

Date:

Environmental Science

~~(Q#7)~~

(part 2)

Earth Summit - 1992

↳ Introduction

Rio Earth Summit of 1992 and officially known as **United Nations Convention on Environment and Development (UNCED)** was a landmark event in the history of environmental thought. It was a global event in which approximately **172 countries** participated which included heads of states or governments, diplomats, civil society members, and several NGOs. Earth Summit gave number of products and raised awareness on a global scale. It propagated the idea that nations must strive towards actual strategies and action plans to deal with the numerous environmental problems.

↳ Historical Buildup upto 1992

The world was reaching the end of the 20th century and had undergone numerous problems related to the environment that were becoming more severe with

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the passing time.

The world faced various environmental disasters either due to lack of proper safety measures or harmful anthropogenic activities. Key events include.

Japan's Minimata Disaster

(Neurological disorders, paralysis, death of residents)

1952: The Great

Smog of London

(approximately, 12000 premature deaths)

Key
events before
1992

Bhopal Gas

Tragedy of

1984; Gas Leak

Killing 3000 workers

Instantly, and thousands others due to after effects

Chernobyl

nuclear

disaster;

1986; Radiation

hazard and

environmental damage.

Beside these major events, there were also other several key incidents like Bixy Canyon Oil spill etc which caused significant environmental damage.

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Along with these, there was also great awakening regarding these disasters and people were questioning the government and were demanding actions to combat these problems. Key authors that significantly impacted the environmental movement in 20th Century were:

1. Rachel Carson's book:

'The Silent Spring', 1962

that raise awareness regarding the harmful impacts of pesticides DDT.

2. Paul Erlich

'The Population Bomb', 1968

that raise awareness regarding the unsustainable population growth. For example population was around 4 billion in 1974 compared to just 2 billion in 1930s. It was growing rapidly.

↳ Preceding Milestones

Before Rio Summit of 1992, the world was already striving to tackle the environmental problems and Earth Summit was also added. Naveed to that

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chain - the other preceding milestones were.

1. IUCN (International Union for Conservation of Nature - 1948).
2. Stockholm Conference - 1972
3. Creation of UNEP - 1972
4. 'Our Common Future' Report 1987
5. 'Rio Summit - 1992'

↳ Products of Earth Summit - 1992.

1. Rio Declaration

2. Agenda-21

Products

3. UNFCCC

5. UN CBD

4. Statement on Forest Principles

Date:

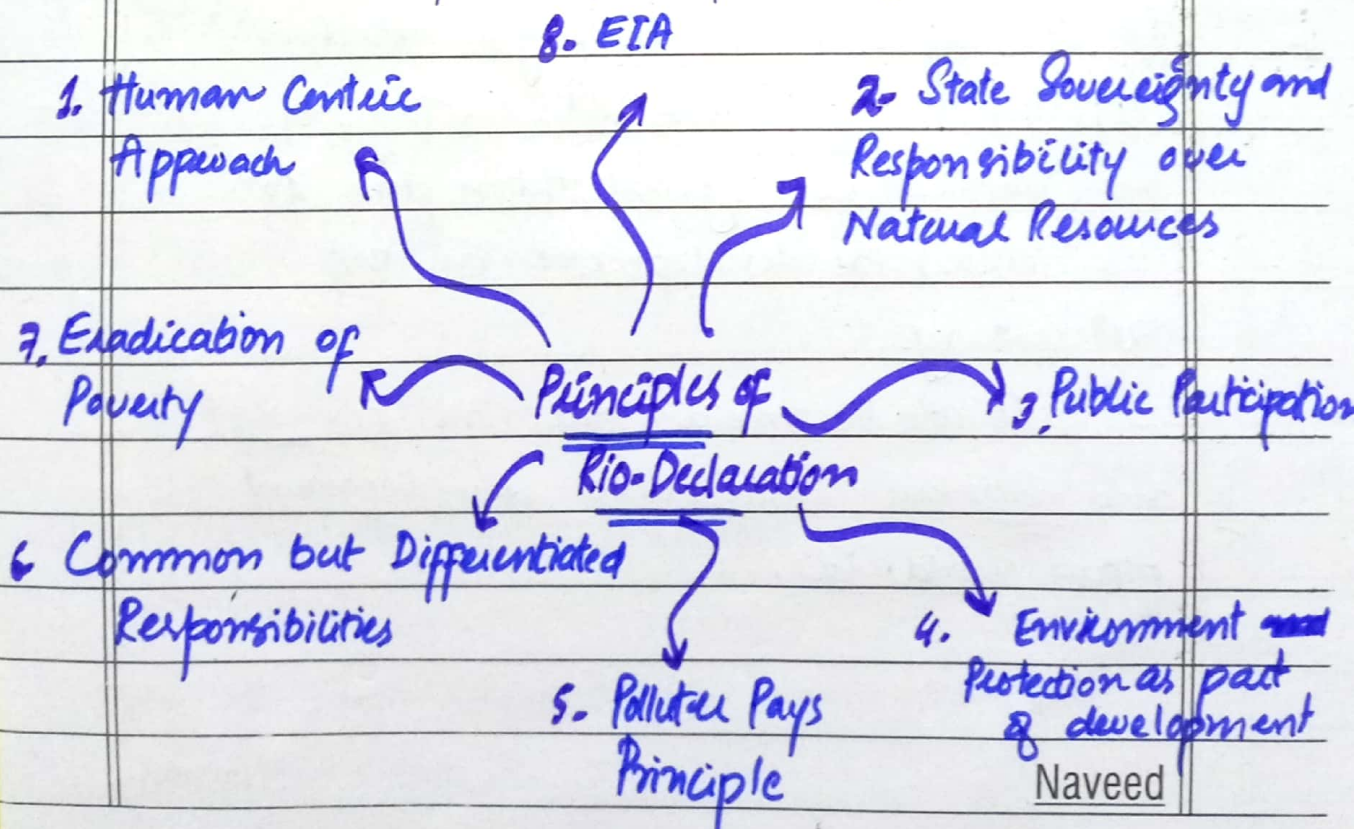
Rio-Summit gave these above products, some of which were legally binding and others were not and dependent on voluntary commitments.

1. Rio-Declaration on Environment and Development:

It was a set of 27 guiding principles adopted at the Summit. It was **non-binding** in nature and therefore, it depended on political and voluntary commitments. The key principles provided global framework for linking

Environmental protection → Human and Economic Development

→ Some of the principles are given below:



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Above are some of the principles of Rio Declaration, others include protection of environment in occupied territories, war zones, inclusion of women, youth, and indigenous communities in environmental protection etc.

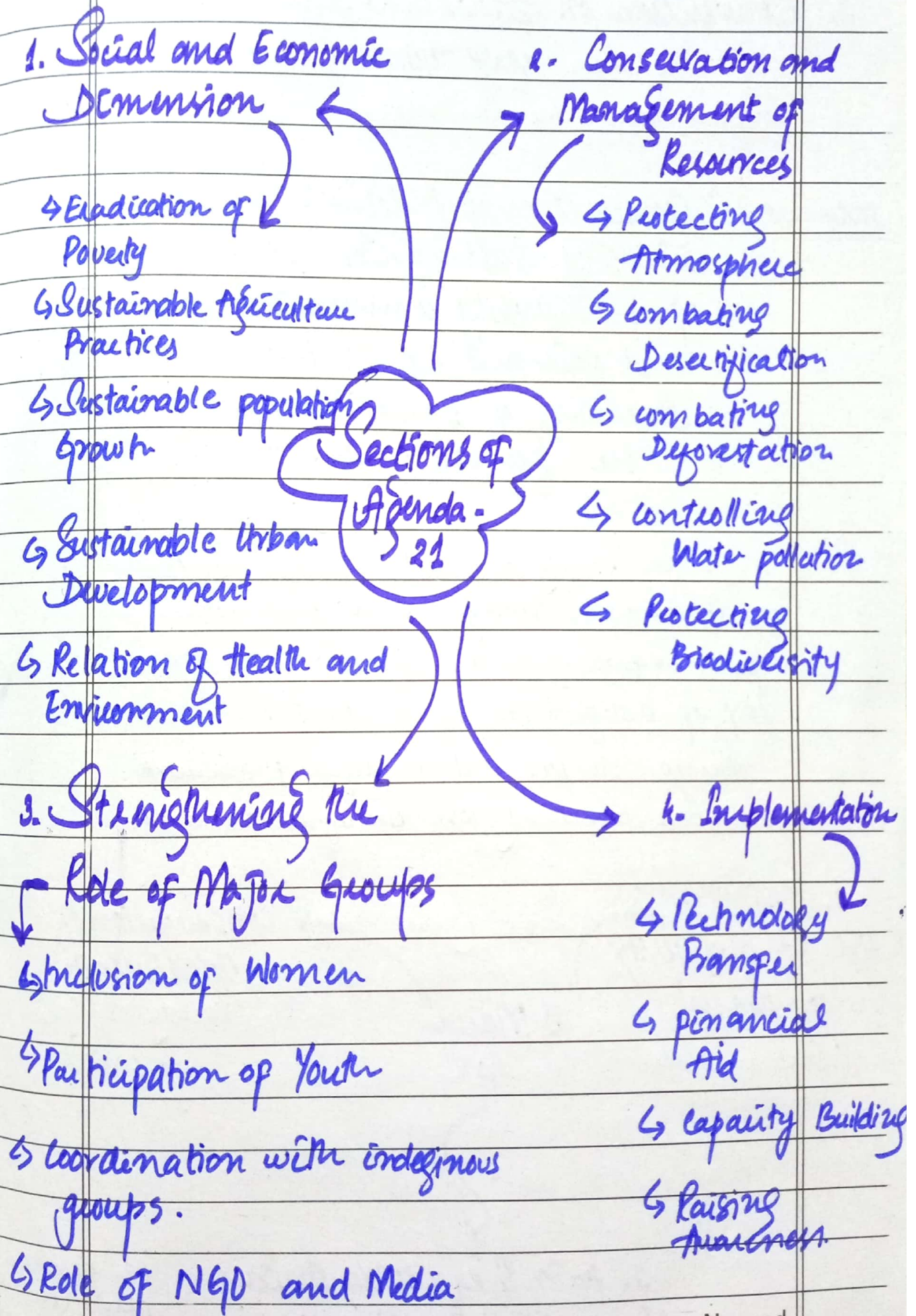
2. Agenda-21

Agenda 21- was also non-binding in nature and the

'21' $\longrightarrow$ 21st century
referred to

Agenda 21 included 40 chapters that were divided into 4 sections. The Agenda 21 was also adopted at the Rio Summit and it aimed to prepare the world for the upcoming challenges and opportunities of the 21st century. It was comprehensive global action plan for the sustainable development in the 21st century.

It also became a blueprint for local and national sustainable development plans worldwide.



Date:

3. Convention on Biological Diversity (UNCBD)

It was legally binding and was also adopted during the Rio Summit.

Statement: "Conservation of Biological Diversity, sustainable use of biodiversity components, and fair and equitable sharing of benefits from the genetic resources"

It was mainly adopted to overcome the biodiversity loss. For Example; Amazon Rainforest was rapidly degrading and it is home to around 10% of biological diversity on Earth.

Therefore, it provided a legal framework to combat biodiversity loss throughout the world.

2. Sustainable use of biodiversity components
(Such as plants, animals).

3. Main Goals

Conservation of Biodiversity
(Variety of life on Earth).

3. Fair & equitable sharing of benefits of genetic resources

(e.g. such as plants in Naveed medicines)

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4. Statement of Forest Principles:

It was also adopted during the Rio Summit and is **Non-legally binding**. Its purpose was to provide:

1. 'Guidelines for Sustainable forest management and conservation'

2. 'Emphasize the sovereign rights of nations to use their forest resources and their responsibility to manage them properly'

5. UNFCCC (United Nations framework convention on climate change)

It was adopted at Rio Summit and is **legally-binding treaty** that laid the foundation for future climate change negotiations. Its main aim was:

'To stabilize the GHGs; green house gases, concentration in atmosphere at levels Naveed

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that prevent dangerous interference with the climate change.

* It also recognized that the developed countries were the historical contributors of elevated levels of GHGs and they must take lead in Reducing them.

Future Protocols

1. Kyoto Protocol (1997)

legally binding emission reduction targets.

2. Paris Agreement (2015)

universal climate action commitments.

It also advocated for technology transfer, financial aid, and capacity building of developing nations.

↳ Pakistan's Commitments to the Rio-Summit Products:

Pakistan attended the Rio Summit in 1992, and legally ratified almost

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all of the commitments and has worked to bring the Pakistan closer to the international compliance of these agendas and commitments.

National
Conservation
Strategy - 1992

Pakistan
Environmental
Protection Act -
1997

Measures by
Pakistan

EIA and IEE; 2000
Regulations

Pakistan
Environment
Protection Agency

↳ Conclusion:

Earth Summit was a landmark event, that produced legally binding agreements and non-legally binding declarations and agendas to make the world a better place for humanity. Most of the agendas and commitments are still shaping the environmental policies and frameworks around the world.

Date:

(part b)

↳ Introduction:

'Our common future' Report or Brundtland Report was introduced in 1987 and revolutionized the way people, government, organisations thought about the environmental protection, economic and social development. It is a most famous event in the history of environmental thought.

↳ Historical context:

'Our common future' report came forward when the world was facing major problems:

1. Deforestation
2. Land Degradation eg, 1930's Dust Bowl.
3. Population Pressure
4. Air pollution eg, 1952 Smog of London
5. Water pollution eg, Japan's Minimata Disaster.

and the world was facing major existence threats and the major question before policy makers, governments, and others was:?

"How to continue development without degrading the environment further?"

Date:

But when 'Brundtland Report' came forward to address this question properly.

↳ Leadership and Publication

The Report was prepared under the leadership of Norwegian PM

'Gro Harlem Brundtland'

as she was famous for combining economic policies and environmental protection and conservation.

The findings of the report were published as

'Our Common Future'

The title suggested the key idea behind the Report:

'Earth is a common heritage of humanity and that humans share the common future and actions taken by one country or community will have significant for everyone on the planet'

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↳ Role of 'Our Common Future' Report in Shaping the future:

Our common future report played significant role in shaping the future by not only offering the solutions but also changing the very mindset that environmental protection and economic development cannot go hand in hand.

1. Introduction and Popularization of the term

'Sustainable Development'

The most remarkable and the most significant achievement of report was the introduction of concept of 'Sustainable Development', that is still widely used and discussed.

"Development that meets the needs of the present without undermining the ability of the future generations to meet theirs"

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2. Bridging environmentalism with economic and social agendas:

It introduced the concept of integration and made it evident that environmental problems are deeply linked to poverty, inequality, and underdevelopment. It emphasized that

Sustainable economic growth, social justice and environmental health must be pushed together. As policies in one area (Agriculture, industry, trade) directly affects the outcomes in other areas (eg biodiversity loss, air quality, and public health impacts).

3. Mechanism to reduce the North-South Divide

The Report shaped the future by recognizing that the developed North is

responsible for the emissions of greenhouse gases and driving environmental destruction and the Global South needs technology transfer, financial aid, and capacity building to meet

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the environmental Regulations.

In this way, it created a mechanism to reduce the gap between global North and Global South by making sure that no one exploits the others and that Developed nations should take lead in action.

4. Integration of environment and development in Decision making

The 'Our common future' report shaped the future by presenting the idea that environmental protection and development concerns should be addressed during the decision making and not something to be dealt with as an aftermath.

It saves time, cost, and above all environment.

5. foundation for future Summits and key milestones:

'Our common future' report set the stage for future summits that are still shaping the environmental governance and policy frameworks and will continue to do so in the future.

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1. Rio-Summit-1992

↓
Agenda 21

↓
UNFCCC + UNCBD

↓
Rio Declaration.

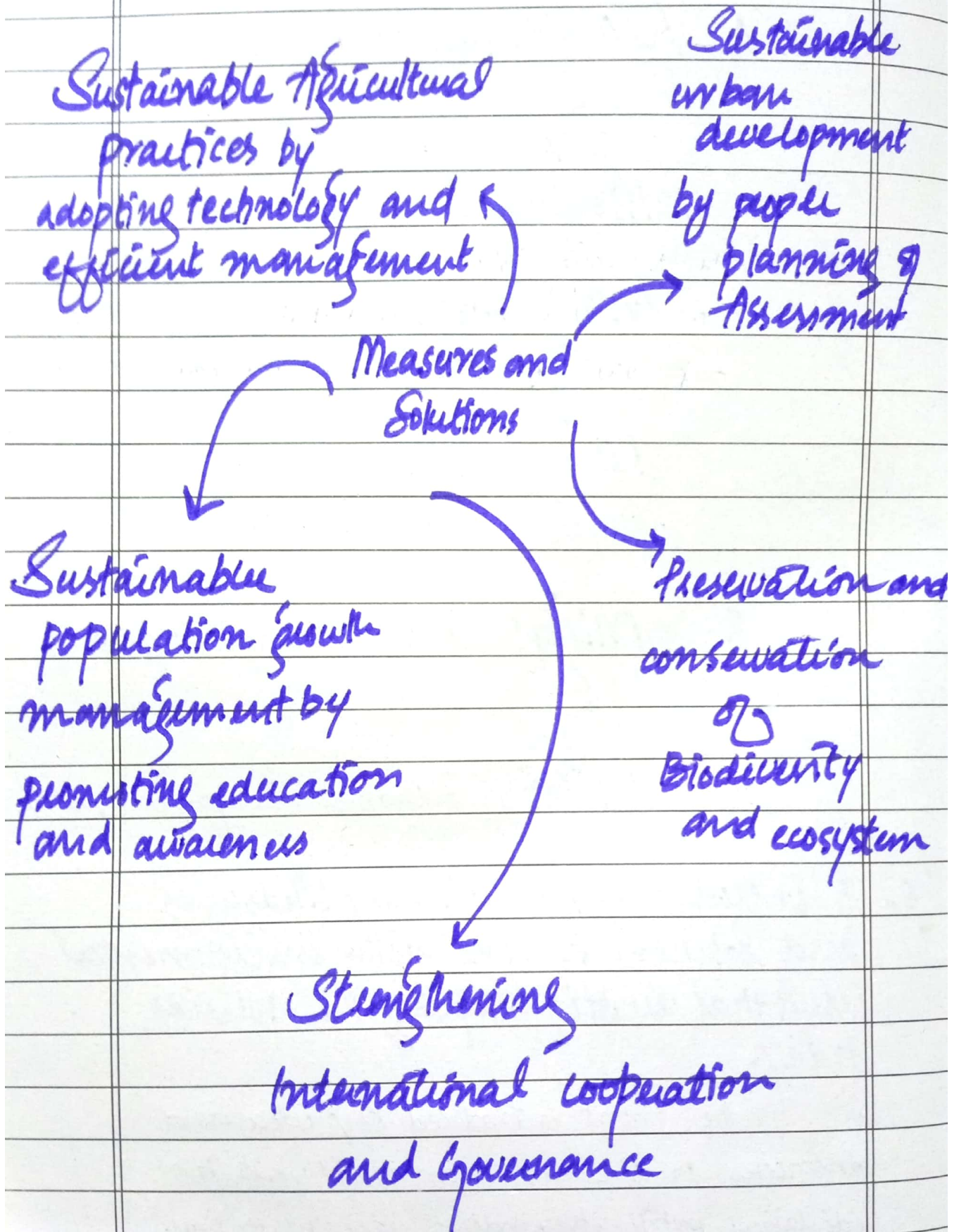
2. MDGs (Millennium Development Goals)

3. SDGs (Sustainable Development Goals)

6. It introduced Revolutionary Measures and Solutions to deal with environmental issues that are still shaping the policies today.

The Report introduced key idea and measures to the most common threats it identified while its findings were underway. To name a few are:

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→ Conclusion:

Our common future report was revolutionary and it identified common threats and provided measures and solutions to deal with them. It shaped the future and is still contributing meaningfully in the environmental governance.

At the same time, it addressed the most important question of integration of economy, society, and environment and also fulfilled the UN mandate.

"We do not inherit the Earth
from our ancestors; we
borrow it from our
children"

— Gro Harlem Brundtland.

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~~Q#4~~

(part a)

↳ Introduction:

There are various technological options available today to deal with the air pollution that is a leading cause of premature deaths worldwide.

Definition of Air pollution:

'The presence of harmful gases such as SO_x , NO_x , and dust particles etc that poses significant threat to human health and causes environmental degradation is known as air pollution

↳ Pakistan's Ranking on Air Quality Index:

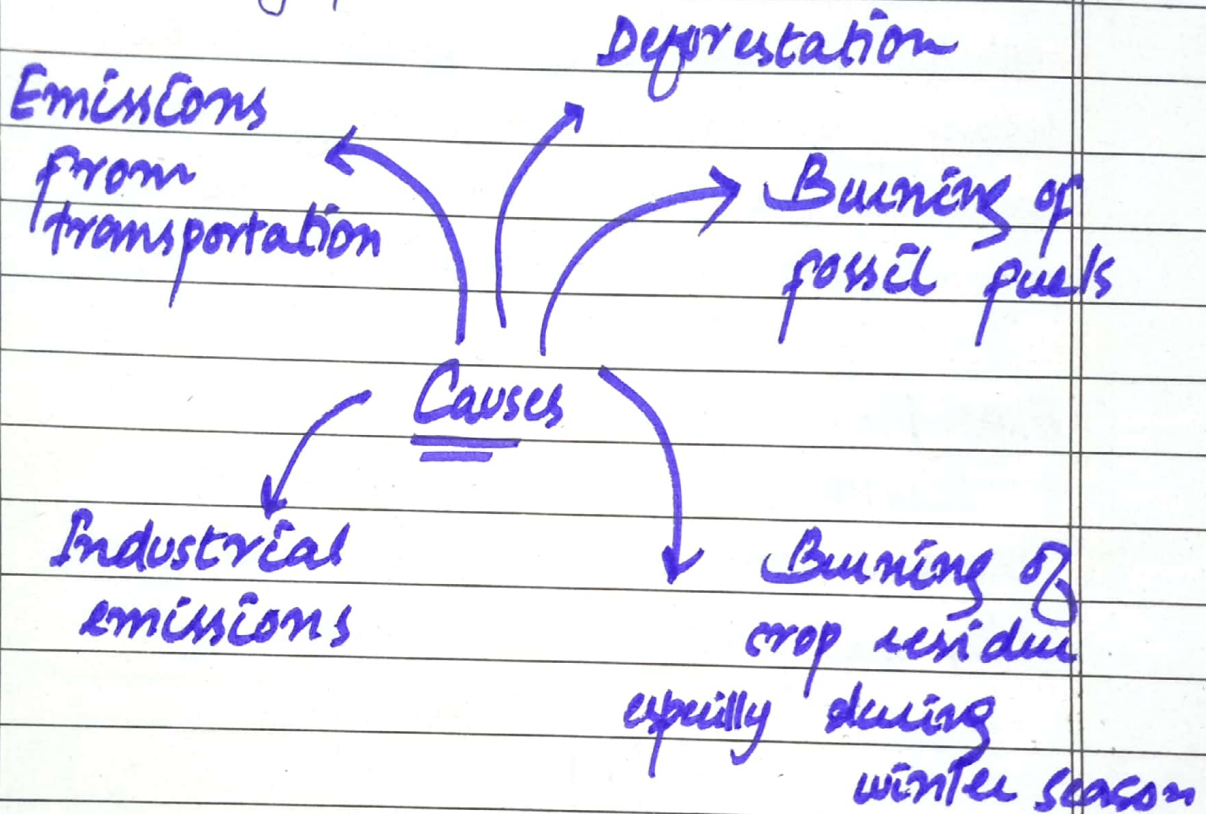
Pakistan ranked 3rd on the Air Quality Index, according to the report published in 2025, titled

Date:

The most polluted countries in 2024.

↳ Causes of Air pollution:

There are many causes of air pollution and the significant ones are:



↳ Technological options available to counter air pollution:

There are various technological options that are available worldwide to deal with the air pollution.

1. Scrubbers
2. Cyclone Separators
3. Catalytic Converters

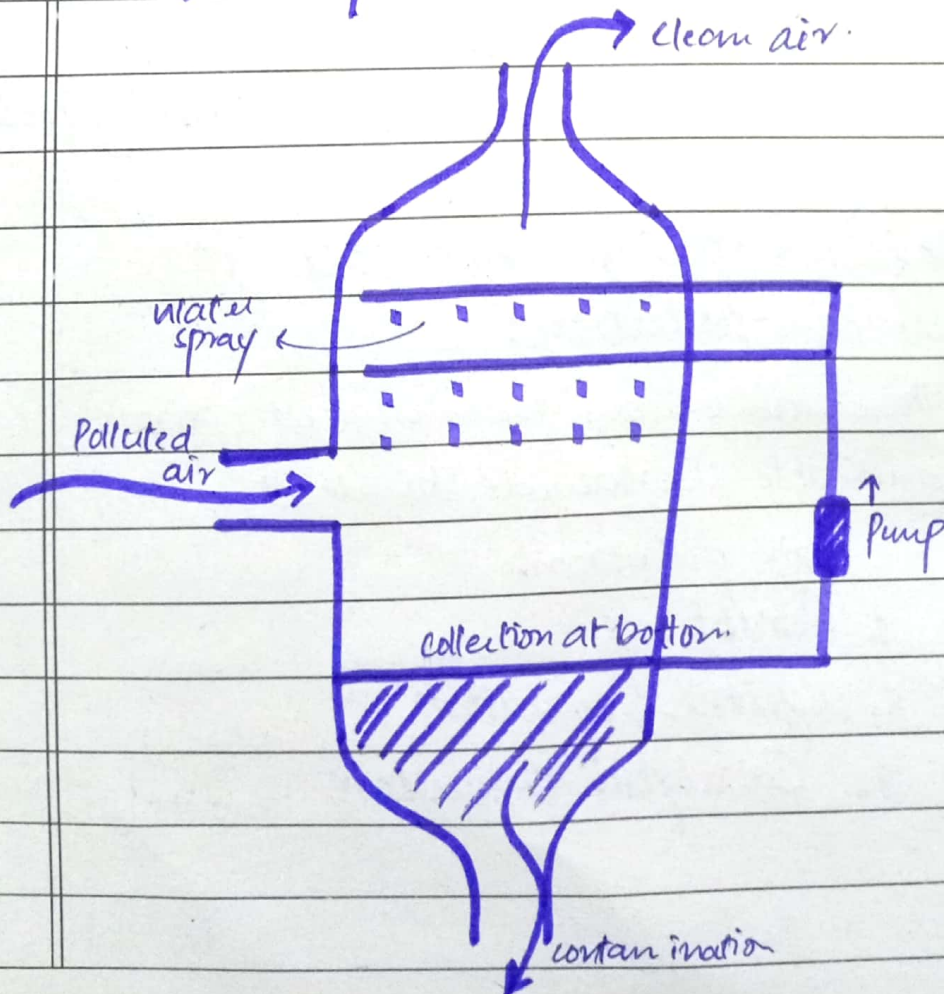
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1. SCRUBBERS

Scrubbers are used to control air pollution. The scrubbers spray water (mixed with chemicals) on the polluted gas. The polluted gas reacts with the chemicals and is collected at the bottom of the container. The clean gas then moves out from the opening at the upper corner of the chamber.

Example:

Limestone slurry scrubbers in thermal power plant capture SO_2 and NO_x and prevent acid rain.



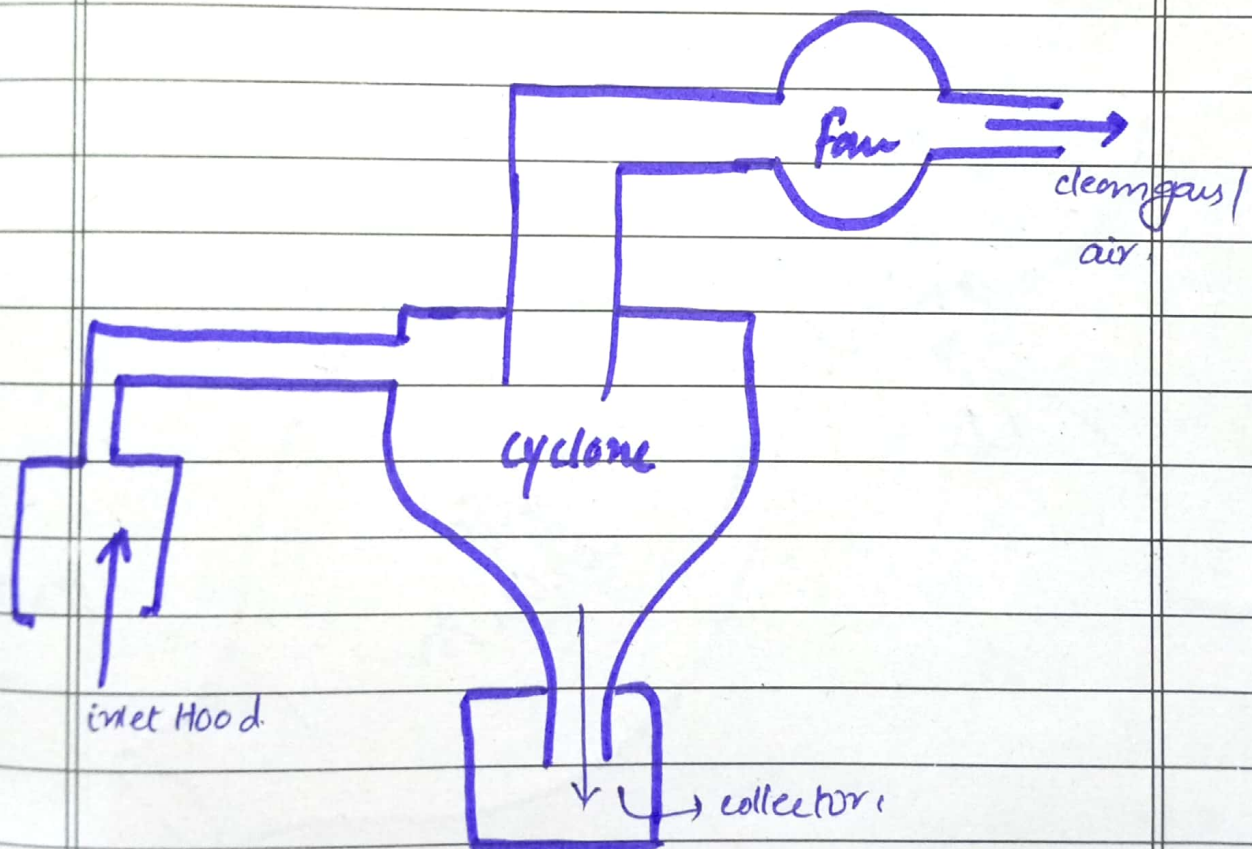
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2. Cyclone Separators:

Cyclone separators spin the polluted air at very high speed. Due to high speed the heavier dust particles are pushed/pressed against the walls of the container because of

'centrifugal force'

and then fall down and then the clean air is moved out of the chamber.



Cyclone separator are ~~cheap~~ cheap and simple and are useful in industries where dust is a major issues.

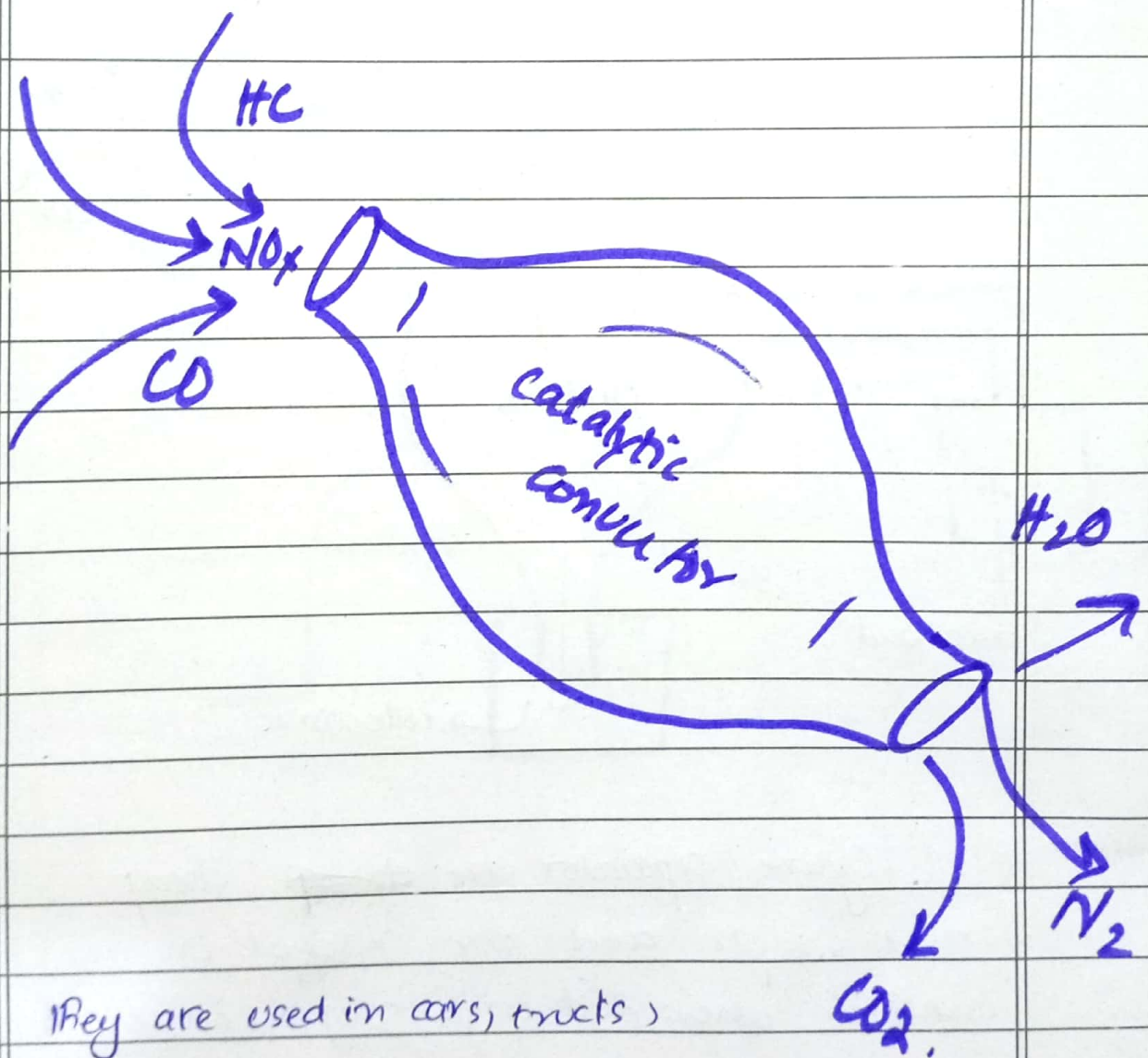
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3. Catalytic Converter

Catalytic converters are fixed at or fitted in exhaust engines and they use metals like

(platinum and palladium)

as catalyst and convert harmful emissions like CO , NO_x and Hydrocarbons into less harmful ones like CO_2 , N_2 and H_2O



They are used in cars, trucks and buses.

Date:

↳ Conclusions:

There are some of the technological options available for treating air pollution that is causing significant environmental damage as well as posing serious health implications for humans.

(Q4 part b)

↳ Climate Change:

"climate change refers to the longterm shift in temperature and weather patterns mainly due to the natural processes/ causes and anthropogenic activities."

↳ Pakistan's Ranking on Climate Risk Index

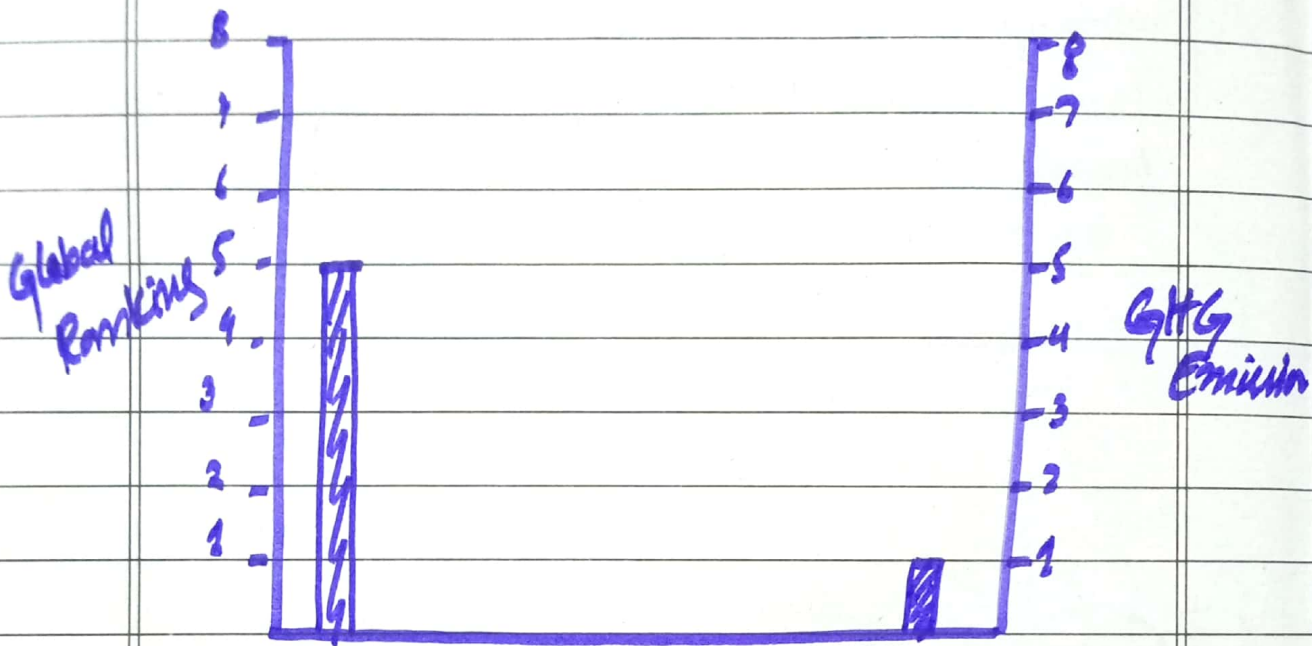
Pakistan is ranked among the top 10 ~~most~~ nations most affected by the climate change.

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1. According to Climate Risk Index 2024, Pakistan ranked 5th among top 10 nations.



2. According to Climate Risk Index 2025, Pakistan ranked top among all nations mainly because of economic losses of 2022 floods

30 billion US dollars

33 million people displaced.

— World Bank

Naveed

- How Climate Change is affecting Pakistan
1. By...
 2. By...
 3. By...

Date:

'Pakistan is ground zero
for climate devastation and
litmus test for climate
justice'

- Antonio Guterres, Secretary
General of UN.

↳ How Pakistan can adapt to climate
change:

1. By Strengthening Disaster Management

By improve flood forecasting and evacuation
systems.

By building storage roads, bridges and
flood protection structures.

2. By Protecting Forests and Ecosystems

By expanding tree plantation. (eg Billion tree tsunami).
and also by protecting wetlands, rivers, and mountains.

3. By improving Urban Planning

By making cities cooler with green

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zones, proper drainage, and solid waste management.

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4. By Shifting to Clean Energy

By shifting towards solar, wind and hydropower and reducing dependence on imported fossil fuels.

5. By adopting climate Smart Agriculture

Promoting drought resistant seeds, early warning systems, and better cropping patterns. Use of technology and also by educating farmers.

6. By Building climate resilient infrastructure

By building strong embankments, flood resilient infrastructure to withstand the disasters.

↳ Challenges faced by Pakistan

1. Low financial resources and adaptation projects need huge investments.

2. Weak Governance as there is poor coordination between federal and provincial institutions

3. Lack of Awareness as the farmers and communities often don't know climate smart practices.

4. Outdated Agriculture

flood irrigation wastes water around 90% (PCRWR) and poor tech use.

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5. Rapid population growth increases the pressure on food, land and water.

6. Environmental Degradation.

deforestation, pollution, (erh) encroachment on coas worsen the climate impacts.

4 Opportunities for Pakistan.

1. Huge potential for Solar and wind energy that reduces bill and dependence on fossil fuels and also creates jobs.

2. Green economy jobs. in forestry, renewable energy, eco-tourism, climate-resilient farming.

3. International Climate Finance: Pakistan can receive funds from Green Climate Fund, UN agencies.

4. Agriculture modernization

erh. Drip irrigation, precision farming, new seeds can increase yields.

5. Youth population

large young ^{work} force can be trained in green skills

6. Regional population

Pakistan can and should collaborate with China, Central Asia, and SAARC on water and Resource management.

4 Conclusion

Pakistan has a number of challenges in its adaptation to climate change but a number of opportunities are available to overcome these challenges.

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(Q#5)
(part 2)

↳ National Sanitation Policy of Pakistan:

The national sanitation policy of Pakistan was introduced in 2006. It provides a framework to improve sanitation, stop defecation, and manage waste safely, and protect public health and environment.

Its main aims

To ensure safe disposal of human waste, solid waste, wastewater, and drainage water across Pakistan.

↳ Salient features:

1. End of Open Defecation

The policy focuses on making Pakistan open-defecation free (ODF). It encourages building toilets at households and community levels.

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2. Community led Total Sanitation

It involves communities in planning and maintaining sanitation system. It also promotes low cost solutions and behavior changes as cardinal features.

3. Safe Disposal of Human Waste

By encouraging toilet constructions, septic tanks, and sewage systems. It also promotes proper treatment before releasing waste water.

4. Solid Waste Management

Integrated Waste Management by following holistic procedure: collection → storage → transportation → treatment → safe disposal. Reduces burning and open dumping.

5. Waste-Water and Drainage Management

By building drainage channels and waste water treatment plants. It also prevents sewage from mixing into drinking water resources.

6. School Sanitation

It ensures that the schools have clean toilets, handwashing facilities, and hygiene education.

Date:

7. Urban and Rural Sanitation

By adopting different strategies and solutions for cities and villages as their needs and problems are also different.

8. Public Private Partnerships and Awareness

By holding awareness campaigns on handwashing, water safety, and importance of cleanliness.

By using media, schools, mosques, and community groups.

By encouraging private companies and NGOs to participate in sanitation services.

(Q#5)
Part b

EIA:

It stands for

"Environmental Impact
Assessment"

Date:

"It is indept analysis of likely impacts of any development project on the environment by using different strategies and procedures under the guidelines of PEPA-1997"

↳ Legal Background:

The Environmental Impact Assessment is conducted under the **Section-12 of PEPA** and especially for the projects that are mentioned in the **Schedule-II of 2000 Regulations**.

Environmental Impact Assessment is mandatory for major projects and must be conducted before the formal designing of the project.

↳ Difference between EIA and SEA

EIA	SEA
1. stands for "Environmental Impact Assessment"	1. stands for "Strategic Environmental Assessment"
2. EIA is conducted at the project level	2. SEA is conducted at the policy level

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Date:

3

It is a process that checks the possible environmental effects of a project before it is built so that harmful impacts can be avoided or reduced.

4.

Example: Projects like
Dams, Roads,
Industries,
Power plants

5.

Timeframe

Mostly completed
within months.

Maximum upto 90 days

6

Stakeholders:

local population,
indigenous people
etc

3.

It is a process that examines the environmental impacts of policies, plans, and programs before they are approved, to ensure long-term sustainability

4. Example:

National policies,
development
plans etc.

It may take
upto years for
its formulation.

Stakeholders:

Government
officials, experts,
civil society
members etc.

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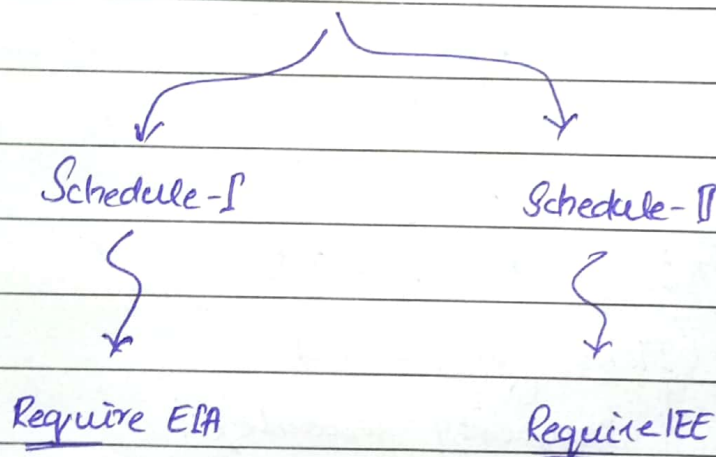
↳ Process for Conducting EIA:

The procedural process of EIA is very important and each step must be conducted thoroughly and properly:

1. Screening:

The first step is screening. The step decides whether the project requires detailed EIA or just the Initial ^{Environmental} Examination (IEE).

This is done by comparing the project against the lists provided in Schedule-I and Schedule-II.



2. Scoping:

The next step is identifying issues and also setting **Terms of Reference (TOR)** so that the study remains focus. It includes identifying key stakeholders, impact etc.

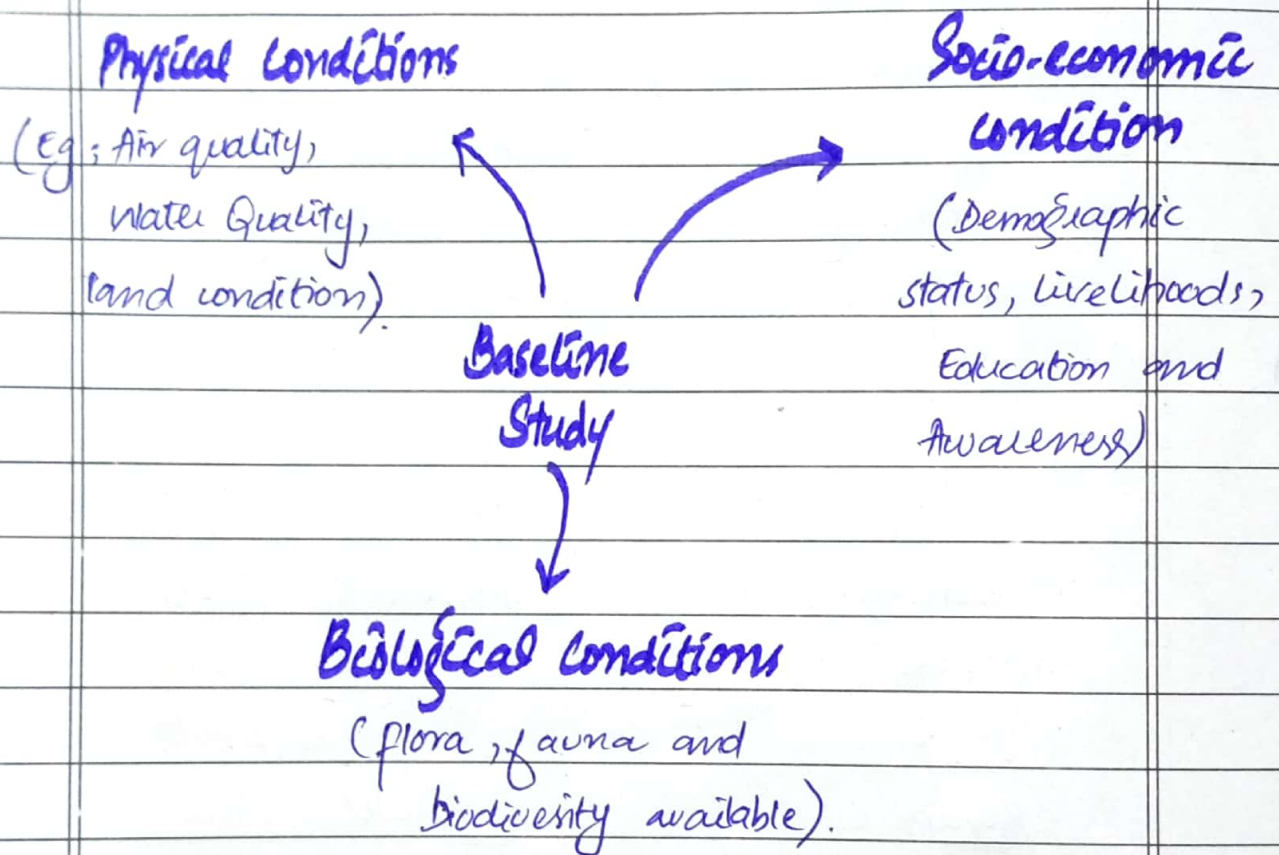
3. Baseline Studies

The next step includes conducting

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baseline studies that include recording the conditions before the construction of the project begins. This act as a reference to measure the changes that happen after or during the construction and operational stage of the project. It includes:



4. Impact Assessment

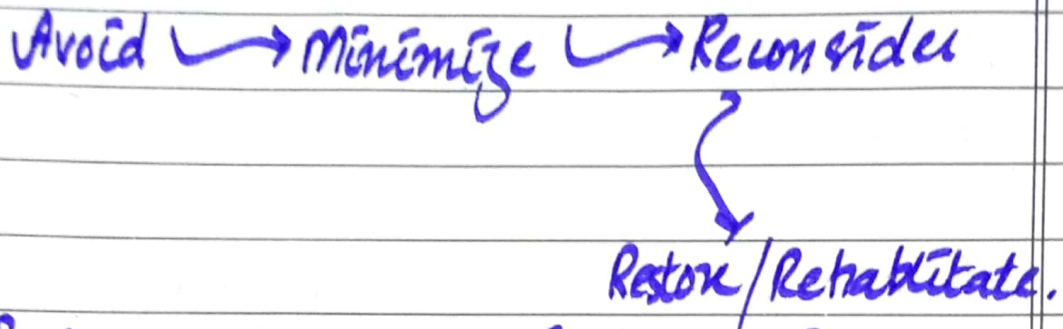
The next step is to conduct the impact assessment that includes the potential impact on the people, environment, and ecosystem.

5. Mitigation and Alternative Measures

On the basis of impact assessment specific mitigation and alternative

Date:

strategies are idealized to avoid or minimize the potential adverse impacts of that process. It usually includes or follow this hierarchy



6. Environmental Impact Statement is prepared

After conducting the preliminary research for the project an initial environmental impact statement is prepared that contains

1. Non-Technical Summary in plain Urdu or English
2. The scoping and screening process.
3. Baseline Studies are included.
4. Impact Assessment with graphs and statistics
5. Mitigation Strategies.
6. Public participation and output from local knowledge is included.
7. Monitoring and Compliance Mechanism
8. Annex includes photographs, maps, and relevant statistics of the project.

Date:

7. Public Participation

The procedure also includes meaningful public participation through seminars, surveys, interviews etc. It ensures transparency, legitimacy, and reduces conflict and litigations etc.

8. Decision Making after EPA Reviews

It is submitted for the EPA Review and EPA makes sure that all the procedure is followed accurately.

Then the final decision is made

1. It can be accepted with some conditions.
2. It can be sent back for more scrutiny
3. It can be rejected.

9. Monitoring and Compliance:

If the project is approved by the EPA, ~~then~~ then it is regularly monitored to check whether the conditions attached to its approval are being followed or not.

For example, the use of clean tech etc.

If the compliance is avoided, the project can be halted, can face penalties and fines etc.

Date:

4 Conclusion:

Environmental Impact Assessment is a very important process to ensure that the environment is considered and integrated in development process.

(Q#3)

(part b)

4 Biodiversity:

According to the definition provided by United Nations convention of Biological Diversity (CBD):

"Biodiversity means variability among living organisms from all sources including marine, terrestrial and other aquatic sources and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystem"

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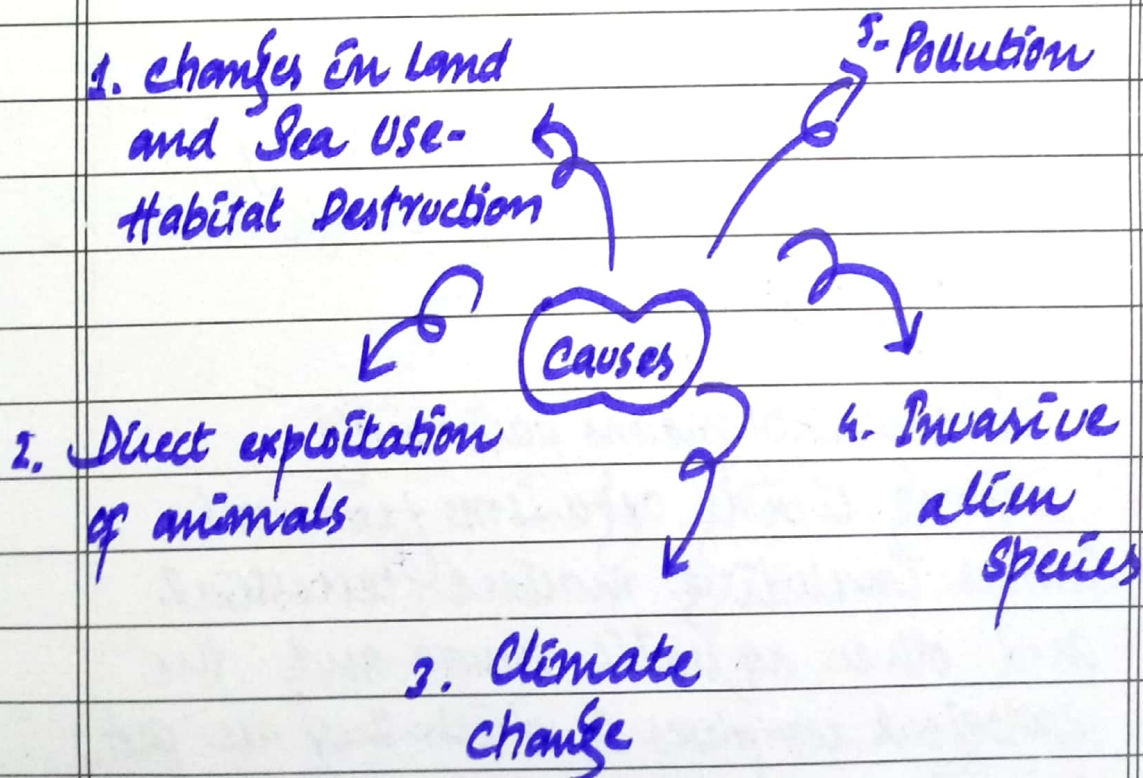
↳ Biodiversity Loss:

'It refers to the loss of, or decline of' biological diversity at genetic species or ecosystem levels'

It means fewer species, reduced genetic variations, or damaged ecosystems.

↳ Causes of Biodiversity Loss

According to **IPBES**, there are **5 causes** of biodiversity loss.



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1. Habitat loss due to deforestation for agriculture, or destruction of wetlands drives animals and plants out of their natural living conditions. This leads to rapid decline.

for example:

According to the survey conducted by Snow Leopard Foundation only 167 Snow Leopards are remaining in our hilly areas due to the destruction of their habitat, conducted in late 2025.

2. The unsustainable harvesting of plants, animals and other organisms for food, medicine, trade, and materials beyond their capacity to regenerate also lead to biodiversity loss.

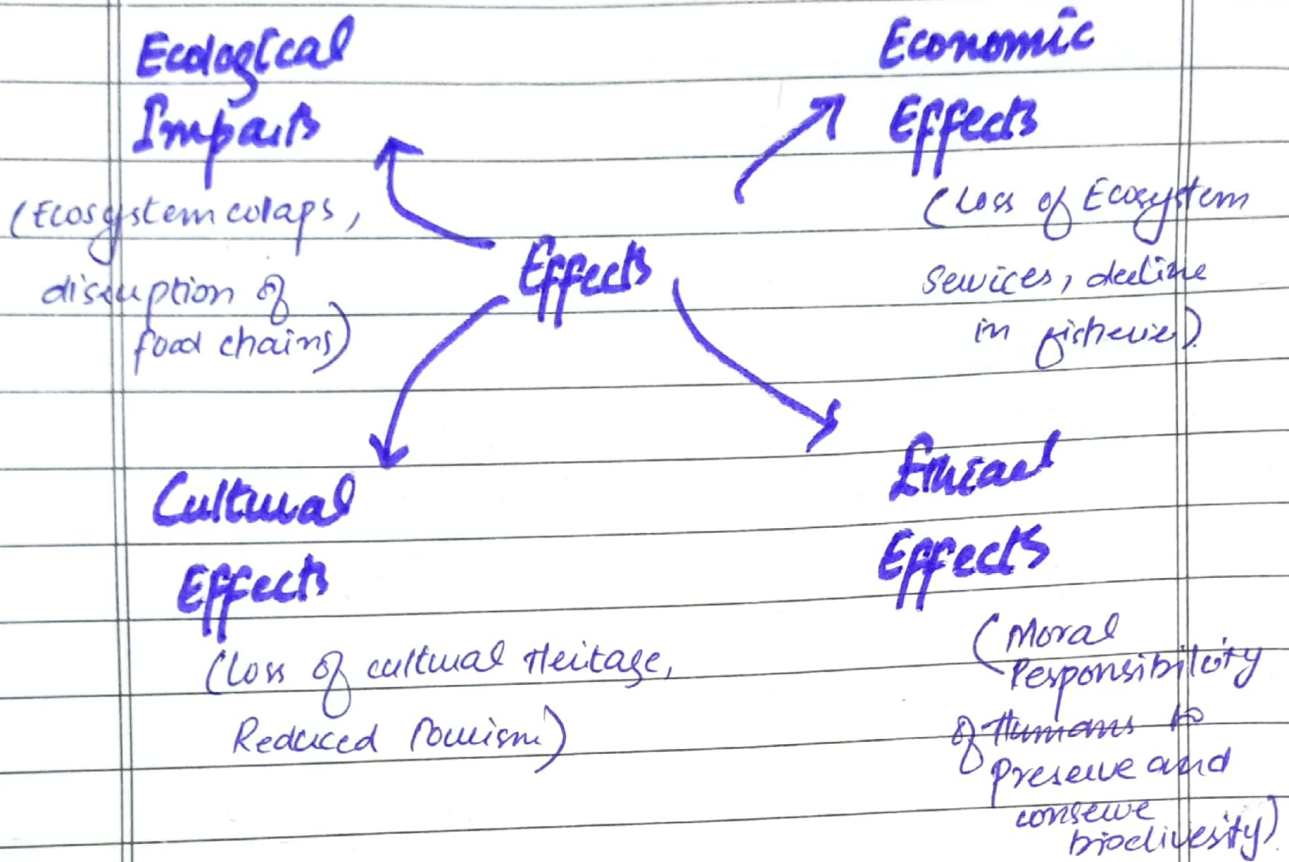
for example

According to **FAO**, the overfishing has caused the collapse of **Atlantic cod fisheries in Canada during 1990s**.

Due to the overexploitation species decline and even become extinct. It also lead to destruction of food web and disruption of
"Ecological Balance"

Date:

↳ Effects of Biodiversity Loss:



1. The overfishing and habitat destruction reduce fish populations, threatening livelihoods and food security.

forexample

The Indus River Dolphin number has reduced to as low as 1200 due to habitat destruction and exploitation.

2. Wildlife loss reduces ecotourism opportunities, harming local economies.

3. There is reduced resilience to climate change as monoculture are more vulnerable to extreme weather events and pests.

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↳ Suggestions to counter biodiversity loss:

There are a number of steps and suggestions that can be taken to counter the biodiversity loss.

Main Steps

1. In-Situ Conservation

It means protecting and conserving the plants or animals in their natural habitat.

Example

* It includes ~~Natural~~ National parks, wildlife sanctuaries or game reserves.

* Khumjung National Park protects Snow leopard and Monal sheep.

2. Ex-Situ Conservation

It means protecting and conserving the plants or animals in controlled environments to ensure their survival.

Example

* It includes seedbanks, Botanical gardens, or captive breeding programs for endangered species.

* Svalbard Global Seed vault holds seed samples from ~~Nature~~ ^{Nature} around the world.

3. Legal and Policy Measures to protect
e.g., CBD and CITES
4. Restoration and repairing of degraded ecosystems
e.g., Billion Tree Tisuai Project
- Other Suggestions
5. Raising awareness and education regarding importance of Biodiversity
6. Sustainable use of resources e.g., Sustainable forestry (selective logging instead of clear cutting)

(Q3 part 2)

Global Warming:

It refers to the

"gradual rise in Earth's average temperature mainly due to the elevated levels of greenhouse gases emitted by anthropogenic activities"

Date:

In recent years, the Global Warming is increasingly being referred as

"Global Boiling"

due to the unprecedented rise in temperature.

According to the IPCC, the year 2024 was the warmest year in a decade with temperature rising upto as far as 50°C in some areas.

↳ Why Global Warming is considered as threat to humanity?

Global warming is considered a significant threat to humanity because it has offset a dangerous chain of reactions and these reactions are increasingly becoming more severe and more frequent.

As Elon Musk said,

'We are running the most dangerous experiment in our history right now which is to see how much carbon dioxide our atmosphere can handle before there is an environmental catastrophe'

Date:

and the main driver of global warming is the greenhouse gases and among these carbon dioxide is the most potent one.

1. Glacier Melting

* Due to rising temperature, glaciers are rapidly melting due to which significant portion of fresh water reservoirs is being lost posing a significant threat to human survival.

* According to a survey 30-40% of Hindukush and Himalayan glacier mass could be lost by 2100 due to the rising temperature.

2. Increased flooding

* Due to the glacier melting and unpredictable and harsh weather patterns (e.g., monsoons in South Asia), there is more frequent and intense flooding, that not only destroys infrastructure but also causes significant damage to economy.

* For example, Pakistan is increasingly facing the floods and the timespan between each episode is

Date:

increasingly becoming short.

1. 2010 Super floods



2. 2022 catastrophic floods



3. 2025 flash floods

3. Exposure to frequent Drought:

There is extreme weather weiding due to global warming as immediately after the floods, some regions face subsequent droughts.

ex. Tharparker region in Pakistan.

4. Rising Sea-Level

Due to the global warming, there is rapid glacial retreat and that is adding significant amount of water to the sea. Therefore, sea-level is also rising and is causing harmful impacts like salt water intrusion or soil erosion.

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* For example, some regions in Pacific like Tuvalu and Kiribati are buying lands in Australia and other places to relocate their population, as rising sea-level is engulfing their lands and homes.

5. Large Climate Refugee

As the global warming is contributing to the climate change and because of the harmful impacts people have to migrate. This will lead to a large number of climate refugee in the coming years.

* It is estimated that by 2050, there will be approximately 1.2 billion climate refugees.

6. Fights over Scarce Resources

As the global warming is causing glacial retreat this will lead to water scarcity in coming years and people will fight over these scarce resources as they are vital for survival.

The wars of this century were fought over oil, the wars of

Date:

the next century will
be fought ~~of~~ over
water

- former VP of World Bank

4 Conclusion:

Hence, global warming poses significant threat to humanity by altering the natural process, by increasing the frequency of disasters, and by enhancing the likelihood of conflicts over scarce resources

