

GLOBAL ENVIRONMENTAL ISSUES

1. LARGEST GLOBAL ENV ISSUES :
acid rain, global warming, ozone depletion, smog, water pollution, natural resource depletion and rainforest depletion.
2. Env issues are created due to human activities and cause harm to environment. Env issues are interconnected
3. Humans are putting natural carbon cycle out of balance.
4. **Mauna Loa Observatory's location marks an ideal spot for sampling earth's air. It is located in Hawaii on the side of Mauna Loa, the world largest active volcano. It is 3400km above sea lvl and remain a long distance away from significant pollution sources(anthropogenic)**
5. Sometime during the 21st century the conc of co2 will be twice as it was before Industrial Revolution. Co2

increase global temp increase this was proposed by **Arrhenius**

6. The temperature rise will be small in tropics but much greater at high altitudes
7. **Green house effect** is a natural process that keeps the earth warm. It is attributed by the molecules like **CO₂, H₂O AND CH₄** which can modify the planets energy budget by absorbing the **long wave thermal radiation**(Infrared radiation) emitted from the earths surface. Without greenhouse effect life on earth would be impossible
8. The net effect is the gradual heating of earths atmosphere and surface a process known as **global warming**
9. CO₂ absorbs infrared radiation, plays crucial role in weathering of rocks, raw material for photosynthesis, carbon is incorporated in organic matter in the biosphere and may eventually be stored in earth as fossil fuel.

10. Nitrogen and oxygen are transparent to infrared while water vapors and carbon dioxide and methane absorb infrared radiation
11. They collect this heat energy and hold it in the atmosphere delaying its passage back out of the atmosphere
12. Most of the sun's energy that falls on earth is the visible light spectrum and this is largely because earth is transparent to these radiations because ozone screens out mostly all the higher frequency waves such as UV.
13. Part of sunlight is reflected back into space depending upon albedo or the reflectivity of the surface (high albedo means reflects lot of light and low albedo means absorbs a lot of light ex high albedo material is snow and ice)
14. Temp measurement signify the oceans are warming and sea level is rising because of thermal expansion and glaciers are melting.

15. Sea lvl rose about 30cm during the last century mostly because of thermal expansion of the oceans. Se lvl is expected to rise by 1m during the upcoming century
16. Warmer sea surfaces will result in more and stronger tropical storms such as hurricanes and typhoons
17. Arctic Sea is thinning; Gangotri glacier is shrinking
18. Higher temp will produce more rainfall across globe but regional rainfall patterns will likely to be changed- some areas will get more some areas will get less; the timing of wet and dry periods may change- stronger storms and damaging winds
19. Some areas may go from being marginal to breadbasket region whereas some may go from major agriculture production to marginal.
20. High co2 higher plant growth because its enhances photosynthesis but weeds grow better than crop and crop growth

may be nullified by weed growth

Natural ecosystems will be hard pressed to keep up with the changing climate because the rate of change will be faster than typical long-term natural climate change.

21. Many species especially plants will not be able to migrate to cooler regions fast enough to keep up with climate change
22. Arctic species will have no place to go and may not be able to adapt to the new conditions
23. Higher heat and expansion of tropical areas may lead to increased incidence of malaria
24. Beginning of 20th century mean temp increased by 0.3 to 0.6 and by the mid of 21st century the mean temp will increase unto 1-5
25. 20th century was the warmest in the last millennium, 1990s were the warmest decades. 1998 and 2005 were the warmest years in 1000yrs
26. Prior to Industrial Revolution co₂ in the atmosphere remained constant at 280 ppm on a global scale for

several centuries.

27. Most anthropogenic emissions come from consumption of **fossil fuels** and **deforestation**

About half of what we produce is taken back into carbon sinks in biosphere and oceans – the rest is left in atmosphere.

28. GWP(global warming potential) of (GHGs) warm the earth by absorbing energy ad slowing the rate at which energy escapes to space

29. Two key ways in which GHGs differ from each other are : their ability to absorb energy(**radiative efficiency**) and how long they can stay in the atmosphere (**lifetime**)

30. CO₂ has longer lifetime but absorbs less heat whereas methane aborbs a lot of heat but have shorter time period it has higeshst global warming potential 21 times greater than co₂. (CO₂ has GWP of 1 regardless of time period use

because it is the gas being used as the reference) HFCs has highest GWP.

31. GW can be decrease by using fluorescent bulbs instead of incandescent bulb.
32. Other techniques have also been proposed such as **chemical removal of CO₂ from smokestacks and burial in deep underground reservoirs**

Though only certain areas can benefit from this, or disposal in the deep ocean where they will form a semi-stable compound under the cold temperatures and high pressures, though the CO₂ could too easily come bubbling back up.

33. Global climate system is the consequence of
34. (A). Atmosphere
(B). Oceans(Hydrosphere)
(C). Ice sheets(cyrosphere)
(D). Living organisms(Biosphere)
(E). Soils sediment and rocks(Geosphere)

33. Weather refers to short term atmospheric conditions whereas

climate is the weather of a specific region averaged over a long period of time

“Climate change” is a change in the statistical distribution of weather patterns when that change lasts for an extended period of time (i.e., decades to millions of years).

Climate change refers to long-term changes.

Climate change may refer to a change in average weather conditions, or in the time variation of weather around longer-term average conditions (i.e., more or fewer extreme weather events).

1. Factors that shape climate are called **climate forcings** or **forcing mechanisms**, Forcing mechanisms can be internal or external

- Internal forcing mechanisms are natural processes within the climate system itself (e.g., the thermo-haline circulation- *the movement of seawater in a pattern of flow dependent on variations in temperature which give rise to changes in salt content and hence in density*).
- External forcing mechanisms can be either natural (e.g., changes in solar output) or anthropogenic (e.g., increased emissions of greenhouse gases).

fast (e.g., a sudden cooling due to airborne volcanic ash reflecting sunlight),

slow (e.g. thermal expansion of warming ocean water), or

a combination (e.g., sudden loss of albedo in the arctic ocean as sea ice melts, followed by more gradual thermal expansion of the water).

These include processes such as

- variations in solar radiation,
- variations in the Earth's orbit,
- variations in the albedo.
- mountain-building and
- continental drift and
- changes in greenhouse gas concentrations.

(albedo (*the proportion of the incident light or radiation that is reflected by a surface, typically that of a planet or moon*) or reflectivity of the continents and oceans.)

3. Trends that persist for a decade or more probably signal a shift to a new regime. Instrumental tracking has shown a recent temperature increase of less than 1 degree

4. Coupled with this seemingly minute temp change are the shrinking glaciers , less sea ice , latitudinal limits of some plants and animals have expanded towards the poles

5. The majority of evidence of climate change comes from geologic record
6. Climates of ancient times are referred to as paleoclimate
7. Scientists reconstructing the paleo climates rely on the records of the natural events that closely mimic the climate- climate proxy records
8. Though they lack precision of instrumental data proxy records from different localities can add unto a detailed picture of climatic trends.
9. Cores obtained from the Greenland and antarctic ice sheets provide continuous records of weather conditions for hundreds of thousands of years
10. Glacier ice is laid down in annual layers. Measurement of oxygen isotopes in glacier ice enables scientists to estimate the air temperature when that snow accumulated and the trapped air also provides a sample of ambient air at the time.

11. US + UAE + SAUDI ARABIA + AUSTRALIA are responsible for Artic ice melts
12. Pieter Bruegels Winter landscape with a Bird Trap shows a Time when European rivers were likely to freeze over. And paintings from that period also shows more dark skies and clouds
13. Many organism lay down annual growth rings and are potentially useful for providing paleoclimate info- trees and corals
14. Some lake sediments display a distinctive alteration of parallel layers, a pair of these is deposited in a single year is termed as varve and preserves a record of climatic variations
15. Annual climate records can be found in Tree rings , lake sediments and ice layers each year includes early wood(light) and latewood(dark) growth. Wide rings occur during wet, warm years and narrow rings during

cold dry years

16. Short term climate change is recorded in tree rings like about 100 yrs but it is necessary to measure partial record from multiple trees to get a climate record.
17. Three distinct climate periods for the northern hemisphere- Medieval warm period ; The little Ice age (very cold but not really an ice age) and by the end of the 19th century the climate moderated leading to our present relatively warm temp
18. Climate records indicate that northern hemisphere experienced glaciation(ice age) during the last 2 million years
19. North America was dominated by a 3km thick continental glacier centered over Canada
20. Weather changes all the time and the average pattern of weather is termed as climate which remains same for centuries if it is left to itself

The effects of climate change depend upon how much change there is, how fast it occurs, and how easily the world can adapt to the new conditions.

21. **IPCC- intergovernmental panel on climate change.** It is the international body for assessing the science related to climate change it was set up by WMO(world metereomlogical org) and UNEP(United Nations environmental program.

Nations Environment Programme (UNEP) to provide policymakers with regular assessments of the scientific basis of climate change, its impacts and future risks, and options for adaptation and mitigation.

22. IPCC provide a scientific basis for the governments at all levels to develop climate related properties

The assessments are policy-relevant but not policy-prescriptive:

- they may present projections of future climate change based on different scenarios and
- the risks that climate change poses and discuss the implications of response options,
- but they do not tell policymakers what actions to take.

First IPCC report (FAR)	Underlined the importance of climate change as a challenge with global consequences and requiring international cooperation
SAR –"Impacts, Adaption and vulnerability"	An assessment of the ten avaialable scientific and socio economic information on climate change

TAR-“mitigation of climate change”

The synths report was released in phases in time to pave the way for negotiations on reducing carbon emissions at the UN climate change conference in Paris

The **Paris Agreement** is an agreement within the United Nations Framework Convention on Climate Change (UNFCCC) dealing with greenhouse gases emissions mitigation, adaptation and finance **starting in the year 2020.**

The agreement will only enter into force **provided that 55 countries that produce at least 55% of the world's greenhouse gas emissions ratify, accept, approve or accede to the agreement;**

although the minimum number of ratifications has been reached, the ratifying states do not produce the requisite percentage of greenhouse gases for the agreement to enter into force.

Paris repot was open for signature on earth day

Paris Agreement on Climate Change

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- Three aims of Paris agreement- Finance, technology and capacity building support- (Art. 9, I0, II).
- the Paris agreement' five key points-
 - First universal climate agreement
 - Limit temperature well below 2° C
 - Helping poor nations.
 - Publishing greenhouse gas reduction targets.
 - Carbon neutral by 2050.

OZONE DEPLETION

1. Stratosphere- second major layer of earth's atmosphere. It is stratified in temperature with warmer layers higher up and cooler layers further down. This interacts with the troposphere near the earth's surface which is cooler higher up and warmer farther down.
2. Ozone layer is situated at the top of stratosphere 35 to 50 km above earth's surface and its thickness varies seasonally and geographically.
3. It's earth's own "Block system" and yet

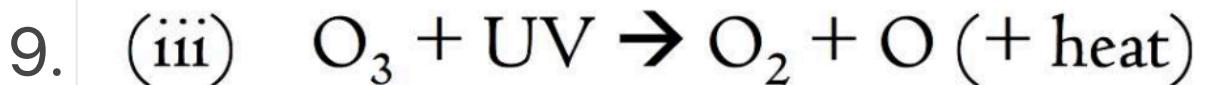
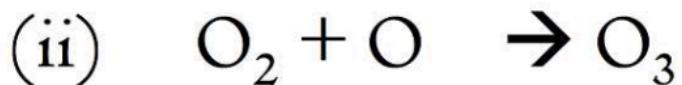
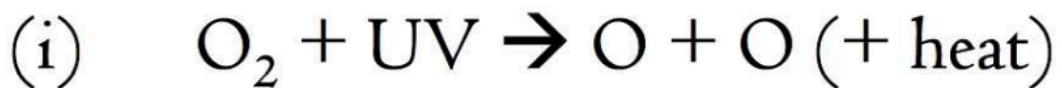
stops 97-99% of the incoming UV

UVC	Shorts wavelength	Most dangerous filtered out by the atmosphere
UVA & UC		Causes skin cancer and wrinkles after repeated long term exposure

4. UV rays can penetrate through your clothes (**UV Blocking fabrics- UPF clothes**)
5. Up to 80% uv rays can pass thru clouds and affect us
6. **SPF 15 lotion blocks out 92 % of UV that reaches earths surface. Protects from UVB rays**
7. **Glass filters out UVB radiation but UVA gets through because it penetrates deeper this why many**

adults have more freckles on their right side more than their left during driving

8. UV breaks O₂ into O atoms. O atoms combine with O₂ to form ozone and UVB strikes and ozone and breaks it back down to an O₂ molecule and an O atom



10. No long term change in the concentration of ozone occurs

11. UV radiation is converted from light to heat by the destruction of oxygen molecules and ozone molecules

12. Temp rises with increasing altitude in stratosphere for the same reason

13. Ozone Depleting Substances: CFCs, HCFCs HBFCs Methyl and other halogenated ozone depleting substances.

Methyl bromide	Used as a fumigant to kill pest by suffocating
CCL4 & Halons	Fire extinguishers
Methyl Chlorofrn	Cleaning metal parts and circuits boards and industrial solvents

14. **Equivalent Effective Stratospheric Chlorine(EESC):** the total amount of effective halogens(cl and br) in the stratosphere can be calculated .

- a steady decline of about 4% in the total amount of ozone in Earth's stratosphere (the ozone layer), , and
- a much larger springtime decrease in stratospheric ozone around Earth's polar regions.
- The latter phenomenon is referred to as the ozone hole.

15. In addition to these well known stratospheric phenomena there are also **springtime polar tropospheric ozone depletion events**

16. Both the processes are catalytic destruction of ozone by atomic halogens and the main source of

these halogens in the stratosphere is the photodissociation of man made halocarbon refrigerants

17. They are destroyed by free radical substitution the most of which are hydroxyl radical, nitric oxide, chlorine and bromine, tho OH and NO in stratosphere is of natural origin but human activity has significantly increased the levels of chlorine and bromine in the atmosphere
18. CFCS: they are volatile organic compounds.(non flammable, non toxic) used as aerosols propellants and refrigerants and they are inert and they remain in the atmosphere for about 200 yrs but they can be broken down by photolysis (UV) radiation which frees chlorine from CFCs
19. They find a way to the stratosphere without being destroyed in the troposphere due to their low reactivity

$\text{Cl}\cdot + \text{O}_3 \rightarrow \text{ClO} + \text{O}_2$: The chlorine atom changes an ozone molecule to ordinary oxygen

$\text{ClO} + \text{O}_3 \rightarrow \text{Cl}\cdot + 2\text{O}_2$: The ClO from the previous reaction destroys a second ozone molecule and recreates the original chlorine atom, which can repeat the first reaction and continue to destroy ozone.

20. Montreal protocol in us banned aerosol sprays

21. Antarctic ozone hole

22. Why is ozone depletion

concentrated over Antarctica?- nice weather patterns over Antarctica-
Polar vortex. A polar vortex is an upper level low pressure area lying near earth's pole. A large area of low pressure and cold air surrounding both of earth's poles. Two polar vortices: north and south beneath that lies a large mass of cold dense arctic air. Leads to the formation of polar stratospheric clouds (water +nitric acids / sulphuric acids)

23. The nitric acid in the air reacts with CFCs which catalyses the photochemical destruction of ozone

24. They are mainly formed during the event of a polar vortex in winter more intense at South Pole

The Cl-catalyzed ozone depletion is dramatically enhanced in the presence of polar stratospheric clouds (PSCs) .

25. Polar stratospheric clouds accelerate ozone depletion

26. Ice particles in these clouds provide surface on which the chemical reactions can occur including the release of calorie bearing compounds

27. In spring temperature rises processes that produce ozone outpace destruction and ozone begins to increase

28. Ozone formation and destruction are temperature dependent phenomenon

ACID RAINS

1. It contains elevated levels of hydrogen ions
2. It is a popular term referring to the deposition of a mixture from wet and

dry deposition

wet (rain, snow, sleet, fog, cloud-water, and dew)

and

dry (acidifying particles and gases) acidic components".

3. Distilled water once CO_2 removed has a pH of 7
4. Clean and unpolluted rains have acidic pH but not lower than 5.6 because of formation of carbonic acid due to CO_2 in the atmosphere
5. It can also contain nitric acid produced by electric discharge in the atmosphere such as lightning
6. Formation of H_2SO_4 and HNO_3 as secondary pollutants and also presence of hydrogen sulphide and chlorine results in acid rain pH less than 4.4
7. H^+ and SO_4^{2-} ions leach nutrients from the soil.
8. Acid rain also inhibits the activity of symbiotic nitrogen fixing bacteria

present in the nodules of leguminous family

9. Due to acid rain limestone is converted to gypsum
10. It is also responsible for wiping out many bacteria and blue green algae disrupting the ecological balance.

Prevention of acid rain via limitation of pollution emissions, using of catalytic converters, limitation of fossil fuel and bio-fuel burning

11. Catalytic converters convert harmful gases into less harmful substances before releasing them into the atmosphere
12. Fitting scrubbers into factories chimneys they are chemical filters that remove sulphur from smoke, fit special converters in cars.
13. Urban heat island effect causes cities to be warmer during to absorptive properties of asphalt and pavement and reduced airflow during to blocked winds large buildings block wind flow causing updrafts and down drafts

14. Urban heat extremes are the result of two distinct phenomenon the Urban heat island effect and green house effect
15. **Urban heat islands are defined as urban and suburban areas with elevated air temperatures relative to the surrounding rural areas or wild lands**
16. UHI are produced by four factors:
 1. Use of dark , dense paving and building materials
 2. 3D buildings which absorb solar radiation and restrict air circulation
 3. Reduced abundance of vegetation which decreases shade and restricts evapotranspiration
 4. And the addition of heat from anthropogenic sources mentioned above
 5. **Urban heat extremes are caused by a combination of UHI and global greenhouse effect**
 6. Extreme heat kills more people than any weather related factor

Green infrastructure offers benefits in the form of improved storm water management, air quality, carbon sequestration, and microclimate regulation.

17. Cool pavements : light colored non permeable; cool roofs which are white blue or green , increase in planting of vegetation and reduce waste heat

18.

(UNCCD), ‘desertification’ is defined as

"land degradation in arid, semi-arid, and dry sub-humid areas, resulting from various factors, including climate variations and human activity.“

19. Desertification does not refer to the expansion of existing deserts