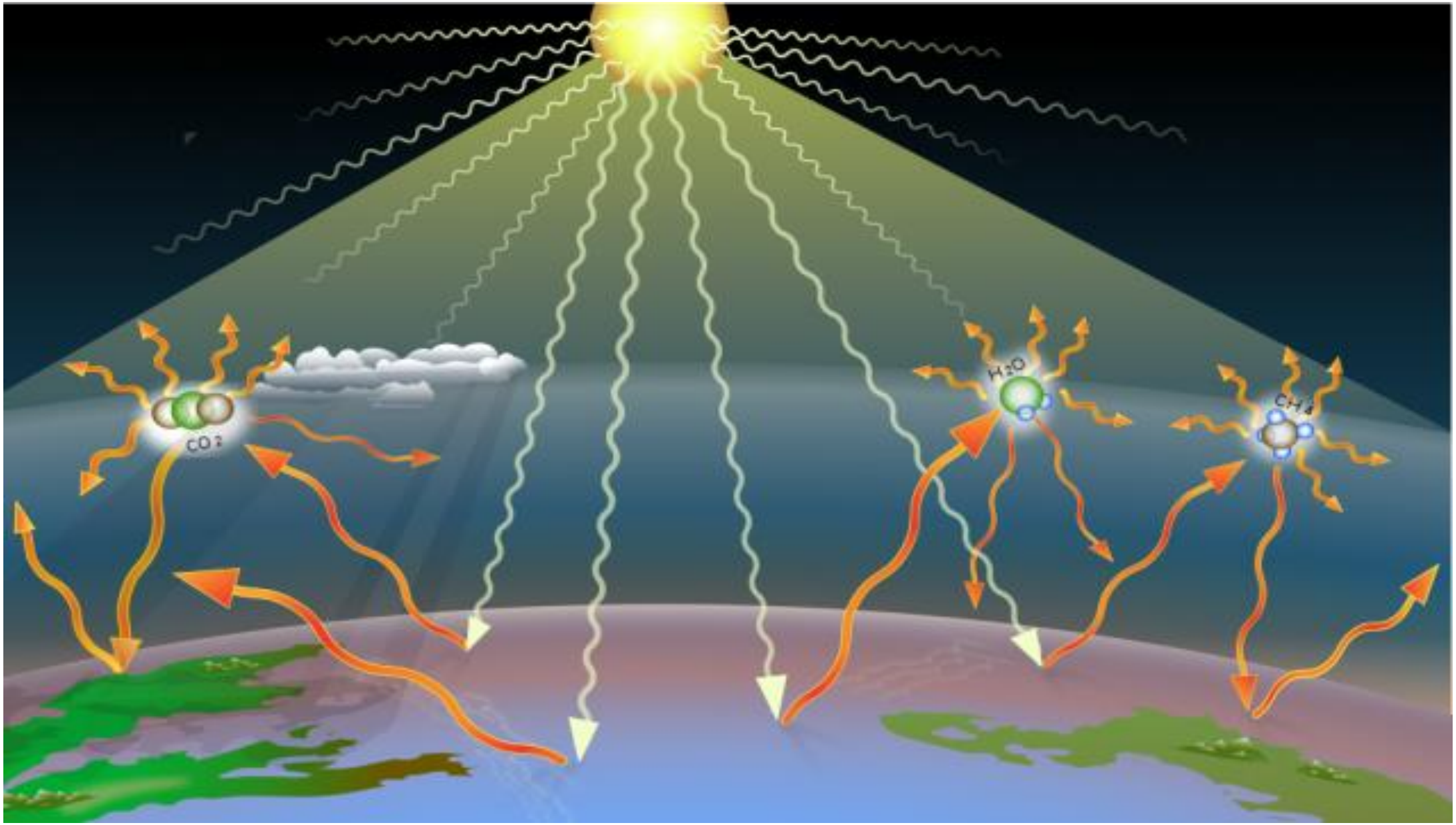


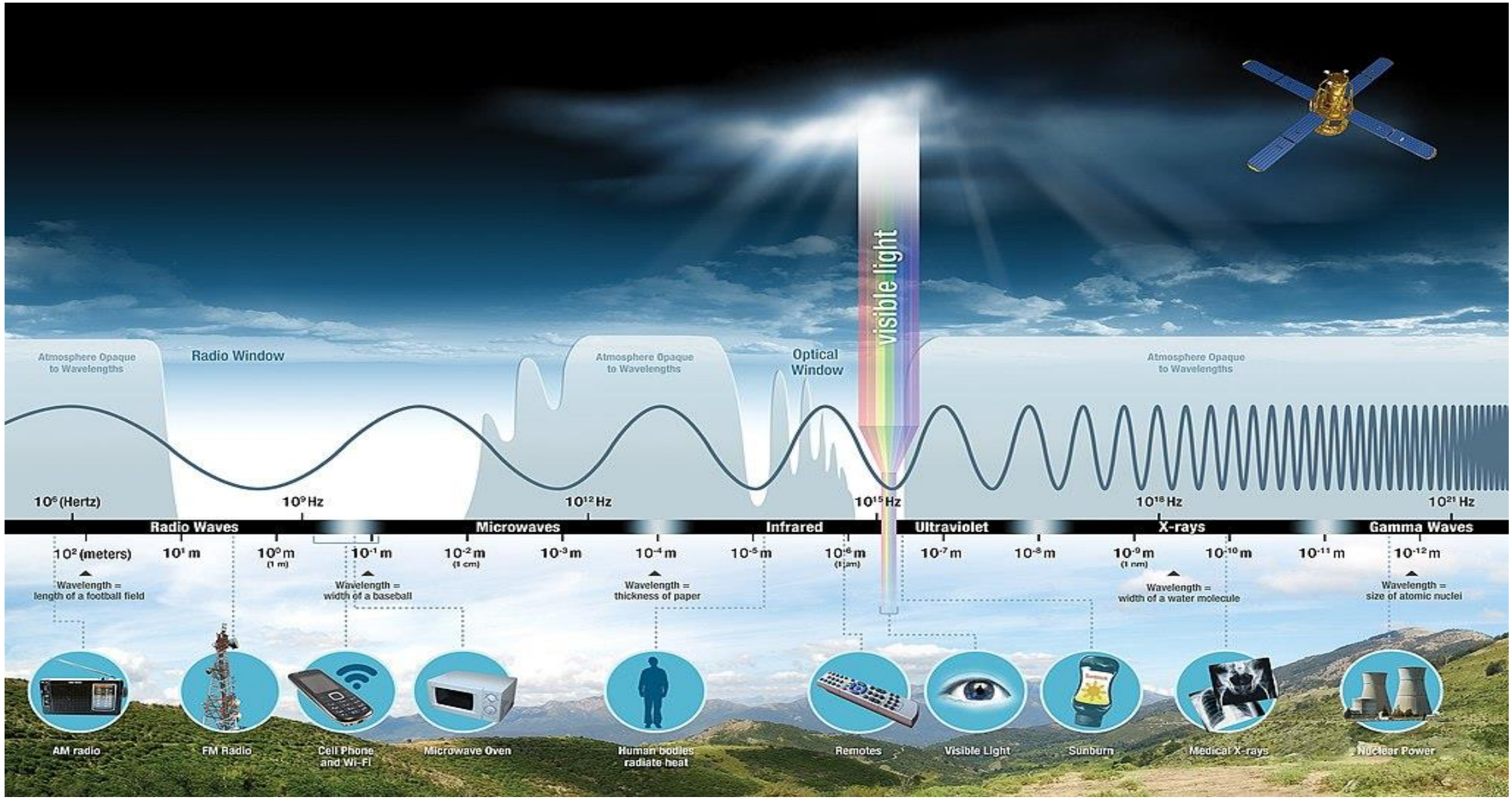
- Carbon dioxide in the atmosphere warms the planet, causing climate change. Human activities have raised the atmosphere's carbon dioxide content by 50% in less than 200 years.
- Carbon dioxide (CO_2) is an important heat-trapping gas, or greenhouse gas, that comes from the extraction and burning of fossil fuels (such as coal, oil, and natural gas), from wildfires, and from natural processes like volcanic eruptions.
- Since the beginning of industrial times (in the 18th century), human activities have raised atmospheric CO_2 by 50% – meaning the amount of CO_2 is now 150 % of its value in 1750. This is greater than what naturally happened at the end of the last ice age 20,000 years ago.

How Exactly Does Carbon Dioxide Cause Global Warming?

How does carbon dioxide trap heat?

- You've probably already read that carbon dioxide and other greenhouse gases act like a blanket or a cap, trapping some of the heat that Earth might have otherwise radiated out into space. That's the simple answer. But how exactly do certain molecules trap heat? The answer there requires diving into physics and chemistry.
- Simplified diagram showing how Earth transforms sunlight into infrared energy. Greenhouse gases like carbon dioxide and methane absorb the infrared energy, re-emitting some of it back toward Earth and some of it out into space.


CO2
H2O
CH4


Atmosphere Opaque to Wavelengths
Radio Window
Atmosphere Opaque to Wavelengths
Optical Window
visible light
Atmosphere Opaque to Wavelengths
10⁶ (Hertz)
10⁹ Hz
10¹² Hz
10¹⁵ Hz
10¹⁸ Hz
10²¹ Hz
Radio Waves
Microwaves
Infrared
Ultraviolet
X-rays
Gamma Waves
10² (meters)
10¹ m
10⁰ m (1 m)
10⁻¹ m
10⁻² m (1 cm)
10⁻³ m
10⁻⁴ m
10⁻⁵ m
10⁻⁶ m (1 µm)
10⁻⁷ m
10⁻⁸ m
10⁻⁹ m (1 nm)
10⁻¹⁰ m
10⁻¹¹ m
10⁻¹² m
Wavelength = length of a football field
Wavelength = width of a baseball
Wavelength = thickness of paper
Wavelength = width of a water molecule
Wavelength = size of atomic nuclei
AM radio
FM Radio
Cell Phone and Wi-Fi
Microwave Oven
Human bodies radiate heat
Remotes
Visible Light
Sunburn
Medical X-rays
Nuclear Power

- A diagram showing the wavelengths of different types of energy. Energy from the Sun reaches Earth as mostly visible light. Earth reradiates that energy as infrared energy, which has a longer, slower wavelength. Whereas oxygen and nitrogen do not respond to infrared waves, greenhouse gases do.

- When sunlight reaches Earth, the surface absorbs some of the light's energy and reradiates it as infrared waves, which we feel as heat. (Hold your hand over a dark rock on a warm sunny day and you can feel this phenomenon for yourself.)
- These infrared waves travel up into the atmosphere and will escape back into space if unimpeded.
- Oxygen and nitrogen don't interfere with infrared waves in the atmosphere. That's because molecules are picky about the range of wavelengths that they interact with.
- For example, oxygen and nitrogen absorb energy that has tightly packed wavelengths of around 200 nanometers or less, whereas infrared energy travels at wider and lazier wavelengths of 700 to 1,000,000 nanometers.
- Those ranges don't overlap, so to oxygen and nitrogen, it's as if the infrared waves don't even exist; they let the waves (and heat) pass freely through the atmosphere.

- With CO2 and other greenhouse gases, it's different. Carbon dioxide, for example, absorbs energy at a variety of wavelengths between 2,000 and 15,000 nanometers — a range that overlaps with that of infrared energy. As CO2 soaks up this infrared energy, it vibrates and re-emits the infrared energy back in all directions. About half of that energy goes out into space, and about half of it returns to Earth as heat, contributing to the 'greenhouse effect.'
- The reason why some molecules absorb infrared waves and some don't "depends on their geometry and their composition." He explained that oxygen and nitrogen molecules are simple — they're each made up of only two atoms of the same element — which narrows their movements and the variety of wavelengths they can interact with. But greenhouse gases like CO2 and methane are made up of three or more atoms, which gives them a larger variety of ways to stretch and bend and twist. That means they can absorb a wider range of wavelengths — including infrared waves.

Why does carbon dioxide let heat in, but not out?

- Energy enters our atmosphere as visible light, whereas it tries to leave as infrared energy. In other words, “energy coming into our planet from the Sun arrives as one currency, and it leaves in another”.
- CO2 molecules don’t really interact with sunlight’s wavelengths. Only after the Earth absorbs sunlight and reemits the energy as infrared waves can the CO2 and other greenhouse gases absorb the energy.

How can CO2 trap so much heat if it only makes up 0.04% of the atmosphere? Aren't the molecules spaced too far apart?

- Before humans began burning fossil fuels, naturally occurring greenhouse gases helped to make Earth's climate habitable. Without them, the planet's average temperature would be below freezing. So we know that even very low, natural levels of carbon dioxide and other greenhouse gases can make a huge difference in Earth's climate.
- Today, CO2 levels are higher than they have been in at least 3 million years. And although they still account for only 0.04% of the atmosphere, that still adds up to billions upon billions of tons of heat-trapping gas. For example, in 2019 alone, humans dumped 36.44 billion tonnes of CO2 into the atmosphere, where it will linger for hundreds of years. So there are plenty of CO2 molecules to provide a heat-trapping blanket across the entire atmosphere.

- In the case of greenhouse gases, the planet’s temperature is a balance between how much energy comes in versus how much energy goes out. Ultimately, any increase in the amount of heat-trapping means that the Earth’s surface gets hotter.

If there's more water than CO2 in the atmosphere, how do we know that water isn't to blame for climate change?

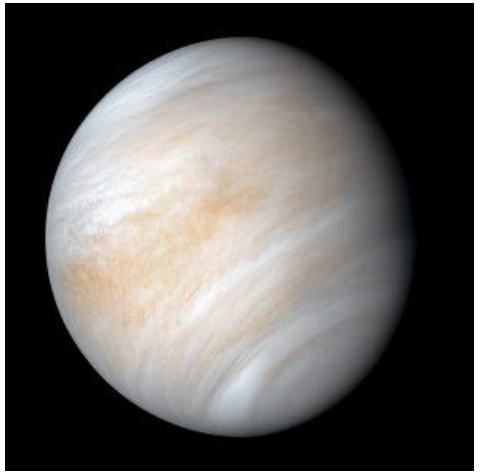
- Water is indeed a greenhouse gas. It absorbs and re-emits infrared radiation, and thus makes the planet warmer. However, the amount of water vapor in the atmosphere is a consequence of warming rather than a driving force, because warmer air holds more water.
- As carbon dioxide and other greenhouse gases heat up the planet, more water evaporates into the atmosphere, which in turn raises the temperature further.
- However, a hypothetical villain would not be able to exacerbate climate change by trying to pump more water vapor into the atmosphere. "It would all rain out because temperature determines how much moisture can actually be held by the atmosphere."

- Similarly, it makes no sense to try to remove water vapor from the atmosphere, because natural, temperature-driven evaporation from plants and bodies of water would immediately replace it. To reduce water vapor in the atmosphere, we must lower global temperatures by reducing other greenhouse gases.

If Venus has an atmosphere that's 95% CO2, shouldn't it be a lot hotter than Earth?

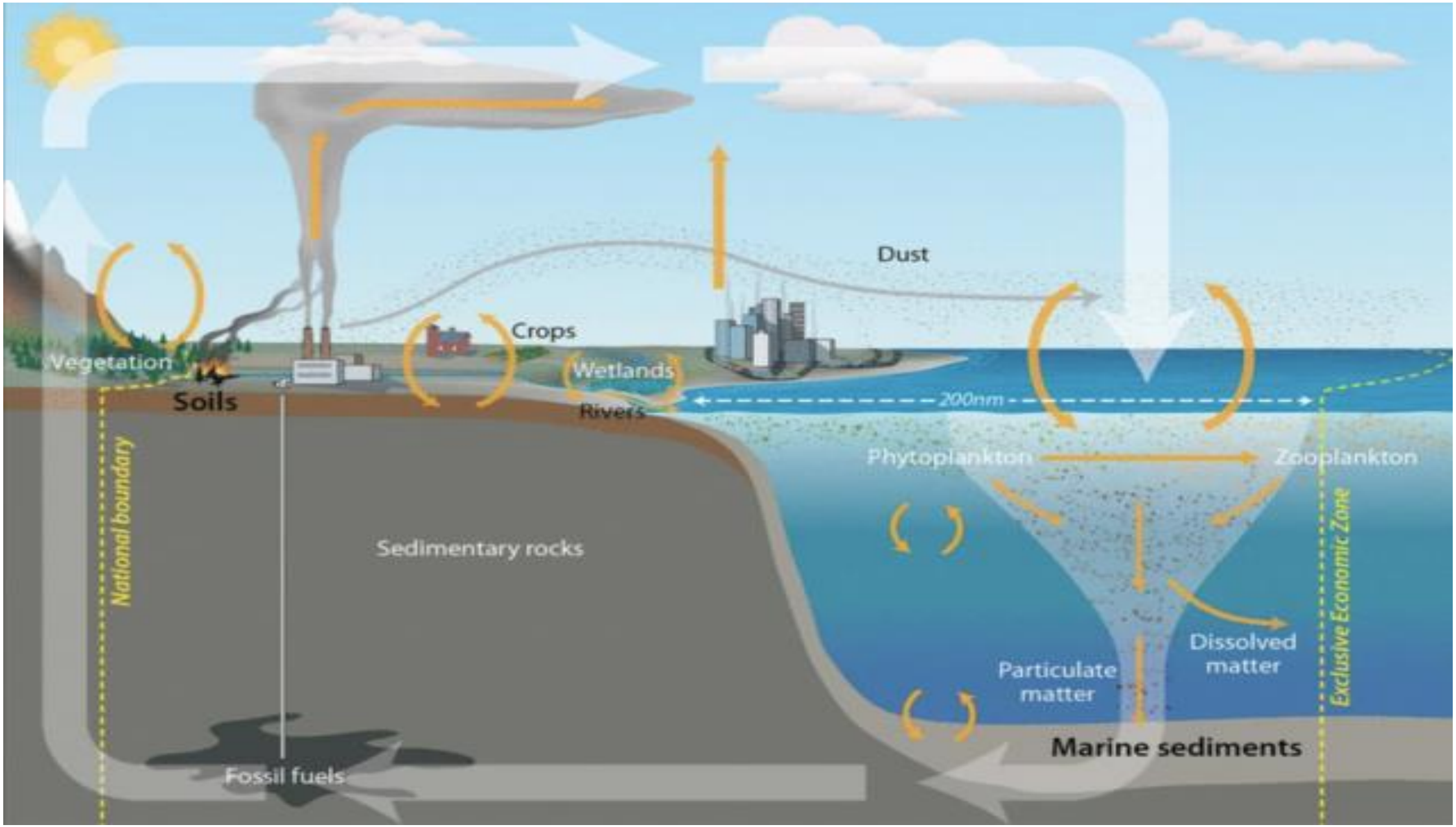
- The concentration of CO2 in Venus' atmosphere is about 2,400 times higher than that of Earth. Yet the average temperature of Venus is only about 15 times higher. What gives?
- Interestingly enough, part of the answer has to do with water vapor. Scientists think that long ago, Venus experienced a runaway greenhouse effect that boiled away almost all of the planet's water — and water vapor, remember, is also a heat-trapping gas.
- "It doesn't have water vapor in its atmosphere, which is an important factor," says Smerdon. "And then the other important factor is Venus has all these crazy sulfuric acid clouds."

- High up in Venus' atmosphere, he explained, clouds of sulfuric acid block about 75% of incoming sunlight. That means the vast majority of sunlight never gets a chance to reach the planet's surface, return to the atmosphere as infrared energy, and get trapped by all that CO2 in the atmosphere.
- Thick clouds of sulfuric acid surround Venus and prevent 75% of sunlight from reaching the planet's surface. Without these clouds, Venus would be even hotter than it already is.



Won’t the plants, ocean, and soil just absorb all the excess CO2?

- Eventually … in several thousand years or so.
- Plants, the oceans, and soil are natural carbon sinks — they remove some carbon dioxide from the atmosphere and store it underground, underwater, or in roots and tree trunks. Without human activity, the vast amounts of carbon in coal, oil, and natural gas deposits would have remained stored underground and mostly separate from the rest of the carbon cycle. But by burning these fossil fuels, humans are adding a lot more carbon into the atmosphere and ocean, and the carbon sinks don’t work fast enough to clean up our mess.


Dust
Crops
Vegetation
Wetlands
Soils
Rivers
200nm
National boundary
Phytoplankton
Zooplankton
Sedimentary rocks
Exclusive Economic Zone
Dissolved matter
Particulate matter
Marine sediments
Fossil fuels

- Unfortunately, we don’t have thousands of years to wait for nature to absorb the flood of CO2. By then, billions of people would have suffered and died from the impacts of climate change; there would be mass extinctions, and our beautiful planet would become unrecognizable. We can avoid much of that damage and suffering through a combination of decarbonizing our energy supply, pulling CO2 out the atmosphere, and developing more sustainable ways of thriving.

Causes of Climate Change

- Generating power
- Manufacturing goods
- Cutting down forests
- Using transportation
- Producing food
- Powering buildings
- Consuming too much

Effects of Climate Change

- Hotter temperatures
- More severe storms
- Increased drought
- A warming, rising ocean
- Loss of species
- Not enough food
- More health risks
- Poverty and displacement

- https://www.un.org/en/climatechange/what-is-climate-change
- https://www.un.org/en/climatechange/science/causes-effects-climate-change

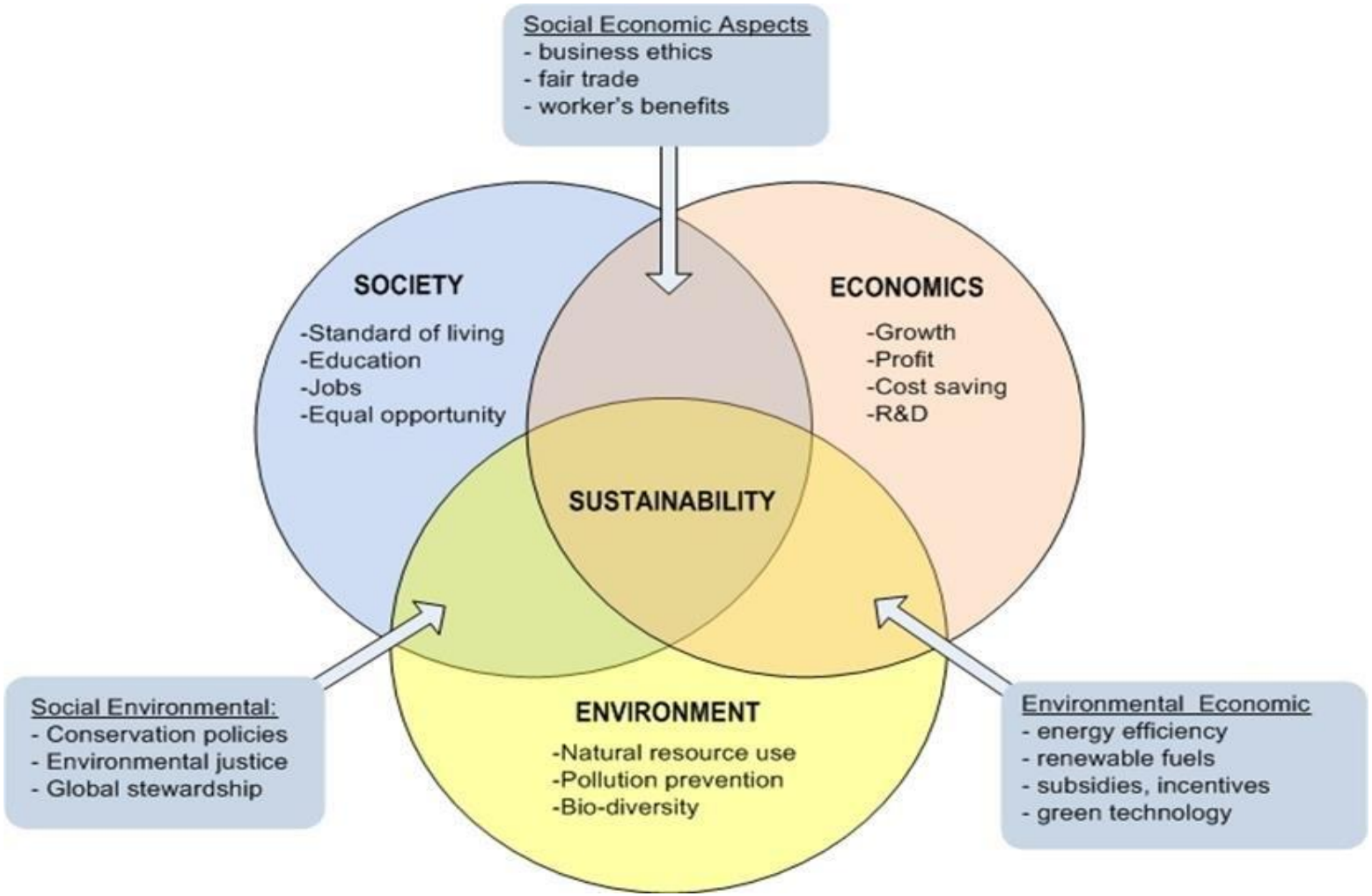
Questions

- How does carbon dioxide trap heat?
- Why does carbon dioxide let heat in, but not out?
- What are the Causes of Climate Change?
- What are the Effects of Climate Change?

Unit 2:- Technological Growth for Sustainable Development

- **Social, Economical and Environmental aspects of Sustainable Development**
- **Renewable Energy Harvesting**
- **Concept of Carbon credit**
- **Green Building**
- **Power and functions of Central Pollution Control Board and State Pollution Control Board**

Social, Economical and Environmental Aspects of Sustainable Development



What Is Sustainability?

- **Sustainability** can be broadly defined as “meeting the needs of the present generation without compromising the ability of future generations to meet their own needs.”
- When it comes to describing sustainability in our world, we need to be concerned about three main areas of influence.
- There are three interconnected spheres of sustainability that describe the relationships between the environmental, economic, and social aspects of our world.
- These spheres are a related set of concepts that, when taken together, can form a solid ground from which major decisions and actions can be made.

- When the concepts contained in the three spheres of sustainability are applied to real-world situations, everybody wins.
- Natural resources are preserved, the environment is protected, the economy isn't harmed, and the quality of life for our people is improved or maintained.

Environmental Sustainability

- In a truly sustainable environment, an ecosystem would maintain populations, biodiversity, and overall functionality over an extended period of time.
- Ideally, decisions that are made should promote equilibrium within our natural systems and seek to encourage positive growth.
- Unnecessary disturbances to the environment should be avoided whenever possible.
- If there is a disturbance, it should be mitigated to the maximum practicable extent.
- When decisions are made, one part of the discussion should always be the environmental impacts of the proposed outcome or result.
- There are several items that are directly related to environmental sustainability.
- One of the concepts that are of the utmost importance is the proper management of our natural resources.
- In some cases, we can even promote habitat restoration and preservation as means to negotiate a successful solution to a problem.

Economic Sustainability

- Similar to environmental sustainability, economic sustainability involves creating economic value out of whatever project or decision you are undertaking
- Economic sustainability means that decisions are made in the most equitable and fiscally sound way possible while considering the other aspects of sustainability
- In most cases, projects and decisions must be made with the long-term benefits in mind (rather than just the short-term benefits)
- Keep in mind that when only the economic aspects of something are considered, it may not necessarily promote true sustainability.
- However, when good business practices are combined with the social and environmental aspects of sustainability, you can still have a positive result that is for the greater good of humanity.

- There are several key ideas that make up economic sustainability.
- For example, governments should look to promoting "smart growth" through no-nonsense land use planning and subsidies or tax breaks for green development.
- Strong financial support for universities, education programs, and research & development is an important part of economic sustainability as well.
- In addition to this, an emphasis should also be placed on other areas such as reducing unnecessary spending and cutting red tape.

Social Sustainability

- Social sustainability is based on the concept that a decision or project promotes the betterment of society.
- In general, future generations should have the same or greater quality of life benefits as the current generation do.
- This concept also encompasses many things such as human rights, environmental law, and public involvement & participation.
- Failing to put emphasis on the social part of decisions or actions can result in the slow collapse of the spheres of sustainability (and society as well).

- One great example of social sustainability is the Water (Prevention and Control of Pollution) Act in 1974
- Overall, these sets of laws were great pieces of legislation that set minimum water quality standards for both surface and drinking water.
- The Clean Water Act also served to protect our nation's water supply by making it essentially illegal to discharge pollutants in adjacent rivers, lakes, and streams.
- This period of time in our nation also saw many other improvements in our environmental laws.
- For many people, the main concern in their lives is their overall well-being and quality of life. Think about how this relates to the economy and the environment.
- In a poor economy, people experience a poor quality of life. The same also holds true for a poor environment. In a poor environment, the impacts on quality of life are not always easily observable.

- However, it doesn't take a trained individual to see how things such as polluted storm water runoff, over-development of floodplains, and the poor management of our scarce resources can have an effect on our everyday quality of life.
- The three spheres of sustainability encompass many concepts which explain how decisions and actions can have an impact on the overall sustainability of our world.

Questions

- What are the various components of sustainable development?
- What are some environmental and social challenges of sustainability?
- Can you describe what sustainability means in terms of today's society?
- How does sustainable development make economic sense for society?

What are the various components of sustainable development?

- Sustainable development must include a design that holistically accounts for and minimizes all aspects of environmental, economic, and anthropogenic impacts.
- In general, sustainable components for new development would fall under the same categories as sustainability in its overall context.
- To be sustainable, new development and infrastructure should complement the landscape and the area.
- Its construction should add to what's already in the environment rather than taking away from it.
- New development should respect the natural laws of economics, the environment, and harmonize with societal values of users and residents.

- Sustainable development requires the use of creative ideas and innovative design techniques. Regarding the environment, Low Impact Development Techniques should be employed to best manage available storm water.
- Other Green components should be used as well to minimize the impact on air quality, electricity use, etc.
- Efficiently developed and eco-friendly materials local to the area should be utilized for construction whenever possible.
- The local labor pool should be tapped for development which will improve the local economy and give people a sense of ownership in the project.

What are some environmental and social challenges of sustainability?

- In the world that we live in today, there are plenty of challenges in these two areas.
- In the environmental area we have several big challenges such as 1) Deforestation, 2) Carbon emissions, 3) Unsustainable reliance on fossil fuels 4) Oceanic Pollution, and 5) Habitat destruction just to name a few.
- These issues are global issues and can only be solved by implementing a community-by-community approach to sustainability.
- For social issues, there are plenty of issues as well.
- Here are perhaps five big ones 1) Hunger and access to clean water, 2) Poverty, 3) government and corporate corruption, 4) Persecution based on race/religion/etc, and 5) Vaccinations/Disease.
- No matter which of these (or others) that you look at, the issues affect millions of people.

Can you describe what sustainability means in terms of today's society?

- Sustainability is a set of conditions which results in an indefinite state of equilibrium between the human population and the resources that we rely upon for survival as well as the waste that we generate.
- In other words, sustainability a set of behaviors, policies, and actions that serve to strike a balance between the rates at which we use resources and the rates at which those resources are replenished or replaced in addition to striking a balance between the waste that we generate (pollution & emissions) and the environment's ability to absorb and decompose that waste.
- Therefore, waste and resource management is at the heart of the sustainability ideology.

How does sustainable development make economic sense for society?

- Any sustainable development process will make economic sense in the medium and long term, provided that it:
  - reduces the use of non-renewable resources (such as metals and oil) whose prices rise as they become increasingly rare;
  - allows renewable resources to be used in perpetuity because they are used appropriately (forest and fishery products, other biological resources, etc.);
  - reduces the enormous costs of decontamination, clean-up and the restoration of environments disturbed by human activity.

- It also makes economic sense for our society:
  - to facilitate the reconciliation of work and family life;
  - to invest in training, education and quality health care;
  - to reduce the consumption of junk food and encourage physical activity, thereby lowering health care costs;
  - to make better use of our residual materials by turning them into new resources for our development, and by promoting reuse, recovery and recycling in that order;
  - to save water and maintain its quality, ensuring a safe supply and reducing treatment costs;
  - to reduce consumption of energy. This has immediate financial impact because it lessens the need for new hydroelectric plants and the massive costs that will come with climate change.
- All of these measures contribute to sustainable development.
- Conversely, there are terrible costs associated with the waste of resources, overconsumption, deterioration of the environment, poverty, social inequality and the debts a society leaves to future generations.
- These costs are above all the result of development situations that are not viable.

EVS STUDY MATERIAL (SEM-V)

COMMON FOR ALL BRANCHES

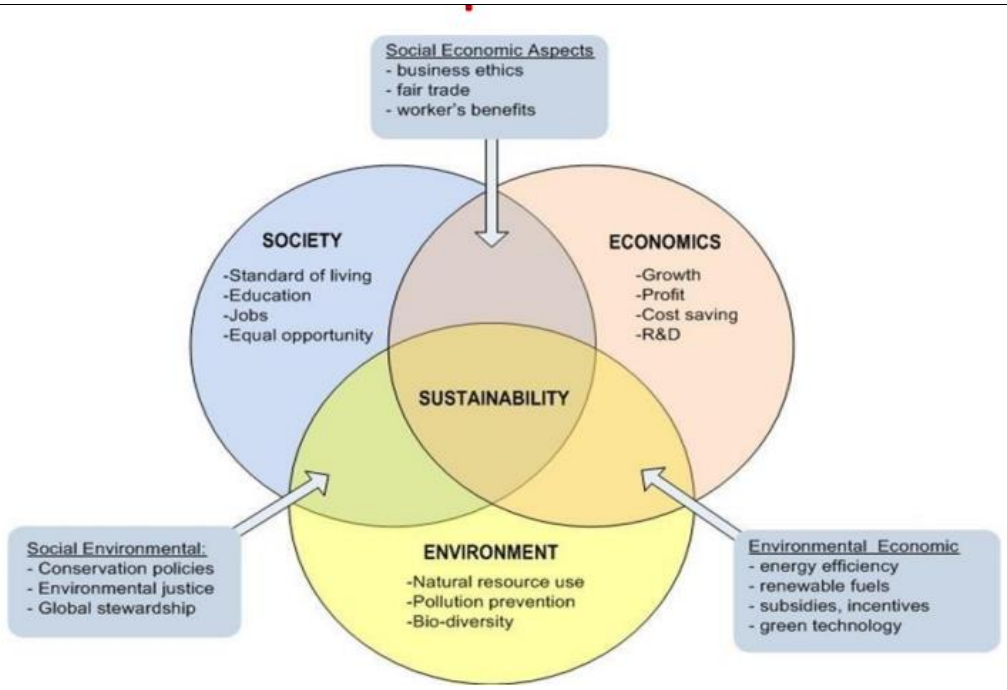
Q-1	**What is the Ecological Footprint?**
ANS	•The Ecological Footprint is a resource accounting tool that measures how much biologically productive land and sea is used by a given population or activity, and compares this to how much land and sea is available. ` • Productive land and sea areas support human demands for food, fiber, timber, energy, and space for infrastructure. • These areas also absorb the waste products from the human economy. • The Ecological Footprint measures the sum of these areas, wherever they physically occur on the planet. • The Ecological Footprint is used widely as a management and communication tool by governments, businesses, educational institutions, and non-governmental organizations
Q-2	**What does the Ecological Footprint measure?**
ANS	• The Ecological Footprint measures the amount of biologically productive land and water area an individual, a city, a country, a region, or all of humanity uses to produce the resources it consumes and to absorb the waste it generates with today's technology and resource management practices. • This demand on the biosphere can be compared to bio capacity, a measure of the amount of biologically productive land and water available for human use. • Biologically productive land includes areas such as cropland, forest, and fishing grounds, and excludes deserts, glaciers, and the open ocean. • Global hectares are hectares with world-average productivity for all productive land and water areas in a given year. • Studies that are compliant with current Ecological Footprint Standards use global hectares as a measurement unit. • This makes Ecological Footprint results globally comparable, just as financial assessments use one currency, such as dollars or Euros, to compare transactions and financial flows throughout the world.
Q-3	**What is bio capacity?**
ANS	•Bio capacity represents the ability of ecosystems to produce useful biological materials and to absorb wastes generated by humans, using current management and extraction technologies. • Useful biological materials are defined as those materials that the human economy actually demanded in a given year. • The Ecological Footprint measures demand on this productive capacity
Q-4	**What is overshoot?**
ANS	• Ecological overshoot at any scale occurs when a population's demand on an ecosystem exceeds the capacity of that ecosystem to regenerate the resources it consumes and absorb its wastes. • The Ecological Footprint is often used to calculate global overshoot; which occurs when humanity's demand on the biosphere exceeds the available biological capacity of the planet. • By definition, overshoot leads to a depletion of the planet's life supporting biological capital and/or to an accumulation of waste products
Q-5	**Is the Ecological Footprint a measure of carrying capacity?**
ANS	• Carrying capacity is a technical term that refers to the maximum population of a species that a given land or marine area could support. • Many species have easily defined and consistent consumption needs, making carrying capacity relatively easy to define and calculate.

	• For humans, however, carrying capacity estimates require assumptions about future per-person resource consumption, standards of living and "wants" (as distinct from "needs"), productivity of the biosphere, and advances in technology. • An area's carrying capacity for humans is thus inherently speculative, and difficult to define. • Ecological Footprints are not speculative estimates about a potential state, but rather are an accounting of the past. Instead of asking how many people could be supported on the planet, the Ecological Footprint asks the question in reverse and considers only present and past years. • The Footprint asks how many planets were actually necessary to support all of the people that lived on the planet in a given year, under that year's standard of living, biological production, and technology.
Q-6	**What is a global hectare?**
ANS	• To allow different types of land to be compared using a common denominator, equivalence factors are used to convert physical hectares of different types of land, such as cropland and pasture, into the common unit of global hectares. • The use of global hectares recognizes that different types of land have a different ability to produce useful goods and services for humans. • One hectare of cropland can produce a greater quantity of useful and valuable food products than a single hectare of grazing land, for example. • By converting both cropland and pasture into global hectares, they can be compared on an equal basis. • A global hectare is defined as a hectare with world-average productivity for all biologically productive land and water in a given year. • Biologically productive land includes areas such as cropland, forest, and fishing grounds, and excludes deserts, glaciers, and the open ocean. • Global hectares are the common, standardized unit used for reporting Ecological Footprint and bio capacity across time and for areas throughout the world. • Because total global production changes over time, the amount of physical material produced by a single global hectare also changes over time. Global hectares can also be converted into global acres
Q-7	**What is resource depletion?**
ANS	• Resource depletion happens when the consumption of renewable or non-renewable resources becomes scarce, as they are consumed at a faster rate than they can be replenished. • The term resource deletion is most commonly used with fossil fuels, water usage, fishing, mining, logging etc. • Resource depletion is the consumption of a resource faster than it can be replenished. • Natural resources are commonly divided between renewable resources and non-renewable resources. • Use of either of these forms of resources beyond their rate of replacement is considered to be resource depletion. • A resource that is rare on earth due to depletion has a higher value than a natural resource that is in abundance. • Due to the increasing global population, the levels of natural resource degradation are also increasing. • Consequently, the world's eco-footprint is estimated to be one and a half times the ability of the earth to sustainably provide each individual with enough resources that meet their consumption levels.
Q-8	**What are the causes of depletion of natural resources?**
ANS	1. **Overpopulation** • The total global population is more than seven billion people. Still, there is a consistent increase in the overall earth populace and this has been a critical factor in accelerating the depletion of natural resources. An increase in the populace expands the need for resources and conditions necessary to sustain it. • Even if everyone tried to adopt a correspondingly low material standard of living, with the population approaching eight billion, it would still cause the depletion of natural resources.

	2. **Poor Farming Practices** • Humans are causing a lot of stress on land resources due to the over-reliance on food production for daily nutritional requirements. Poor irrigation practices, for example, are a key contributing factor to the salinization and alkalization of the soil that sustains plant growth. • Poor soil management practices and the use of heavy machinery and farming equipment also destroy the soil structure, making it unsuitable for plant growth. • Due to the drastic soil vibrations and destruction, the fertile material vital to life is being destroyed. • Some farming practices, such as excessive use of pesticides, fungicides, and herbicides, equally kill important soil micro-organisms that are essential in replenishing nutrients in the soil. 3. **Logging** • The World Bank reported that the net loss of global forest between 1990 and 2016 was 1.3 million square kilometers. The gross loss every year that followed was around 13 million hectares, and by July 2022, the net loss of global forest was around 17 million hectares. • On the same note, tropical deforestation is estimated to occur at a rate of one percent annually, especially in the Latin American regions. People are clearing forests primarily for agricultural reasons due to the increase in population pressure. • Humans are also cutting down trees to make space for residential complexes and multiplexes. Through deforestation, the planet loses not only trees but also thousands of animals and great plant biodiversity due to the destruction of their natural habitats. 4. **Overconsumption of Natural Resources** • The 1760 industrial revolution saw large-scale mineral and oil exploration, and the practice has been gradually growing, leading to more and more natural oil and mineral depletion. • Together with the advancements in technology, development, and research in the contemporary era; exploitation of minerals has become easier and humans are digging deeper to access different ores. The increased exploitation of different minerals has led to some of them entering into a production decline. • For example, minerals such as gasoline, copper, and zinc production are estimated to decline in the next 20 years. Plus, oil mining continues to rise due to the upsurge in the number of engines that use petroleum, thereby magnifying its depletion. 5. **Pollution** • An increase in population and modern anthropogenic activities is a major contributor to the disposal of pollutants into the natural environment, and as such, the value of the natural environment is gradually exposed to degradation. • The soil, air, lakes, and seas are being contaminated with sewage, radioactive materials, and toxic chemicals, among other pollutants. • Pollution can directly kill plants and animals, destroy the environment and cause further dilemmas, thus leading to natural resource depletion. • Uncontrolled releases of carbon monoxide, nitrous oxide, sulfur oxide, and carbon dioxide, for example, have resulted in the degradation of the ozone layer and global warming — environmental changes with their resultant depletive impacts on different natural habitats 6. **Industrial and Technological Development** • The present-day world is incessantly becoming industrialized as more and more countries make major technological breakthroughs. But as technological advancements continue, there is also a considerable growth in industries that release toxins and chemical by-products which are eventually deposited in lakes, oceans, soils, and lands. • Some of the industrial by-products are organic compounds, metals, radioactive materials, and other destructive wastes. As a result, the by-products and toxic materials alter natural habits such as aquatic systems and wildlife. • Examples of the impacts include acidic lakes, dead zones, and the death of wildlife as well as aquatic life. Industrial and technological advancements have also driven the demand for virgin materials for research, development, and production.
Q-9	**What are the effects of depletion of natural resources?**
ANS	1. **Water shortages** • Poor farming practices, deforestation, and pollution are major causes of water resource depletion due to contamination, wastage, and the destruction of natural water catchment areas. • As of today, approximately two billion people lack access to clean water because of the effects of deforestation and contamination of water sources and groundwater. Water shortages further contribute to famine and food insecurity. • Due to the lack of clean

	water access, there are around two billion cases of diarrhea among children younger than five years old, three million cases of cholera, and 11 million cases of typhoid fever. Moreover, a lot of water-related diseases and deaths are continuously occurring. 2. **Oil depletion** • Oil is a nonrenewable resource that accounts for roughly 40 percent of the total global energy consumption. Oil is used for plenty of purposes, and together with technological advancements, it is being more frequently used than ever. • Research by EIA's International Energy Outlook had shown that due to the high rate of oil exploitation, the amount of oil remaining would last for only 25 years. Moreover, EIA's research stated that by 2030, oil consumption will be at 118 million barrels per day. • The energy consumption of humans is increasing rapidly while replacing the resources being used in energy production is still at a slow pace. Oil is an essential commodity in manufacturing, planting, mining, and transportation among many activities, and its depletion would be devastating. 3. Approximately 18 million acres of forest cover are destroyed annually. This means that half of the world's natural forest cover has already been cleared and millions of animal and plant habitats are destructed. • Furthermore, studies indicate an increase in deforestation in the past three decades has resulted in a 12% to 17% rise in greenhouse gases globally. Due to the lack of trees to absorb carbon dioxide, global warming is becoming more severe. • Other devastating effects of deforestation include soil erosion, an increase in greenhouse gases leading to global warming, loss of biodiversity, increased flooding, and drought. 4. **Depletion of minerals** • There has been an increase in the exploitation of minerals such as phosphorus, gasoline, copper, and zinc, among others, to sustain the seven billion people on earth. • Studies by the Global Phosphorus Research Institute, for example, show that the earth could run out of phosphorus—an essential element for plant growth—in the next 50 to 100 years. • Studies by the United States Geological Survey also indicate that there is an increase in non-renewable resource consumption of natural minerals and construction materials such as copper, sand, gravel, and stone 5. **Extinction of Species** • Due to the changes in the living conditions of animals as a result of resource overexploitation and habitat degradation, some species may go extinct. Habitat destruction is one of the primary reasons why species of plants and animals are being endangered, or worse, extinct. • Forested regions are known to be habitats for thousands of animals, but deforestation is progressively destroying forest habitats. Practices such as overfishing and pollution have similarly led to a drastic reduction in the number of marine species such as tuna fish.
Q-10	**What are the solutions to depletion of natural resources**
ANS	1. **Controlling Deforestation** • Programs aimed at checking against deforestation, such as REDD (Reducing Emissions from Deforestation and Forest Degradation), created by the World Bank, the New York Declaration on Forests, and the United Nations, are initiatives that could help reduce the depletion of natural resources. • The initiatives may also act as incentives for encouraging the general public to conserve forests as these are the habitat and protectors of some of the world's unique plant and animal species and water sources, respectively 2. **Reducing oil, mineral, and material consumption** • Oil-rich countries, together with the World Bank, state, and consumables' regulatory bodies, should join hands towards a common international objective of discussing how oil and mineral consumption, as well as exploitation, can be reduced. • Manufactures can, for instance, be trained on lean manufacturing (recycling, reuse, and reducing wastage) while consumers are sensitized on how to adopt reuse, reducing wastage, and recycling technique 3. **More exploration and use of renewable sources of energy** • Renewable sources of energy such as solar and wind power can be explored more and utilized to reduce the dependency

	on fossil fuel, which is a major cause of environmental pollution, climate change, global warming, and the destruction of natural habitats. • Through the exploration of different renewable sources of energy, a lot of technological innovations can be developed, which in turn could help reduce the use of natural non-renewable resources 4. **Protecting wetlands and coastal ecosystems** • Wetlands are regions saturated with groundwater that play a significant role in sustaining vegetation cover. • The coastal and wetland ecosystems are thus vital in sustaining the food chain as they replenish water sources and avail minerals and nutrients for primary producers (green and flowering plants), essential for maintaining plant and animal biodiversity. • Also, when coastal ecosystems are protected, they aid in controlling marine overfishing and protect coral reefs 5. **Sensitization and awareness creation** • People must be educated on how their daily practices put a strain on scarce natural resources, as well as their individual contributions to resource depletion. The main purpose of creating awareness would be to encourage people to preserve and restore the natural environment by getting involved in conservation efforts. • Awareness education may be in the form of a symposium, creating videos for people to watch, writing articles and blog posts for people to read, or many other ways to educate everyone across the globe
Q-11	**What are the Causes of Climate Change? Explain any two in details.**
ANS	• **Generating power** • Manufacturing goods • **Cutting down forests** • Using transportation • Producing food • Powering buildings • Consuming too much
Q-12	**What are the Effects of Climate Change? Explain any two in details.**
ANS	• **Hotter temperatures** • More severe storms • Increased drought • **A warming, rising ocean** • **Loss of species** • Not enough food • More health risks • Poverty and displacement
Q-13	**What Is Sustainability? Explain Environmental Sustainability and Economic Sustainability in short.**

ANS	 1. Sustainability can be broadly defined as "meeting the needs of the present generation without compromising the ability of future generations to meet their own needs." There are three interconnected spheres of sustainability that describe the relationships between the environmental, economic, and social aspects of our world. • These spheres are a related set of concepts that, when taken together, can form a solid ground from which major decisions and actions can be made. Natural resources are preserved, the environment is protected, the economy isn't harmed, and the quality of life for our people is improved or maintained. **Environmental Sustainability:** In a truly sustainable environment, an ecosystem would maintain populations, biodiversity, and overall functionality over an extended period of time. Ideally, decisions that are made should promote equilibrium within our natural systems and seek to encourage positive growth. Unnecessary disturbances to the environment should be avoided whenever possible. If there is a disturbance, it should be mitigated to the maximum practicable extent. **Economic Sustainability:** • Similar to environmental sustainability, economic sustainability involves creating economic value out of whatever project or decision you are undertaking • Economic sustainability means that decisions are made in the most equitable and fiscally sound way possible while considering the other aspects of sustainability • In most cases, projects and decisions must be made with the long-term benefits in mind (rather than just the short-term benefits) • Keep in mind that when only the economic aspects of something are considered, it may not necessarily promote true sustainability.
Q-14	**What are the various components of sustainable development?**
ANS	Sustainable development must include a design that holistically accounts for and minimizes all aspects of environmental, economic, and anthropogenic impacts. To be sustainable, new development and infrastructure should complement the landscape and the area. New development should respect the natural laws of economics, the environment, and harmonize with societal values of users and residents.

	Sustainable development requires the use of creative ideas and innovative design techniques. Regarding the environment, Low Impact Development Techniques should be employed to best manage available storm water. • Other Green components should be used as well to minimize the impact on air quality, electricity use, etc. • Efficiently developed and eco-friendly materials local to the area should be utilized for construction whenever possible. • The local labor pool should be tapped for development which will improve the local economy and give people a sense of ownership in the project
Q-15	**What are some environmental and social challenges of sustainability?**
ANS	• In the world that we live in today, there are plenty of challenges in these two areas. • In the environmental area we have several big challenges such as 1) Deforestation, 2) Carbon emissions, 3) Unsustainable reliance on fossil fuels 4) Oceanic Pollution, and 5) Habitat destruction just to name a few. • These issues are global issues and can only be solved by implementing a community-by-community approach to sustainability. • For social issues, there are plenty of issues as well. • Here are perhaps five big ones 1) Hunger and access to clean water, 2) Poverty, 3) government and corporate corruption, 4) Persecution based on race/religion/etc, and 5) Vaccinations/Disease. • No matter which of these (or others) that you look at, the issues affect millions of people.