



An Institute for Civil Services

INTERVIEW GUIDANCE SERIES

IAS

**CURRENT AFFAIRS
& MAJOR DEBATES**

of

ENVIRONMENT



An Institute for Civil Services

INTERVIEW GUIDANCE PROGRAMME 2023

Give **Mock Interview** with the **India's Most Eminent Panel**
of **Acclaimed Civil Servants & Academicians**



Dr. J. N. Singh
Retd. IAS,
Former Chief
Secretary Gujarat



U Venkateswarlu
Ex. Chief
Secretary,
Tripura



R.P. Sinha
Retd. IAS,
Former Secretary,
Govt. of India



Akhil Shukla
Ex DGP,
Tripura



Sumeet Jerath
IAS (Retd),
Former Secretary,
Govt. of India



Dakshita Das
Former Additional
Secretary,
Govt. of India



B.K. Pandey
IES,
Former Adviser -
Niti Aayog



S.B. Singh
Well known
IAS Interview
Mentor



S.D. Muni
Member
Exe. Council,
IDSA



Sudhir Tiwari
Ex. Additional
Secretary, Gol



Dr. N.K. Sahu
IES,
Former Joint Secy.
HRD Ministry



Manoj K. Jha
Director,
GS SCORE



Anurag Mishra
Ex IIS
Chief Editor
Yojna



Devi Prasad
IES, Celebrated
Budget & Economic
Survey Expert



K.D. Singh
IFoS, Ex Principal
Conservator of
Forests



Prof. C. Mahapatra
Ex. Prof,
International
Relations

To get Customized
Questionnaire on your DAF &
Contemporary issue notes

Mail Your **DAF** at
daf@iasscore.in
or

REGISTER AT



For any query call at **9899448458**

Contents

1.	INDIA'S CITIES EXPANDING INTO FLOOD-PRONE AREAS	5
2.	RESTORATION OF URBAN ECOSYSTEMS	6
3.	INDIA'S & ITS LOVE FOR COAL.....	6
4.	THE LOSS AND DAMAGE FUND (LDF): COP 28	6
5.	COP 28: DUBAI, UAE.....	7
6.	ENVIRONMENT DRIVEN TAXES:	11
7.	AIR POLLUTION IN DELHI.....	11
8.	ARTIFICIAL INTELLIGENCE: BOON OR BANE FOR CLIMATE CHANGE?	12
9.	BIODIVERSITY CONSERVATION EFFORTS:.....	12
10.	SUSTAINABLE DEVELOPMENT OF RIVER.....	12
11.	INDIA'S RENEWABLE ENERGY SECTOR AND EFFORTS AT GLOBAL LEVEL	12
12.	ACCESS TO A CLEAN, HEALTHY ENVIRONMENT, A UNIVERSAL RIGHT.....	13
13.	AGRO-FORESTRY AND ITS SOCIO-ECONOMIC IMPACT	13
14.	MAN-ANIMAL CONFLICT	14
15.	GREEN INVESTMENTS AND ESG GOALS	14
16.	INDIAN SOLAR-POWER DREAM.....	14
17.	E-WASTE	15
18.	CLIMATE SMART AGRICULTURE.....	15
19.	GRASSLANDS ECOSYSTEM	16
20.	DESERT ECOSYSTEM	17
21.	TUNDRA ECOSYSTEM.....	17
22.	AQUATIC ECOSYSTEM	18
23.	MARINE ECOSYSTEM.....	18
24.	ESTUARINE ECOSYSTEM	19
25.	ENVIRONMENTAL DEGRADATION: NATURAL AND ANTHROPOGENIC FACTORS	20
26.	DEGRADATION OF HIMALAYAN ECOSYSTEM	20

27.	LAND DEGRADATION AND DESERTIFICATION: THREATS AND GLOBAL ACTIONS	21
28.	PLASTIC POLLUTION: A GLOBAL CHALLENGE	22
29.	CORAL BLEACHING AS AN INDICATOR OF ENVIRONMENT DEGRADATION	23
30.	WATER POLLUTION: IMPACTS ON HUMANS	23
31.	RADIOACTIVE POLLUTION: A CLASSIC EXAMPLE OF ANTHROPOGENIC MISMANAGEMENT OF RESOURCE	24
32.	SOLID WASTE: ISSUES WITH TREATMENT AND DISPOSAL	25
33.	URBAN POLLUTION: ISSUES AND CHALLENGES	26
34.	E-WASTE MANAGEMENT: A GROWING CHALLENGE	26
35.	MARINE POLLUTION: THREAT TO MARINE ECOSYSTEM.....	27
36.	SAND MINING: ISSUES AND IMPACT ON ENVIRONMENT	28
37.	SPECIATION AND EXTINCTION: CAUSES AND CONSEQUENCES OF BIODIVERSITY LOSS	28
38.	REGULATING TRADE IN WILDLIFE: NATIONAL AND INTERNATIONAL EFFORTS	29
39.	ONE HEALTH APPROACH: OPTIMAL HEALTH FOR PEOPLE, ANIMALS AND OUR ENVIRONMENT	30
40.	CIRCULAR ECONOMY	31
41.	GENE POOL AND ITS SIGNIFICANCE	32
42.	CHEETAH RE-INTRODUCTION: SIGNIFICANCE AND CHALLENGES	32
43.	VULTURES: ISSUES AND CHALLENGES IN THEIR CONSERVATION	33
44.	INDIAN RHINO VISION 2020: SUCCESS AND IMPACT ON ENVIRONMENT.....	34
45.	DOLPHIN: HABITAT FRAGMENTATION AND LOSS	35
46.	CLIMATE CHANGE MITIGATION: GLOBAL EFFORTS	35

ENVIRONMENT

1. INDIA'S CITIES EXPANDING INTO FLOOD-PRONE AREAS

- ◆ **Preface:** India's urban areas have been flooding more and more often. In July this year, a **State Bank of India report estimated the economic loss** due to the 2023 North India floods was around Rs 10,000 crore.
- ◆ **What is Urban Flooding?** Urban flooding is the inundation of land or property in a built environment, particularly in more densely populated areas (like cities), caused by rainfall overwhelming the capacity of drainage systems.

Causes of Urban Flooding in India	Impacts of Urban Flooding
<ul style="list-style-type: none"> ◆ Encroachments on Drainage Channels ◆ Climate Change ◆ Unplanned Tourism Activities <ul style="list-style-type: none"> • Example: Ashtamudi Lake in Kollam, Kerala polluted from oil spillage from boats. ◆ Uninformed Release of Water from Dams <ul style="list-style-type: none"> • Example: Chennai Floods 2015 due to release of water from Chembarambakkam Lake. ◆ Illegal Mining Activities: <ul style="list-style-type: none"> • Example: Jaisamand Lake- Jodhpur, Cauvery river- Tamil Nadu. 	<ul style="list-style-type: none"> ◆ Loss of Life and Property ◆ Ecological Impacts ◆ Impact on Animal and Human Health ◆ Psychological Impacts

◆ **Solutions to Mitigate Urban Flooding:**

- ◆ Improved Drainage Infrastructure
- ◆ Green Infrastructure
- ◆ Floodplain Management
- ◆ Public Awareness and Education
- ◆ Early Warning Systems
- ◆ Urban Planning Reforms
- ◆ Community Engagement

2. RESTORATION OF URBAN ECOSYSTEMS

- ◆ **Preface:** Urban ecosystems represent a radical transformation of the natural areas they have replaced and are often highly degraded.
- ◆ **Issues:**
 - ◆ Land plays a key role in climate systems, but nearly 40% of the world's land is degraded.
 - ◆ Poor planning seals soils and leaves little space for vegetation amid the houses, roads and factories.
 - ◆ Waste and emissions from industry, traffic and homes pollutes waterways, soils and the air.
- ◆ **What would it take to restore urban ecosystem?**
 - ◆ Restoring urban ecosystems requires awareness and commitment.
 - ◆ Green spaces need to be placed at the heart of urban planning.
 - ◆ There is need to clean up waterways, plant trees and create urban woodland and other wildlife habitat in parks, schools and other public spaces.
 - ◆ Creating **carbon sinks** by reclaiming land using forestry techniques.

Ecosystem restoration

The UN describes ecosystem restoration as the act of helping degraded and destroyed ecosystems recover, while also protecting and conserving the ecosystems that are still intact.

3. INDIA'S & ITS LOVE FOR COAL

- ◆ **India's climate ambitions:** India has set aggressive targets for clean energy deployment, and is seen as one of the most attractive developing markets for renewable investment. Yet it refuses to turn its back on coal.
- ◆ India, along with China, has opted out of the **Global Renewables and Energy Efficiency pledge at the COP28 climate conference**—which included a commitment to curtail investment in new coal power.
 - ◆ The deal called for **tripling global renewable energy capacity and doubling energy efficiency rates by 2030** which, according to the International Energy Agency, is critical to avoid breaching the 1.5 degrees Celsius threshold.
- ◆ **Usage:** Coal currently meets nearly **three-quarters of India's growing energy needs**. Moreover higher electricity capacity will, ironically, be key to survival in its increasingly hot weather as air conditioning needs rise.
 - ◆ India, the world's second-largest coal producer after China, currently extracts 95 per cent of its coal from opencast mines carved into the surface, and relies on the fuel for about three-quarters of its power production.
- ◆ **India's stand at COP28:** India "strongly resisted" the rich nations' call for limitations on new and unabated coal power generation.
 - ◆ India accounts for 17% of the global population but its contribution to global carbon emissions is just four per cent.
 - ◆ Poverty eradication is a priority for many nations. So, India did not give in to the pressure from developed countries (for a fossil fuel phase-out).

4. THE LOSS AND DAMAGE FUND (LDF): COP 28

- ◆ **Preface:** The 28th Conference of the Parties (COP28) to the **UN Framework Convention on Climate Change** operationalised the **Loss and Damage Fund**, which was established by COP27 in 2022.

- ◆ **Meaning:** Housed with the World Bank, the fund is expected to provide financial assistance to vulnerable countries that are already experiencing the impacts of climate change, such as **rising sea levels, extreme weather events, and mass displacement.**
- ◆ **Benefits for India, with the establishment of LDF:**
 - ◆ There are chances that countries like India may not be benefiting from the proposed loss and damage fund, considering that it's the third highest GHG emitter. Further EU, US had emphasised during the COP27 negotiations that nations that are both high GHG emitters but are still considered developing (such as India and China) should also pay into the fund
- ◆ **Challenges:** 1) The first thing to decide is how much countries will receive in loss and damage. 2) How will loss and damage be assessed, 3) How will the loss of Indigenous cultural heritage or loss of national and local ecosystems be assessed in a mutually agreeable way 4) What baselines will be agreed for attributing loss and damage.

Contributions: Already, a few key nations have pledged contributions to it.

- ◆ **The UAE,** the COP28 presidency, spearheaded the initiative with a \$100 million pledge, followed by Germany's \$100 million contribution.
- ◆ **The UK** stepped forward with £40 million for the fund and an additional £25 million for other loss and damage funding arrangements.
- ◆ **The US** pledged \$17.5 million, while Japan contributed \$10 million.
- ◆ **The European Union** made a substantial €225 million commitment.

5. COP 28: DUBAI, UAE

ALTERRA: UAE Commits \$30bn to Climate-Focused Investment Vehicle

- ◆ **Preface:** The UAE announced a US\$30 billion commitment to the newly launched catalytic climate vehicle, **ALTERRA.**
- ◆ **About ALTERRA:** With this US\$30 billion commitment, **ALTERRA** becomes the **world's largest private investment vehicle** for climate change action and will **aim to mobilize US\$250 billion globally by 2030.**
- ◆ **Objective:** It aims **to steer private markets** towards **climate investments** and focus on transforming emerging markets and developing economies, where traditional investment has been lacking due to the higher perceived risks across those geographies.
- ◆ **Benefits of ALTERRA:**
 - ◆ ALTERRA provides a **transformational solution** for attracting private capital.
 - ◆ Its **scale and structure** will create a **multiplier effect** in climate focused investment, making it a vehicle like no other.
 - ◆ Its launch reflects the COP Presidency's Action Agenda and the **UAE's efforts to make climate finance available, accessible and affordable.**
 - ◆ ALTERRA is one of a **range of finance-led initiatives** launched during COP28 to accelerate the **global transition to a low-carbon economy** and build climate resilience.

ALTERRA and India:

- ◆ From the vehicle's initial commitment, immediate capital investment has been earmarked for the development of **over 6.0 GW of new clean energy capacity in India.**
- ◆ This includes the **construction of 1,200 MW of wind and solar projects** that will begin producing **clean power by 2025.**

5.1: COP 28: 22 Countries Pledge to Triple Nuclear Power Capacity

- ◆ **Preface:** In a landmark move, the United States, along with 21 other nations, declared its intention to triple the global generation capacity of nuclear power by 2050.
- ◆ **Objective:** The announcement underscores a growing consensus among governments worldwide that **increased use of nuclear power** is **essential to combat climate change** and reduce carbon emissions.
- ◆ Key Countries Leading the Pledge:
 - ◆ **U.S. and Allies:** The **United States spearheads the initiative**, joined by countries such as Canada, the UK, France, South Korea, and the UAE. This collaborative effort emphasizes the global recognition of nuclear power as a vital component of sustainable energy solutions.
 - ◆ **European Perspective:** European nations, including France, **aim to reduce dependence on oil and gas from Russia** by boosting nuclear power. While acknowledging the need for substantial investment, the move aligns with a broader strategy to enhance energy security and combat climate change.
- ◆ **Global Nuclear Generation Capacity:**
 - ◆ **Current Status:** As of the end of 2022, **the International Atomic Energy Agency reported** global **nuclear power generation capacity** at approximately **371 GW**, with **411 reactors in operation**.
 - ◆ **The Pledge's Ambitious Goal:** The commitment to triple nuclear energy production by 2050 aims to **address climate change** by harnessing the **carbon-free nature of nuclear power**.

5.2: COP28 climate meet | India not among 118 nations that pledged to triple green energy

- ◆ **Preface:** The COP28 climate summit witnessed a significant development **with 118 nations signing the Global Renewables and Energy Efficiency Pledge**.
- ◆ **Objective:** This commitment aims to **triple the worldwide installed renewable energy generation capacity** to at **least 11,000 GW** and **double the global average annual rate of energy efficiency improvements to over 4% by 2030**.
 - ◆ However, notable **exclusions from the list of signatories are India and China**, the latter being the world's leader in installed renewable energy capacity.
- ◆ **India's Notable Absence and Reasons Behind It:** Despite being part of the **G20 declaration**, **India chose not to sign the pledge**. The reasons behind this decision remain unclear, with some sources pointing to **"problematic" language in the text**.
- ◆ **Legal Sanctity and Inclusion in Main Negotiating Texts:** There is ongoing global disagreement about whether large dams, considered as renewable sources by India, truly fall under this category.
- ◆ The pledge, as it stands, **lacks legal sanctity** and is yet to be included in the main negotiating texts.

5.3: COP28: Global Stocktake Assessment

- ◆ **Preface:** One of the objectives of COP28 was to take **stock of the actions** that nations have undertaken since the **Paris pact of 2015**.
- ◆ **About:** The global stocktake means looking at everything related to where the world stands on climate action and support, identifying the gaps, and working together to chart a better course forward to accelerate climate action. It is like a report card on the 2015 Paris Agreement's goal.

◆ **Mandate of the Paris Agreement:**

- ◆ **2 degrees Celsius:** The Paris Agreement set the goal of **limiting global warming to below 2 degrees Celsius** from the pre-industrial era, with a more ambitious target of **staying under 1.5 degrees Celsius** to minimize severe climate change impacts.
- ◆ **Periodic assessments:** This mandate necessitated **periodic assessments**, with the **first scheduled Global Stocktake occurring in 2023** and subsequently every five years.

◆ **India's position in global stocktake**

- ◆ The draft text for **Global Stocktake** gave priority to "phasing-out" over the "phasing-down" strategy proposed by India at last year's climate conference.
- ◆ India had last year proposed to **phase down all fossil fuels** and not just coal. New Delhi's call was supported by several countries, including the European Union.
- ◆ India even skipped signing the pledge to commit to **tripling the global renewable energy capacity by 2030**.
- ◆ Over the reduction of greenhouse gases, India also refrained from signing the COP28 Declaration on Climate and Health.

5.4: COP28 climate meeting: The fossil fuel question

- ◆ **Preface:** Oil, gas, coal, and their derivatives account for at least 80 per cent of greenhouse gas emissions. Yet, COPs over the years have not even acknowledged the role of fossil fuels in global warming.
- ◆ **COP 28 and Fossil Fuel:** The annual climate change conferences have historically sidestepped the crucial issue of fossil fuels' role in global warming. However, the ongoing COP28 in Dubai is witnessing a potential shift, sparked by controversial remarks from Sultan Al Jaber, the conference's presiding figure.
- ◆ **The Furore in COP 28:**
 - ◆ **Fossil Fuel controversy:** Al Jaber's comments during an online event, where he downplayed the necessity of eliminating fossil fuels to achieve the 1.5-degree Celsius target, have triggered a significant controversy.
 - ◆ **Conflict of Interest:** As the CEO of the Abu Dhabi National Oil Company, the world's 12th largest oil company, Al Jaber's role as COP28 president has drawn criticism for potential conflicts of interest.
- ◆ **The Fossil Fuel Debate:**
 - ◆ **GHG emissions:** Fossil fuels, responsible for at least 80% of greenhouse gas emissions, have been a contentious topic in climate negotiations.
 - ◆ **Core Issues:** Despite their significant contribution to climate change, influential countries have attempted to reduce emissions without addressing the core issue of fossil fuel usage.
- ◆ **The Indian Initiative:** The terms "phase-out" and "phase-down" remain subject to negotiation and contention.
 - ◆ **Phase-out of fossil fuels:** India took a bold step during COP27, calling for a phase-out of fossil fuels in the final conference outcome.
 - ◆ **Phase-down of coal:** While the mention was vague, urging the acceleration of a "phase-down" of unabated coal, it marked the first official acknowledgment of any fossil fuel in COP decisions.

5.5: Green Credits Initiative

- ◆ **Preface:** India announced the launch of the Green Credit Initiative at COP28 summit.
- ◆ **About:** The environment ministry in October 2023 announced a green credits program—defining it as a market-based mechanism designed to incentivize voluntary environmental actions across diverse sectors by various stakeholders like individuals, communities, private sector industries, and companies, according to the ministry of environment, forest and climate change.
 - ◆ In its initial phase, it will focus on **water conservation and afforestation**.
- ◆ **Green credit program:** The green credits initiative is based on the **green credit program** and basically envisions the issue of green credits for plantations on waste and degraded lands, and river catchment areas in order to restore their vitality.
- ◆ **LeadIT 2.0:** The Prime Minister launched another initiative called **LeadIT 2.0** i.e. ‘**Leadership Group for Industry Transition**’, at an event co-hosted by India and Sweden.
 - ◆ **Joint initiative:** LeadIT 2.0 is a joint initiative launched by **India and Sweden in 2019** at the **UN Climate Action Summit** in New York.
 - ◆ It is aimed at **fostering collaboration among decision-makers**, as well as bringing together **public and private sector companies** to aid in **the acceleration** of industry transition to **net-zero emissions**.

6. ENVIRONMENT DRIVEN TAXES:

India is considering levying a carbon tax on imports from countries with high per capita carbon emissions. The move comes in the backdrop of the **European Union’s Carbon Border Adjustment Mechanism (CBAM)**.

- ◆ **Carbon Border Tax:** An instrument proposed by the EU, a carbon border tax is a tax on carbon emissions attributed to imported goods that have not been carbon-taxed at the source.
- ◆ **Challenges:** 1) From an equity perspective, it increases costs in poorer countries, due to the need to remit new taxes 2) It will be a major policy challenge for lower-income countries.
- ◆ **What is Green protectionism:** It is a Protectionism measures against free trade in the name of environment conservation.
- ◆ **Why EU wants to introduce it:** The Emissions Trading System of the EU makes operating within the region expensive for certain businesses. The EU authorities’ fear that these businesses might prefer to relocate to countries that have more relaxed or no emission limits. This is known as ‘carbon leakage’ and it increases the total emissions in the world.
- ◆ **Impact on India:** Starting January 2026, the Indian steel, cement, aluminium, and fertiliser industries will pay steep Carbon Border Tax (CBT) imposed by EU.
 - ◆ This tax would make Indian goods less attractive for buyers and could shrink demand.
- ◆ **How India can switch to low carbon process?**
 - ◆ Blast furnaces using iron ore and coal/coke
 - ◆ Electric arc furnace using steel scrap as inputs and electricity
 - ◆ Using hydrogen in a “direct reduction” process that converts iron ore to metallic iron for feeding into an electric arc furnace

7. AIR POLLUTION IN DELHI

- ◆ **Why is Delhi's air often bad?** Mundane geographical placement, Stagnant air, Seasonal Stubble Burning, Vehicular and Industrial pollution getting trapped in fog to form Smog
- ◆ **Why is stubble being burned:**
 - ◆ Most farmers in Punjab are poor and cannot afford machinery.
 - ◆ Stubble Burning is a cheaper solution.
 - ◆ Lack of knowledge to operate modern machines
- ◆ **Is there any alternative to stubble burning:**
 - ◆ Bio Enzyme-PUSA, Crop residue management by zero-tiller machines
 - ◆ Use of bio-decomposers
 - ◆ Use of rice straw as cattle fodder
 - ◆ **Other Alternative Use:** Instead of burning the stubble, it can be used in different ways like cattle feed, compost manure, roofing in rural areas, biomass energy, mushroom cultivation, packing materials, fuel, paper, bio-ethanol and industrial production, etc.
- ◆ **Required Measures:** Measures to decrease stubble burning and enforcing stringent regulations to enhance greenery, reducing vehicular emissions and managing waste transportation, adopting eco-friendly practices.

8. ARTIFICIAL INTELLIGENCE: BOON OR BANE FOR CLIMATE CHANGE?

- ◆ **Is AI good or bad for climate change:** AI can both help and hurt the environment. On one hand artificial intelligence increases factory efficiency and lowers energy costs but on the other hand AI consumes lot of energy. Data centres are critical for storing the large amounts of data needed to power AI systems, but demand a huge amount of energy.
- ◆ **Does AI have any negative externalities on Health of humans:** Mind control and manipulation, for example: YouTube and Facebook are using their algorithms to estimate and favour more addictive videos or news feeds to specific groups of users.
- ◆ **Which AI applications may lead to carbon emissions:** Data centres are critical for storing the large amounts of data needed to power AI systems, but demand a huge amount of energy. In addition, training advanced artificial intelligence systems, including deep learning models, can require high-powered GPUs to run for days at a time.

9. BIODIVERSITY CONSERVATION EFFORTS:

- ◆ **Significance of global biodiversity framework (GBF):** GBF sets out targets for 2030 on protection for degraded areas, resource mobilisation for conservation, compensation for countries that preserve biodiversity, halting human activity linked to species extinction, reducing the spread of invasive alien species.
- ◆ **Threats posed by invasive alien species to local biodiversity:** 1) Competition for food and shelter with local species 2) Allelopathic Effects 3) Threat to food crops eg: Apple and Papaya mealybug.
- ◆ **Significance of Biodiversity for Humans:** 1) Maintenance of proper food chain 2) Biodiversity supports human and societal needs, including food and nutrition security, energy, development of medicines and pharmaceuticals and freshwater, which together underpin good health.

- ◆ **Ecological benefits of the relocation of Cheetahs:** Cheetah population forms keystone species in the grassland ecosystem. Its revival will conserve the habitat in dry forests in India. (Note: Cheetahs Introduced from Namibia to Kuno National Park, located in the Chambal region).

10. SUSTAINABLE DEVELOPMENT OF RIVER

- ◆ **Sources of river pollution:** Agricultural Runoff, Littering, runoff from mismanaged wastewater treatment plants, sewage, industrial runoff, as well as storm runoff which delivers high concentrations of contaminants such as oil and sediment from roads.
- ◆ **Ganga River & livelihood:** cultural importance, Agricultural importance, Source of fresh water, Important for livelihood of flora and Fauna, Environmental significance.
- ◆ **Required innovative measures:** Usage of biodegradable detergents, judicious use of fertilizers to curb eutrophication (drip and sprinkle irrigation), Establishment of sewage treatment plants, and Regular inspection of industries to check discharge of industrial effluents.
- ◆ **Importance of Jal Jeevan Mission:** Ensuring availability of water to every house hold at adequate quality and quantity. It focuses not only on the quantity of water but also on the quality.

11. INDIA'S RENEWABLE ENERGY SECTOR AND EFFORTS AT GLOBAL LEVEL

- ◆ **Steps to increase Renewable Energy Production:** 1) Increasing expenditure on research and development 2) Technology sharing at global level 3) Improving global access to components and raw materials 4) Level the playing field for renewable energy technologies by incentivizing renewable energy and dis-incentivising environment Polluting energy generation.
- ◆ **Need for wind-solar hybrid projects:** Both are weather dependent and are non-uniform source of energy. Linking both will provide continuity in energy supply to some extent.
- ◆ **Importance of Hydrogen as a source of energy:** Hydrogen generates electrical power in a fuel cell, emitting only water vapour and warm air. Hence it is non-polluting in its usage. However the storage and production of Hydrogen makes it both costly as well as polluting. Green Hydrogen which is produced without emission of co2 is a good alternative but it too consumes energy in storage.
- ◆ **What is Long term Low Emission Development strategy' (L-LEDS) presented by India at COP27:** It aims at smooth transitions from fossil fuels in a just, sustainable and all-inclusive manner. It promotes usage of alternate energy such as Hydrogen, Biofuels etc.
- ◆ **What is Net-zero emissions:** Total emission must be equated by total absorption to have net zero impact on climate.
- ◆ **What are India's Updated Nationally Determined Contribution submitted at COP 26:** Reach 500GWNNon-fossil energy capacity by 2030, 50 per cent of its energy requirements from renewable energy by 2030, Reduction of total projected carbon emissions by one billion tonnes from now to 2030, Reduction of the carbon intensity of the economy by 45 per cent by 2030, over 2005 levels, Achieving the target of net zero emissions by 2070

12. ACCESS TO A CLEAN, HEALTHY ENVIRONMENT, A UNIVERSAL RIGHT

- ◆ **Does making a clean environment a part of Human Rights, ensures its fulfilment:** Rights comes along with duties. Though state is constitutionally bound to ensure the fulfilment of rights for its citizens but it is also responsibility of citizens to keep environment clean.

- ◆ Thus the fulfilment of this right depends on active participation of both citizens and nations at global level since environment pollution is matter of global concern and can't be dealt individually by any nation.
- ◆ **Challenges in implementing a clean environment as a Human Right in India:** 1) Lack of acknowledgement by people with some thinking that environment pollution is still to happen. 2) Measures like smog towers addresses the effect and not the cause of pollution 3) Behavioural change is needed 4) It is a right whose fulfilment not only depend on single state but global collaboration is needed

13. AGRO-FORESTRY AND ITS SOCIO-ECONOMIC IMPACT

- ◆ **What is Agro-Forestry? How is it different from social forestry:** Agro forestry activities are limited to farmer's own land i.e., homestead, farmland, etc., while social forestry extends throughout the community places including Government and forests also.
- ◆ **Benefits:** Reducing soil erosion by reducing the impact of raindrops on the barren surface, Decaying leaves makes the soil richer by forming an organic layer on top, increasing the capacity of soil in storing water, Prevents expansion of invasive species, Source of income for farmers
- ◆ **Major crops grown under Agro-Forestry:** Agrisilviculture, Agrihorticulture, Silvo-pastoral: Rubber, Eucalyptus, Kadam, Tamarind, Amla, Neem etc depending on the region it is done.
- ◆ **Impediments in the adoption of Agro-forestry:** shortage of superior planting material and improved seed varieties, the marketing infrastructures for agroforestry produce are unavailable in the country except in the few states, lack of awareness of technical and economic data on different agroforestry models, small land holdings of farmers, lack of information on the selected trees.

14. MAN-ANIMAL CONFLICT

- ◆ **What are the cause of increasing Man-animal conflicts:** 1) Humans settlement closer to forest 2) Decline of Prey in forest forcing animals to hunt humans for food 3) Construction of Roads between or near forest eg: Elephant attack on a car in Chhattisgarh (Feb 2022).
- ◆ **Is Man-Animal Conflict a positive externality of conservation programmes:** Though it may seem that increasing the number of Tigers or increasing the area under forest cover have brought Animals closer to Human settlements but Human beings have to also acknowledge that it is us who first occupied the natural habitat of Animals. Thus conservation programmes can't be blamed for increasing Man-Animal conflict rather occupancy of forest by humans is to be blamed.
- ◆ **How technology can be harnessed to address man-animal conflicts:** Remote sensing, Cameras, Bee fencing, electric fencing, Creating alternative water points for wildlife to steer them away from community water sources, installing predator-proof roofs on livestock corrals
- ◆ **Vermin:** Vermin are pests or nuisance animals that can spread diseases or destroy crops or livestock. Example: common crows, fruit bats, rats and mice, which may be hunted freely
- ◆ **Is it correct to declare an animal as Vermin animals:** The concept of vermin gives precedence to human needs over the life of other animals. It does not consider Right to life of animals thus is ethically incorrect.

15. GREEN INVESTMENTS AND ESG GOALS

- ◆ **What is Green Investment:** Green investing seeks to support business practices that have a favourable impact on the natural environment. Often grouped with socially responsible investing

(SRI) or environmental, social, and governance (ESG) criteria, green investments focus on companies or projects committed to the conservation of natural resources, pollution reduction, or other environmentally conscious business practices.

- ◆ **What is Green washing:** Green washing involves making an unsubstantiated claim to deceive consumers into believing that a company's products are environmentally friendly or have a greater positive environmental impact than they actually do.
- ◆ **Are Green investments synonymous with Sustainable Development:** Green investing consists of investment activities that focus on projects committed to the conservation of natural resources. Green investment will help attaining the goals of sustainable development.
- ◆ **What are ESG Goals:** Environmental, Social, and Governance (ESG) goals are a set of standards that force companies to follow better governance, ethical practices, environment-friendly measures and social responsibility.

16. INDIAN SOLAR-POWER DREAM

- ◆ **Importance of solar-energy for Net-zero emissions:** Solar power produces no emissions during electricity generation, and life-cycle assessments clearly demonstrate that it has a smaller carbon footprint.
- ◆ **Problems in meeting 100 GW of solar energy target by 2022:** regulatory roadblocks, net metering limits, the twin burdens of basic customs duty on imported cells and modules and issues with the new and renewable energy ministry's approved list of models and manufacturers, unsigned power supply agreements, banking restrictions, financing issues, delays in or rejection of open-access approval grants, and the unpredictability of future open-access charges.
- ◆ **Steps to increase solar power generation in India:** Building more efficient solar panel models, regular cleaning of solar panels, indigenous production of solar panels, relaxation in custom duty, promoting citizens to establish roof top solar panels.
- ◆ **Solar and wind power projects and Great Indian Bustard conservation:** Natural habitat of GIB is adversely impacted by High tension wires, wind mills and solar power plants.

17. E-WASTE

- ◆ **Can E-waste be considered as a treasure:** E-waste consists of both hazardous and non-hazardous items including ferrous and non-ferrous metals like copper, aluminium, silver, gold, platinum, palladium, etc. These precious earth metals like copper, aluminium, silver, gold, platinum, palladium if extracted and reutilized could prove to be a treasure trove.
- ◆ **Responsibility of Producers, Dealers etc. in handling E-waste:** Extended Producer Responsibility (EPR) is a policy approach under which producers are given a significant responsibility for the treatment or disposal of post-consumer products.
- ◆ **What are toxic elements present in E-waste:** Some of the toxic metals used in electronics are antimony, arsenic, beryllium, cadmium, chromium, cobalt, indium, lead, mercury, nickel, and thallium.

18. CLIMATE SMART AGRICULTURE

- ◆ **Definition:** Climate-smart agriculture is an integrated approach to manage landscapes that address the challenges of food security along with climate change.
- ◆ **Need of climate smart Agriculture:** Methane Emission, Intermittent flooding, Subsidy on power, fertilizers used in agriculture are not only increasing greenhouse gas emission but also

create financial burden on the government thus agriculture production must be done keeping environmental conservation in mind.

- ◆ **Importance of India-Israel collaboration for climate smart agriculture:** 1) Technology sharing 2) Promotion of research and development 3) successful cooperation strengthens both nations, making them more self-reliant.
- ◆ **Nanotechnology in Agriculture:** 1) Nano Urea 2) Nano sensors 3) Nanotechnology devices can be used for the enhancement of nutrients absorption by plants, the delivery of active ingredients to specific sites
- ◆ **Feasibility of Zero Budget Natural Farming (ZBNF) in India:** Pros: All locally available natural ingredients are used, does not require artificial fertilizers, Promotes local Varieties, Reduces input cost for farmers. Cons/Challenges: It may reduce production in initial years.

ENVIRONMENTAL ISSUE

19. CHANGES IN ECOSYSTEM

Forest Ecosystem

The world's forests play a vital role in **supporting biodiversity, regulating climate, providing ecosystem services, and supporting human livelihoods**. However, many regions across the globe are currently experiencing changes in their forest ecosystems due to various factors, including **deforestation, climate change, and human activities**.

- ◆ **Amazon Rainforest, South America:** The Amazon rainforest, the world's largest tropical rainforest, has experienced extensive deforestation over the years. Agricultural expansion, logging, and infrastructure development are some of the primary drivers of deforestation in this region.
 - ◆ **Culprit:** The conversion of vast areas of rainforest into soybean and cattle ranches in Brazil has resulted in the loss of biodiversity and **increased carbon emissions**.
- ◆ **Boreal Forest, North America, and Eurasia:** The boreal forest, or taiga, is a **vast biome** characterized by cold temperatures and dominated by **coniferous trees**. Climate change is significantly impacting this ecosystem, leading to shifts in forest composition and distribution.
 - ◆ **Culprit:** Rising temperatures and altered precipitation patterns have facilitated the expansion of pests and diseases, such as the mountain pine beetle, which has devastated large areas of coniferous forests in North America.
- ◆ **Congo Basin Rainforest, Africa:** The Congo Basin rainforest is the **second-largest tropical** rainforest in the world and one of the most biodiverse regions. Deforestation in this area is primarily driven by agriculture, mining, and logging.
 - ◆ **Culprit:** Small-scale agriculture, particularly for subsistence farming, is a significant driver of deforestation in the region.
- ◆ **Borneo Rainforest, Southeast Asia:** Borneo is home to one of the oldest rainforests in the world, but it has experienced significant deforestation in recent decades.
 - ◆ **Culprit:** The expansion of oil palm plantations and illegal logging are major contributors to deforestation in this region.

20. GRASSLANDS ECOSYSTEM

Grasslands are unique biomes covering vast expanses of the Earth's surface, ranging from tropical savannas to temperate and arctic tundra. These ecosystems are characterized by a dominance of

grasses and herbaceous plants, supporting a diverse array of wildlife. However, many regions across the globe are experiencing changes in their grassland ecosystems due to human activities, such as agriculture expansion, urbanization, overgrazing, and climate change.

- ◆ **North American Prairie:** The North American prairies are among the most iconic grassland ecosystems. Historically, they covered vast areas in the central United States and Canada. However, due to agricultural expansion and urbanization, over 99% of native prairies have been lost. The conversion of these grasslands into croplands for agriculture, particularly for wheat, corn, and soybean cultivation, has led to a significant loss of native prairie habitats.
 - ◆ **Culprit:** The decline of North American prairies has resulted in the loss of numerous native grass species and unique fauna, such as the greater prairie-chicken and bison.
- ◆ **African Savannas:** African savannas are characterized by a mix of grasses and scattered trees, supporting a rich diversity of wildlife. However, these ecosystems are facing threats from deforestation, land degradation, and illegal poaching. Human activities, including agriculture, livestock grazing, and mining, contribute to the decline of these habitats.
 - ◆ **Culprit:** The conversion of savannas into farmlands and human settlements disrupts migration routes for wildlife and leads to habitat fragmentation. This results in the loss of critical habitats for iconic species such as lions, elephants, and giraffes.
- ◆ **South American Pampas:** The South American pampas are vast grasslands found in countries like Argentina, Uruguay, and Brazil. While historically used for cattle ranching, these ecosystems are increasingly threatened by agricultural expansion, especially for soybean cultivation.
 - ◆ **Culprit:** The conversion of pampas into croplands disrupts the natural grassland habitats and negatively impacts native species like the Pampas deer and the Maned Wolf.
- ◆ **Eurasian Steppes:** The Eurasian steppes are vast grasslands that stretch across countries such as Russia, Kazakhstan, Mongolia, and China.
 - ◆ **Culprit:** These grasslands are historically impacted by overgrazing and conversion to croplands for agriculture.

21. DESERT ECOSYSTEM

Desert ecosystems are characterized by **arid conditions, limited precipitation, and extreme temperature fluctuations**. They cover approximately one-third of the Earth's land surface and are home to unique flora and fauna that have adapted to survive in these challenging environments.

- ◆ **Saharan Desert, North Africa:** The Saharan Desert is the largest hot desert in the world, covering a vast area in North Africa. Human activities, including overgrazing by livestock and unsustainable water extraction for agriculture and urban use, are leading to desertification in some areas.
 - ◆ For example, the **expansion of agriculture and urban centers in the Nile Delta** is putting immense pressure on the available water resources, leading to increased desertification.
- ◆ **Sonoran Desert, North America:** The Sonoran Desert spans parts of the southwestern United States and north-western Mexico. This desert ecosystem is facing challenges from urban expansion and infrastructure development, leading to habitat loss and fragmentation.
 - ◆ For example, the **construction of roads and cities in Arizona and California** is disrupting desert habitats.
- ◆ **Thar Desert, South Asia:** The Thar Desert, also known as the Great Indian Desert, is located in north-western India and parts of Pakistan. Overgrazing by livestock and deforestation are major issues in this region. The **over-extraction of groundwater** for agriculture is also contributing to desertification.

- ◆ **Atacama Desert, South America:** The Atacama Desert in Chile is known as one of the driest places on Earth. **Climate change and mining activities** are major drivers of change in this desert ecosystem.
 - ◆ **Culprit:** The extraction of water and minerals from the desert poses significant threats to its delicate balance.

22. TUNDRA ECOSYSTEM

The tundra ecosystem is characterized by extremely cold temperatures, short growing seasons, and a lack of trees. It covers vast areas in the Arctic and Antarctic regions, as well as high-altitude areas in mountains around the world. Despite its harsh conditions, the tundra supports a unique array of plant and animal species adapted to survive in these extreme environments.

- ◆ **Arctic Tundra:** The Arctic tundra is the largest tundra region, covering vast areas in the Northern Hemisphere, including parts of **Alaska, Canada, Greenland, Scandinavia, and Russia**. One of the most significant drivers of change in this region is climate change. As the Arctic experiences more rapid warming than other regions, it has led to permafrost thawing and changes in precipitation patterns.
- ◆ **Alpine Tundra:** Alpine tundra is found at high altitudes in mountain ranges across the globe, including the Rocky Mountains in North America, the Alps in Europe, and the Himalayas in Asia. Climate change also affects alpine tundra, resulting in rising temperatures and the retreat of glaciers.
- ◆ **Antarctic Tundra:** The Antarctic tundra is found on the continent of Antarctica and the surrounding islands. While it is relatively less impacted by human activities, climate change and scientific research activities have put some pressure on this pristine ecosystem.
- ◆ **Siberian Tundra:** The Siberian tundra covers vast areas in northern Russia and is rich in permafrost. Climate change and industrial activities, such as oil and gas exploration, are major drivers of change in this region.

23. AQUATIC ECOSYSTEM

Aquatic ecosystems include a wide range of habitats, from freshwater lakes and rivers to marine environments such as oceans, coral reefs, and estuaries. These ecosystems support an incredible diversity of life and play a crucial role in maintaining global ecological balance.

- ◆ **Coral Reefs in the Coral Triangle, Southeast Asia:** The Coral Triangle, spanning the waters of Indonesia, Malaysia, Papua New Guinea, the Philippines, the Solomon Islands, and Timor-Leste, is known as the "Amazon of the Seas" for its rich marine biodiversity.
- ◆ **The Great Barrier Reef, Australia:** The Great Barrier Reef, located off the coast of Queensland, Australia, is the world's largest coral reef system and a UNESCO World Heritage Site.
- ◆ **Lake Chad, Africa:** The reduction in the size of Lake Chad has led to the loss of wetland habitats, impacting migratory bird populations and reducing fish stocks that local communities depend on for food and livelihoods.
- ◆ **The Gulf of Mexico, North America:** The Gulf of Mexico is a large marine ecosystem that borders the United States, Mexico, and Cuba.

Way Forward: Preventing Aquatic Ecosystem Transitions

- ◆ **Climate Change Mitigation:** Addressing climate change through global efforts to reduce greenhouse gas emissions is critical for preventing further warming of oceans and the associated impacts on aquatic ecosystems.

- ◆ **Sustainable Fisheries Management:** Implementing science-based fishing regulations and **establishing marine protected areas** can help maintain fish populations and preserve the health of aquatic ecosystems.
- ◆ **Pollution Reduction:** Efforts to reduce pollution from agricultural runoff, industrial discharges, and urban runoff can improve water quality and protect aquatic habitats.
- ◆ **Conservation Education and Community Engagement:** Raising awareness about the importance of aquatic ecosystems and involving local communities in conservation efforts can foster stewardship and support sustainable practices.
- ◆ **International Cooperation:** International agreements, like the **Convention on Biological Diversity** and the **Paris Agreement**, play a crucial role in guiding conservation efforts.

24. MARINE ECOSYSTEM

The marine ecosystem encompasses the vast oceans and seas that cover more than 70% of the Earth's surface. It plays a pivotal role in regulating global climate, supporting biodiversity, and providing essential resources for human well-being. However, human activities have led to the degradation of marine ecosystems, posing threats to both the environment and society.

Causes of Degradation

- ◆ **Overfishing:** The **collapse of the cod fishery in the North Atlantic** exemplifies the consequences of overfishing.
- ◆ **Habitat Destruction:** Destructive fishing methods like bottom trawling and coral mining, along with coastal development and pollution, destroy **critical marine habitats such as coral reefs, seagrass beds, and mangroves**.
- ◆ **Pollution:** The **Great Pacific Garbage Patch**, a massive accumulation of marine debris, underscores the global issue of marine pollution.
- ◆ **Climate Change:** The **bleaching events in the world's coral reefs** highlight the vulnerability of these ecosystems to climate change.

Conservation Strategies

- ◆ **Marine Protected Areas (MPAs):** The **Chagos Marine Protected Area**, one of the largest in the world, protects diverse coral reefs and marine species.
- ◆ **Sustainable Fisheries Management:** The **Icelandic approach to fisheries management** has resulted in the recovery of the once-depleted cod population.
- ◆ **Ecosystem-Based Management:** The **Galápagos Islands** have implemented ecosystem-based management to preserve their unique marine biodiversity.
- ◆ **Plastic Waste Reduction:** The **European Union's ban on single-use plastics** is an example of proactive plastic waste reduction.
- ◆ **Climate Mitigation and Adaptation:** Reducing greenhouse gas emissions is crucial for addressing climate change's impact on marine ecosystems. The **"Blue Carbon" initiative** focuses on protecting and restoring coastal habitats for carbon sequestration.

25. ESTUARINE ECOSYSTEM

Estuarine ecosystems are dynamic transitional zones where freshwater from rivers meets and mixes with saltwater from the ocean. These environments are characterized by their unique physical,

chemical, and biological features, making them among the most productive and diverse ecosystems on the planet. Estuaries provide a wide array of ecological, economic, and societal benefits. However, these invaluable ecosystems are under threat due to various anthropogenic activities.

Causes of Degradation of the Ecosystem

- ◆ **Pollution:** Pollution leads to eutrophication, harmful algal blooms, and disruption of delicate ecological balances. The degradation of the **Yamuna River estuary** in India exemplifies the impact of pollution on estuarine health.
- ◆ **Habitat Destruction:** The draining of **Florida's Everglades** and the subsequent alteration of the **Greater Everglades Ecosystem** serve as a stark illustration of habitat destruction in estuaries.
- ◆ **Overfishing:** The **depletion of the Caspian Sea** sturgeon population due to overfishing showcases the severe consequences of ignoring sustainable fishing practices.
- ◆ **Climate Change:** The **Sundarbans mangrove forest** faces threats from sea-level rise, as increased salinity can harm mangrove vegetation.

Conservation Strategies

- ◆ **Protected Areas:** Establishing marine protected areas within estuaries can safeguard critical habitats and limit human activities that contribute to degradation.
- ◆ **Sustainable Fisheries:** Implementing and enforcing sustainable fishing practices, such as size limits and catch quotas, can help maintain fish populations and preserve the integrity of estuarine food webs.
- ◆ **Pollution Control:** Implementing and improving wastewater treatment systems, reducing agricultural runoff through best management practices, and raising awareness about plastic pollution can significantly reduce pollutants entering estuaries.
- ◆ **Habitat Restoration:** Restoring degraded habitats like mangroves and seagrass beds is crucial for estuarine ecosystem recovery.
- ◆ **Climate Adaptation:** Developing strategies to mitigate the impacts of climate change, such as creating buffer zones and allowing for natural shoreline migration, can help estuarine ecosystems adapt to changing conditions.

ENVIRONMENTAL POLLUTION AND DEGRADATION

26. ENVIRONMENTAL DEGRADATION: NATURAL AND ANTHROPOGENIC FACTORS

- ◆ **Environmental degradation** refers to the deterioration of the natural environment due to various factors, both natural and human-induced.
- ◆ Anthropogenic Factors of Environmental Degradation: Examples
 - ◆ **Deforestation:** The deforestation of the Amazon rainforest for cattle ranching and soy production contributes to loss of biodiversity and releases stored carbon.
 - ◆ **Air Pollution:** The notorious case of the London Smog in 1952 resulted in thousands of deaths and highlighted the dangers of air pollution.
 - ◆ **Water Pollution:** The pollution of the Ganges River in India due to industrial effluents and sewage negatively affects both human use and aquatic life.

- ◆ **Overfishing:** The collapse of the cod fishery off the coast of Newfoundland, Canada, resulted from overfishing and had cascading effects on the ecosystem.
- ◆ **Case Studies Illustrating Natural and Anthropogenic Factors:**
 - ◆ **Natural Factor Case Study: The 2004 Indian Ocean Tsunami:** The devastating tsunami was triggered by a massive undersea earthquake. It caused widespread destruction along coastlines across multiple countries. Coastal areas experienced habitat destruction, loss of life, and disruption of marine ecosystems due to the powerful waves and inundation.
 - ◆ **Anthropogenic Factor Case Study: Air Pollution in Beijing, China:** Beijing's rapid urbanization and heavy reliance on coal led to severe air pollution, resulting in frequent smog events and health issues. The "Airpocalypse" in Beijing reduced visibility, posed health risks, and raised concerns about the long-term effects of poor air quality on citizens.
- ◆ **Measures to tackle Environmental Degradation:**
 - ◆ **Sustainable Land Use and Conservation:** Costa Rica's Payment for Environmental Services program encourages landowners to preserve forests, contributing to biodiversity conservation.
 - ◆ **Regulation and Green Technologies:** The Clean Air Act in the United States led to significant reductions in air pollutants and improved air quality in many areas.

27. DEGRADATION OF HIMALAYAN ECOSYSTEM

- ◆ The Himalayan ecosystem, renowned for its breathtaking landscapes and rich biodiversity, faces significant degradation due to a multitude of factors. These factors range from natural phenomena to human-induced activities that threaten the delicate balance of this vital region.
- ◆ **Causes of Degradation in the Himalayan Ecosystem: Examples**
 - ◆ **Deforestation:** In the Garhwal Himalayas, excessive logging has eroded hillsides and destabilized slopes, resulting in landslides during monsoons.
 - ◆ **Land Degradation:** The Banni region in the Indian Himalayas has experienced land degradation due to overgrazing by livestock, leading to reduced vegetation cover.
 - ◆ **Glacial Retreat and Melting:** The Gangotri Glacier, a major source of the Ganges River, has been retreating at an alarming rate, impacting downstream water availability.
 - ◆ **Tourism Pressure:** The excessive tourism activity in the town of Manali in Himachal Pradesh has led to littering, pollution, and disturbance to local ecosystems.
- ◆ **Conservation Strategies for the Himalayan Ecosystem: Examples**
 - ◆ **Community-Based Conservation:** The Nanda Devi Biosphere Reserve in India involves local communities in ecotourism initiatives, providing economic benefits while protecting the ecosystem.
 - ◆ **Afforestation and Reforestation:** The Greening Himalayas Project in Nepal aims to reforest areas with native tree species to restore habitat and protect watersheds.
 - ◆ **Climate-Resilient Agriculture:** In Ladakh, traditional Zing farming involves terraced cultivation and water-efficient techniques to adapt to the region's arid climate.
 - ◆ **Glacier Monitoring and Water Management:** The **International Centre for Integrated Mountain Development (ICIMOD)** conducts glacier monitoring and research in the Himalayas to inform water resource management.
 - ◆ **Regulating Tourism and Infrastructure:** Bhutan follows a high-value, low-impact tourism policy that limits the number of tourists and prioritizes cultural and environmental preservation.

28. LAND DEGRADATION AND DESERTIFICATION: THREATS AND GLOBAL ACTIONS

- ◆ **Land degradation and desertification** are critical environmental issues with far-reaching consequences for ecosystems, livelihoods, and global sustainability. These phenomena result from a complex interplay of natural and anthropogenic factors, and their impacts are evident on both local and global scales.
- ◆ **Causes of Land Degradation and Desertification**
 - ◆ **Natural Factors:** Some degree of land degradation is inherent to natural processes, such as erosion, weathering, and soil nutrient depletion. These processes are typically slow and gradual, allowing ecosystems to adapt over time.
 - ◆ **Anthropogenic Factors:** Human activities play a substantial role in the accelerated degradation of land and the expansion of desertified areas. Unsustainable agricultural practices, deforestation, overgrazing, urbanization, and mining are some of the main anthropogenic drivers.
- ◆ **In India,** the Green Revolution led to the adoption of intensive agricultural practices, often reliant on excessive use of chemical fertilizers and pesticides. This has caused soil degradation and reduced soil fertility over time.
- ◆ **Globally,** the expansion of agricultural frontiers in regions like the Amazon rainforest has led to deforestation and soil degradation. The misuse of water resources in regions like the Aral Sea basin, due to large-scale irrigation projects, has caused the sea to shrink significantly and resulted in the exposure of previously submerged salt deposits, rendering the surrounding land barren.
- ◆ **Global Actions:** Global actions include initiatives like the United Nations Convention to Combat Desertification (UNCCD), which aims to combat desertification and mitigate the effects of drought. Additionally, **Sustainable Development Goal 15 (Life on Land)** emphasizes the importance of halting land degradation and restoring degraded land by 2030.
- ◆ **Examples of Successful Initiatives:**
 - ◆ **China's Green Great Wall:** China's afforestation project aims to create a "Green Great Wall" of trees spanning thousands of kilometers to combat desertification and reduce sandstorms.
 - ◆ **The TerrAfrica Program:** This African-driven initiative promotes sustainable land management, helping countries restore degraded land, reduce poverty, and improve food security.

29. PLASTIC POLLUTION: A GLOBAL CHALLENGE

- ◆ Plastic pollution has emerged as one of the most pressing environmental challenges of our time, with far-reaching consequences for ecosystems, human health, and the economy.
- ◆ **Examples of Plastic Pollution:**
 - ◆ **Great Pacific Garbage Patch:** This massive accumulation of floating plastic debris in the North Pacific Ocean is estimated to be twice the size of Texas. It is primarily composed of microplastics and larger plastic fragments.
 - ◆ **Atlantic Garbage Patch:** Similar to the Pacific Garbage Patch, the accumulation of plastic debris in the North Atlantic Ocean highlights the global extent of marine plastic pollution.
- ◆ **Plastic Pollution in Marine Environments and Formation of Gyres**

- ◆ Plastics are particularly concerning in marine environments due to their buoyancy and durability. They accumulate in oceanic gyres, large systems of rotating ocean currents, leading to the formation of plastic "garbage patches."
- ◆ **Pacific Ocean:** The Great Pacific Garbage Patch, located between Hawaii and California, is the most well-known example. It consists of two distinct patches, the Western Garbage Patch and the Eastern Garbage Patch, with a combined area of millions of square kilometers.
- ◆ **Atlantic Ocean:** The North Atlantic garbage patch, located between North America and Europe, is another significant accumulation zone of plastic debris, although it is less studied compared to the Pacific counterpart.
- ◆ **International Laws, Conventions, and Protocols for Tackling Plastic Pollution**
 - ◆ **Basel Convention:** Regulates the transboundary movement of hazardous waste, including plastic waste, aiming to reduce its generation and promote environmentally sound management.
 - ◆ **Marine Pollution Conventions:** Conventions like MARPOL Annex V address the disposal of garbage at sea, including plastics, to prevent marine pollution.
 - ◆ **United Nations Environment Assembly (UNEA):** The UNEA has resolutions on marine litter and microplastics, calling for measures to combat plastic pollution.
 - ◆ India's Efforts to Tackle Plastic Pollution
 - ◆ **Plastic Waste Management Rules (2016):** These rules emphasize waste segregation, collection, and proper disposal of plastic waste. It also promotes the concept of extended producer responsibility.
 - ◆ **Single-Use Plastics Ban:** Several Indian states have banned or restricted single-use plastics, including carry bags and disposable cutlery.
 - ◆ **Clean India Mission:** Part of the Swachh Bharat Abhiyan, this initiative focuses on promoting cleanliness, waste management, and reducing plastic pollution.
 - ◆ **Development of Biodegradable Plastics as a Solution**
 - ◆ Biodegradable plastics are designed to break down naturally into harmless substances over time. They offer a potential solution to the persistence of traditional plastics in the environment.
- ◆ **Examples of Biodegradable Plastics:**
 - ◆ **PHA (Polyhydroxyalkanoates):** These biopolymers are produced by microorganisms and are biodegradable in various environments, including marine settings.
 - ◆ **PLA (Polylactic Acid):** PLA is derived from renewable resources like cornstarch and is compostable, making it suitable for certain applications.

30. CORAL BLEACHING AS AN INDICATOR OF ENVIRONMENT DEGRADATION

- ◆ Coral reefs, often referred to as the "rainforests of the sea," are among the most diverse and productive ecosystems on the planet. They provide habitat for a vast array of marine species, protect coastlines from erosion, and support local economies through tourism and fisheries.
- ◆ **Using Coral Bleaching as an Indicator:**
 - ◆ Coral bleaching is not just a localized issue; it reflects the broader health of marine ecosystems and the planet's overall environmental condition. Here's how coral bleaching serves as an indicator of environmental degradation:

- ◆ **Biodiversity Loss:** Coral reefs support a quarter of all marine species, and their degradation directly impacts marine biodiversity. When coral reefs suffer, it disrupts the balance of entire ecosystems, leading to cascading effects throughout the food chain.
- ◆ **Economic Impact:** Many coastal communities depend on coral reefs for livelihoods through tourism and fisheries. The decline of healthy coral reefs negatively affects local economies, highlighting the interconnectedness of environmental and economic well-being.
- ◆ **Global Significance:** Coral bleaching events are not isolated incidents; they mirror the widespread degradation of marine and terrestrial ecosystems. Their occurrence can serve as a wake-up call to the urgent need for global environmental action.
- ◆ **Examples of Coral Bleaching Impact:**
 - ◆ **Maldives:** The Maldives, a low-lying island nation, relies heavily on its coral reefs for coastal protection, tourism, and fisheries. Coral bleaching threatens its livelihoods and the very existence of the islands due to rising sea levels.
 - ◆ **Caribbean:** The Caribbean, known for its stunning coral reefs, has experienced extensive bleaching in recent years. The decline of these reefs jeopardizes the region's tourism industry and local economies.

31. WATER POLLUTION: IMPACTS ON HUMANS

- ◆ Water, a fundamental resource for life, sustains ecosystems and communities alike. However, the rampant issue of water pollution threatens its quality and availability, thereby impacting human health, economies, and ecosystems.
- ◆ **Laws to Tackle Water Pollution in India:**
 - ◆ **Water (Prevention and Control of Pollution) Act, 1974:** This law aims to prevent and control water pollution by regulating the discharge of pollutants into water bodies. It provides for the establishment of central and state pollution control boards to oversee water quality.
 - ◆ **Environment Protection Act, 1986:** This comprehensive legislation empowers the central government to take measures to protect and improve environmental quality, including water resources.
 - ◆ **National Green Tribunal (NGT) Act, 2010:** The NGT addresses environmental disputes and violations, including those related to water pollution, providing a platform for quick resolution.
- ◆ **Examples of Successful Initiatives:**
 - ◆ **Clean Ganga Mission:** Launched in 2014, this initiative aims to clean and rejuvenate the Ganges River, focusing on reducing pollution and improving water quality. The **Namami Gange program** under this mission aims to ensure effective sewage treatment and industrial waste management.
 - ◆ **National River Conservation Plan (NRCP):** NRCP focuses on pollution abatement in identified stretches of polluted rivers, ensuring wastewater treatment and solid waste management.
- ◆ **Challenges to Tackle Water Pollution in India:**
 - ◆ Lack of Infrastructure
 - ◆ Regulatory Enforcement
 - ◆ Public Awareness
 - ◆ Industrial Compliance

32. RADIOACTIVE POLLUTION: A CLASSIC EXAMPLE OF ANTHROPOGENIC MISMANAGEMENT OF RESOURCE

- ◆ Radioactive pollution, also known as nuclear pollution, is the release of harmful radioactive substances into the environment, posing serious risks to human health, ecosystems, and future generations.
- ◆ **Radioactive Pollution Scenario in India:** India's growing energy demands have led to an increased focus on nuclear power generation.
 - ◆ The **Bhabha Atomic Research Centre (BARC)** in Mumbai is a prominent institution conducting research in nuclear science and technology. However, India also faces challenges in the proper management of radioactive waste.
 - ◆ The **Mayapuri incident in 2010**, where a scrap dealer's improper handling of a radioactive source led to widespread contamination, highlights the need for stringent regulations and proper disposal methods.
- ◆ **Negative Impacts of Radioactive Pollution:**
 - ◆ **Health Risks:** Exposure to ionizing radiation increases the risk of cancer, genetic mutations, and other health disorders in humans. Chernobyl and Fukushima accidents have led to a rise in thyroid cancers and other health issues in affected populations.
 - ◆ **Ecosystem Disruption:** Radioactive pollution can harm flora and fauna, disrupt ecosystems, and affect biodiversity. It can lead to genetic mutations and reproductive abnormalities in wildlife.
 - ◆ **Long-term Contamination:** Some radioactive substances have long half-lives, meaning they remain hazardous for thousands of years. This long-term contamination poses risks to future generations.
- ◆ **Laws, Conventions, and Protocols for Managing Radioactive Pollution:**
 - ◆ **Atomic Energy Act, 1962 (India):** Regulates the use of atomic energy, nuclear facilities, and radioactive substances in India. It emphasizes safety and security in nuclear operations.
 - ◆ **Joint Convention - International Atomic Energy Agency (IAEA):** A United Nations agency promoting peaceful use of nuclear energy and nuclear safety. It sets international standards for nuclear safety and safeguards.
 - ◆ **Nuclear Non-Proliferation Treaty (NPT):** A global treaty aiming to prevent the spread of nuclear weapons and weapons technology while promoting cooperation in peaceful uses of nuclear energy.
 - ◆ **Paris Agreement:** While not specifically targeting radioactive pollution, the Paris Agreement addresses climate change, which is indirectly linked to nuclear power generation as a low-carbon energy source.
 - ◆ **The Bamako Convention:** It is a treaty of African nations prohibiting the import into Africa of any hazardous (including radioactive) waste. The convention came into force in 1998.

33. SOLID WASTE: ISSUES WITH TREATMENT AND DISPOSAL

- ◆ Solid waste management is a critical challenge faced by societies around the world. It involves the collection, transportation, treatment, and disposal of various types of solid waste generated by human activities.
- ◆ **Laws, Conventions, and Protocols for Solid Waste Management:**

- ◆ **Basel Convention:** Controls the transboundary movement of hazardous waste and regulates its disposal to prevent its adverse impacts.
- ◆ **Stockholm Convention:** Aims to protect human health and the environment from persistent organic pollutants (POPs), a subset of hazardous waste.
- ◆ **Sustainable Development Goals (SDGs):** Goal 12 focuses on responsible consumption and production, urging countries to minimize waste generation and manage waste sustainably.
- ◆ **Solid Waste Management Laws in India:**
 - ◆ **Municipal Solid Wastes (Management and Handling) Rules, 2000:** Provides guidelines for the management of solid waste in urban areas, including waste collection, transportation, and disposal.
 - ◆ **Plastic Waste Management Rules, 2016:** Aim to manage plastic waste by reducing its generation, promoting recycling, and ensuring proper disposal.
 - ◆ **E-Waste (Management) Rules, 2016:** Regulate the management of e-waste by controlling its generation, collection, transportation, and disposal.
- ◆ **Examples of Successful Initiatives:**
 - ◆ **Swachh Bharat Abhiyan:** India's national cleanliness campaign aims to achieve an open defecation-free and garbage-free India. It promotes proper waste management and sanitation.
 - ◆ **Waste-Pickers Integration:** In Pune, the "Kagad Kach Patra Kashtakari Panchayat" organization integrates waste-pickers into the formal waste management system, providing them with livelihood opportunities.

34. URBAN POLLUTION: ISSUES AND CHALLENGES

- ◆ Urban pollution is a complex and pressing environmental issue that arises due to the concentration of human activities, industries, and infrastructure in urban areas. As cities grow, they contribute significantly to **air, water, noise, and light pollution**, impacting the health and well-being of both residents and the environment.
- ◆ **Air Pollution:** Air pollution in urban areas is primarily caused by vehicular emissions, industrial activities, and construction. Pollutants like **particulate matter (PM)**, **nitrogen dioxide (NO₂)**, **sulfur dioxide (SO₂)**, and **volatile organic compounds (VOCs)** degrade air quality and harm human health.
- ◆ **Water Pollution:** Urban areas generate vast amounts of wastewater that often ends up in rivers and water bodies without proper treatment. Industrial discharges, improper waste disposal, and sewage contribute to the contamination of water resources.
 - ◆ **For example:** The Ganges River, one of India's holiest rivers, faces severe water pollution due to the **discharge of untreated sewage, industrial effluents, and religious offerings**.
- ◆ **Noise Pollution:** Urbanization brings increased noise levels from traffic, construction, industrial activities, and commercial establishments. Noise pollution has detrimental effects on human health, causing stress, sleep disturbances, and hearing impairments.
 - ◆ **For example:** Mumbai, one of the most densely populated cities in the world, experiences high levels of noise pollution due to the constant traffic congestion, construction projects, and commercial activities.
- ◆ **Light Pollution:** Excessive artificial lighting in urban areas leads to light pollution, which affects both human health and ecosystems. **Glare, skyglow, and light trespass** can disrupt natural light cycles, impacting wildlife and human circadian rhythms.
 - ◆ **For example:** The bright lights of cities like Las Vegas in the United States create significant light pollution.

35. E-WASTE MANAGEMENT: A GROWING CHALLENGE

- ◆ Electronic waste, or e-waste, poses a significant environmental and health challenge as our reliance on electronic devices grows. Improper disposal and lack of effective management have led to pollution, resource depletion, and health hazards.
- ◆ **Global Perspective:** E-waste is a global concern due to the rapid technological advancements and increased consumerism.
 - ◆ The United Nations University (UNU) estimated that the world produced 53.6 million metric tons of e-waste in 2019, a figure expected to grow. However, only about 17.4% of global e-waste was recycled in 2019.
 - ◆ **For example:** In developed countries like Japan, where e-waste recycling infrastructure is well-established, approximately 21% of e-waste generated was recycled in 2019.
- ◆ **Indian Perspective:** India is one of the largest generators of e-waste, driven by the country's growing economy and increasing use of electronic devices. According to a report by ASSOCHAM and NEC, India produced over 3.2 million metric tons of e-waste in 2019.
 - ◆ The country's recycling rate remains low, with only about 10% of e-waste being formally recycled.
 - ◆ **For example:** Despite India's high e-waste generation, the formal recycling rate remains relatively low. The informal sector plays a significant role in handling e-waste, often leading to unregulated and unsafe practices.
- ◆ **Conventions, Laws, and Protocols for E-Waste Management:**
 - ◆ **Basel Convention:** Regulates the transboundary movement of hazardous waste, including e-waste. It aims to minimize the transfer of hazardous waste from developed to developing countries.
 - ◆ **Stockholm Convention:** While primarily addressing persistent organic pollutants, it indirectly affects e-waste due to the presence of hazardous substances in electronic devices.
 - ◆ **Waste Electrical and Electronic Equipment (WEEE) Directive:** A European Union directive that sets targets for the collection, recycling, and recovery of e-waste.
- ◆ **E-Waste Management Laws in India:**
 - ◆ **E-Waste (Management) Rules, 2016:** These rules establish a framework for the proper management of e-waste in India. They require producers to take responsibility for e-waste collection, recycling, and disposal.
 - ◆ **Extended Producer Responsibility (EPR):** Producers are required to manage the entire lifecycle of their products, including e-waste disposal, encouraging sustainable design and responsible recycling.
- ◆ **Successful Initiative: European Union's E-Waste Directive:** This directive has led to the establishment of collection points, recycling facilities, and the proper disposal of e-waste in EU member states. It encourages manufacturers to design products with recyclability in mind.

36. MARINE POLLUTION: THREAT TO MARINE ECOSYSTEM

- ◆ Marine pollution, caused by the introduction of harmful substances into the ocean environment, poses a significant threat to the health of marine ecosystems, biodiversity, and human populations.
- ◆ **Examples of Marine Pollution:**

- ◆ **Deepwater Horizon Oil Spill (2010):** The largest marine oil spill in history, caused by the explosion of an offshore drilling rig, released millions of barrels of oil into the Gulf of Mexico. The spill caused significant harm to marine life and coastal ecosystems.
- ◆ **Great Pacific Garbage Patch:** A massive accumulation of floating plastic debris in the North Pacific Ocean, primarily caused by ocean currents, showcases the extent of plastic pollution's impact on the marine environment.
- ◆ **Laws, Conventions, and Protocols for Marine Pollution:**
 - ◆ **MARPOL Convention:** The International Convention for the Prevention of Pollution from Ships (MARPOL) sets out regulations to prevent various types of pollution from ships, including oil, chemicals, sewage, and garbage.
 - ◆ **London Convention:** An international treaty that regulates the dumping of wastes and other matter at sea.
 - ◆ **Stockholm Convention:** While mainly addressing persistent organic pollutants, it indirectly affects marine pollution due to the presence of hazardous substances in waste.
- ◆ **Marine Litter Laws in India: The Plastic Waste Management Rules, 2016:** These rules provide a framework for managing plastic waste and prohibit littering, burning, and burying of plastic waste.
- ◆ **Successful Initiatives: European Union's Marine Strategy Framework Directive:** This initiative sets targets for reducing marine litter and plastic pollution. It aims to achieve "good environmental status" in European marine waters.

37. SAND MINING: ISSUES AND IMPACT ON ENVIRONMENT

- ◆ Sand mining is an often-overlooked environmental concern that has far-reaching consequences for ecosystems, water bodies, and communities. While sand is a critical resource for construction and industrial activities, the unregulated extraction of sand can lead to habitat degradation, water pollution, and social conflicts.
- ◆ **Issues and Impacts of Sand Mining:**
 - ◆ **Habitat Destruction:** Sand mining alters river and coastal ecosystems, leading to the destruction of aquatic habitats and affecting aquatic biodiversity.
 - ◆ **Sedimentation:** Excessive sand mining can disrupt natural sediment transport in rivers, leading to erosion of riverbanks, increased sedimentation, and changes in river courses.
 - ◆ **Water Quality:** Sand mining can increase sediment runoff into water bodies, affecting water quality, clarity, and oxygen levels, which, in turn, impacts aquatic life.
 - ◆ **Erosion:** Reduced sand flow in rivers due to mining can increase coastal erosion, making shorelines more vulnerable to storms and sea-level rise.
 - ◆ **Social Conflicts:** Unregulated sand mining can lead to conflicts between various stakeholders, including local communities, industries, and authorities, often due to adverse impacts on livelihoods and resources.
- ◆ **Examples of Impact: Chambal River, India:** Uncontrolled sand mining in the Chambal River has led to erosion, reduced water flow, and habitat degradation, affecting fish populations and local communities.
- ◆ **Sand Mining Laws in India:**
 - ◆ **The Mines and Minerals (Development and Regulation) Act, 1957:** Governs the regulation of minerals, including minor minerals like sand, in India.

- ◆ **Environmental Impact Assessment (EIA) Notification, 2006:** Requires sand mining projects to undergo an environmental impact assessment and obtain clearance to assess and mitigate potential environmental impacts.
- ◆ **Successful Initiative: Singapore's Sand Importation:** Due to a scarcity of local sand resources, Singapore has reduced its reliance on imported sand by incorporating more sustainable construction practices and exploring alternatives like recycled materials.

BIODIVERSITY AND CONSERVATION

38. SPECIATION AND EXTINCTION: CAUSES AND CONSEQUENCES OF BIODIVERSITY LOSS

- ◆ Biodiversity, the variety of life on Earth, is shaped by the processes of speciation and extinction. Speciation leads to the formation of new species, contributing to biodiversity, while extinction results in the loss of species, impacting ecosystems and human societies.
- ◆ **Causes of Speciation:**
 - ◆ **Geographic Isolation:** Physical barriers, such as mountains or oceans, can separate populations, preventing gene flow and leading to genetic divergence. For example: Darwin's finches in the Galápagos Islands underwent speciation due to isolation on different islands, resulting in distinct beak shapes adapted to different diets.
 - ◆ **Adaptive Radiation:** Rapid speciation occurs when a single ancestral species diversifies into a variety of ecological niches. For example: The cichlid fish in Africa's Great Lakes underwent adaptive radiation, leading to numerous species with unique feeding behaviors and coloration.
- ◆ **Polyploidy:** Duplication of an entire set of chromosomes in plants can lead to speciation by creating reproductively isolated populations. **For example:** *Tragopogon miscellus*, a hybrid plant species, underwent polyploidy-driven speciation, resulting in a new species with distinct characteristics.
- ◆ **Causes of Extinction:**
 - ◆ **Habitat Loss:** Destruction of natural habitats due to deforestation, urbanization, and agriculture can lead to the loss of species. For example: The **Sumatran rhinoceros** is critically endangered due to habitat loss caused by logging and development.
 - ◆ **Overexploitation:** Unsustainable hunting, fishing, and harvesting can drive species to extinction. For example: The **passenger pigeon** was once abundant in North America but became extinct due to relentless hunting.
- ◆ **Climate Change:** Altered climate patterns can disrupt ecosystems and affect species' ability to survive. For example: **The Bramble Cay melomys**, a small rodent species, became the first mammal species to go extinct due to human-induced climate change.
- ◆ **Global Laws, Conventions, and Protocols:**
 - ◆ **Convention on Biological Diversity (CBD):** Aims to conserve biodiversity, ensure sustainable use of its components, and promote equitable sharing of benefits.
 - ◆ **IUCN Red List:** Provides information about the conservation status of species globally, aiding in prioritizing conservation efforts.
- ◆ **Laws and Initiatives in India:**

- ◆ **Wildlife Protection Act, 1972:** Provides legal protection to endangered species and regulates hunting and trade in wildlife.
- ◆ **Project Tiger and Project Elephant:** Initiatives aimed at conserving and protecting these flagship species and their habitats.
- ◆ **Successful Initiatives: Panda Conservation in China:** China's efforts to protect giant pandas and their habitats have led to an increase in their population and an improvement in their conservation status.

39. REGULATING TRADE IN WILDLIFE: NATIONAL AND INTERNATIONAL EFFORTS

- ◆ The trade in wildlife, both legal and illegal, poses significant threats to biodiversity and ecosystems. Unsustainable trade can lead to species depletion, habitat destruction, and the spread of diseases.
- ◆ **Global Laws, Conventions, and Protocols for Regulating Wildlife Trade:**
 - ◆ **Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES):** Regulates international trade in endangered species through a system of permits and quotas. It classifies species into three appendices based on their level of protection.
 - ◆ **United Nations Convention on Biological Diversity (CBD):** Aims to promote sustainable use of biodiversity and equitable sharing of benefits from its utilization, including trade.
- ◆ **Laws and Initiatives in India for Regulating Wildlife Trade:**
 - ◆ **Wildlife Protection Act, 1972:** Provides legal protection to wildlife and regulates trade in wildlife and their derivatives. For example, it prohibits the trade in products derived from certain endangered species like tigers and elephants.
 - ◆ **Project Snow Leopard:** Aims to conserve the snow leopard and its habitat while addressing human-wildlife conflicts and supporting local communities.
- ◆ **Examples of National and International Efforts:**
 - ◆ **Illegal Wildlife Trade Campaign by World Wildlife Fund (WWF):** WWF's campaign focuses on raising awareness about the illegal wildlife trade and strengthening enforcement against poaching and trafficking.
 - ◆ **Elephant Protection Initiatives in Africa:** African countries have implemented measures to combat the illegal ivory trade, such as strengthening anti-poaching efforts and imposing stricter penalties for wildlife crimes.
- ◆ **Successful Initiatives:**
 - ◆ **Malaysia's Wildlife Forensics:** The use of DNA analysis and forensic techniques has helped Malaysian authorities crack down on wildlife smuggling and prosecute offenders.
 - ◆ **China's Ivory Ban:** China's decision to ban domestic ivory trade in 2017 marked a significant step in curbing demand and reducing the illegal ivory market.

40. ONE HEALTH APPROACH: OPTIMAL HEALTH FOR PEOPLE, ANIMALS AND OUR ENVIRONMENT

- ◆ The One Health approach recognizes the interconnectedness of human, animal, and environmental health. It emphasizes the importance of collaboration across disciplines to achieve optimal health outcomes for all living beings. By understanding the interdependencies between people, animals, and the environment, the One Health approach addresses complex global health challenges, promotes disease prevention, and supports sustainable ecosystems.

◆ **Examples of One Health Approach:**

- ◆ **Zoonotic Diseases:** Many diseases, such as **Ebola, COVID-19, and H1N1**, originate in animals before spilling over to humans. Understanding animal reservoirs, ecosystems, and human interactions is essential to predict, prevent, and respond to such outbreaks.
- ◆ **Antimicrobial Resistance (AMR):** The misuse of antibiotics in both humans and animals contributes to AMR. A One Health approach advocates for responsible antibiotic use, reducing the development and spread of drug-resistant infections.
- ◆ **Ecosystem Health:** Healthy ecosystems support diverse species, natural resources, and human well-being. A One Health perspective considers the impact of environmental degradation on human and animal health, aiming to mitigate ecosystem disruption.
- ◆ **Food Security:** Livestock and agriculture are integral to food security. A One Health approach addresses food safety, animal health, and sustainable agricultural practices to ensure safe and nutritious food for all.

◆ **Challenges in Implementing the One Health Approach in India:**

- ◆ **Interdisciplinary Collaboration:** Addressing zoonotic diseases like avian influenza requires cooperation between human health authorities and veterinarians.
- ◆ **Data Sharing and Surveillance:** Timely information exchange between animal and human health agencies is crucial for containing outbreaks like rabies.
- ◆ **Infrastructure and Resources:** Developing surveillance systems for monitoring AMR across human and animal populations requires substantial investment.
- ◆ **Behavioral Change:** Encouraging responsible pet ownership and proper waste disposal to reduce the risk of disease transmission from animals to humans.
- ◆ **Policy Integration:** Integrating land-use planning, wildlife conservation, and disease prevention strategies to reduce the risk of zoonotic diseases like Nipah virus.

◆ **One Health Implementation Efforts in India:**

- ◆ **National Centre for Disease Control (NCDC) and National Institute of Veterinary Epidemiology and Disease Informatics (NIVEDI):** These institutions collaborate to monitor zoonotic diseases and strengthen disease surveillance and response mechanisms.
- ◆ **National Action Plan on Antimicrobial Resistance (NAP-AMR):** India's NAP-AMR emphasizes the One Health approach to combat AMR by addressing its impact on human, animal, and environmental health.
- ◆ **Rabies Elimination Efforts:** India has made progress in reducing rabies cases through coordinated efforts in animal vaccination, public education, and access to post-exposure prophylaxis.
- ◆ **Global Partnership for Zero Leprosy:** A coalition of organizations works to eliminate leprosy by adopting a One Health approach, integrating leprosy control efforts with broader health and social development initiatives.

41. CIRCULAR ECONOMY

- ◆ **Preface:** By 2050, India's circular economy is likely to be valued at \$2 trillion. This is expected to create close to 10 million jobs by 2050, stated CII in its 'National Circular Economy Framework' (NCEF).
- ◆ **Environmental Benefits of Circular Economy:**
 - ◆ **Resource Conservation:** Patagonia's "Worn Wear" program encourages customers to repair and trade in their old clothing, reducing the demand for new resources and reducing waste.

- ◆ **Waste Reduction:** The Ellen MacArthur Foundation's Jeans Redesign initiative focuses on creating jeans that are more durable, easily recyclable, and environmentally friendly.
- ◆ **Energy Savings:** The Renault Re-Factory project aims to remanufacture automotive components, reducing energy consumption and raw material extraction.
- ◆ **Lower Carbon Emissions:** The "Right to Repair" movement advocates for policies that enable consumers to repair their electronics, reducing the demand for new devices and their associated carbon footprint.
- ◆ **Ecosystem Preservation:** Circular economy practices in the fashion industry, such as using sustainable materials and promoting clothing rentals, contribute to preserving natural ecosystems.
- ◆ **Examples of Circular Economy Initiatives:**
 - ◆ **Cradle to Cradle Certified Products:** Products bearing this certification are designed for recyclability and safe materials, promoting a circular approach.
 - ◆ **The Loop Initiative:** A partnership between retailers and manufacturers, Loop aims to deliver products in reusable packaging, reducing single-use waste.
 - ◆ **E-Waste Recycling Programs:** Various organizations collect and recycle electronic waste, recovering valuable materials and minimizing environmental harm.

42. GENE POOL AND ITS SIGNIFICANCE

- ◆ The gene pool refers to the complete set of genes and alleles within a population of a species. It is a dynamic reservoir of genetic diversity that underpins the adaptation and evolution of organisms. Gene pool centres play a critical role in preserving this diversity, ensuring species resilience, and supporting ecosystem health.
- ◆ **Global Gene Pool Centres:**
 - ◆ **Svalbard Global Seed Vault, Norway:** This "Doomsday Vault" safeguards the world's seed diversity, ensuring that genetic resources are conserved even in the face of global crises.
 - ◆ **International Rice Genebank, Philippines:** The genebank conserves a diverse collection of rice varieties, contributing to the global food security of one of the most important staple crops.
 - ◆ **Kew Royal Botanic Gardens, UK:** Kew's Millennium Seed Bank Partnership conserves seeds from plants around the world, supporting plant research, habitat restoration, and crop improvement.
 - ◆ **National Center for Genetic Resources Preservation, USA:** It preserves animal genetic material, including semen and embryos, ensuring the genetic diversity of livestock species.
 - ◆ **Global Invasive Species Programme, South Africa:** While focused on invasive species, the programme highlights the importance of preserving gene pools by preventing the spread of harmful non-native species.
- ◆ **Gene Pool Centres in India:**
 - ◆ **National Bureau of Plant Genetic Resources (NBPGR):** NBPGR conserves diverse plant genetic resources for crop improvement, including the famous wheat variety "Lok1" with disease resistance traits.
 - ◆ **Central Zoo Authority (CZA):** CZA manages and conserves captive populations of endangered animals, contributing to the preservation of genetic diversity and species recovery.

- ◆ **Botanical Survey of India:** This organization works on documenting and conserving plant diversity across India, including rare and endangered species like the "Ceropegia radicans."
- ◆ **National Bureau of Fish Genetic Resources (NBFGR):** NBFGR conserves fish genetic resources, supporting sustainable aquaculture and fisheries management.
- ◆ **Salim Ali Centre for Ornithology and Natural History (SACON):** SACON focuses on bird conservation, preserving genetic diversity and supporting the survival of avian species.

43. CHEETAH RE-INTRODUCTION: SIGNIFICANCE AND CHALLENGES

- ◆ Cheetah re-introduction is a complex and ambitious conservation effort aimed at restoring one of the world's most iconic and charismatic big cat species to its historical range. While this endeavor holds immense significance for biodiversity and ecosystem health, it also presents numerous challenges that need to be addressed for successful outcomes.
- ◆ **Challenges Faced by Cheetah Re-introduction in India:** India's attempt to reintroduce cheetahs is facing significant challenges that hamper successful outcomes:
 - ◆ **Loss of Historical Range:** The original habitat of the Indian cheetah, also known as the Asiatic cheetah, has shrunk drastically due to human activities, leaving limited areas for their reintroduction.
 - ◆ **Low Genetic Diversity:** The Indian cheetah population is critically low, and finding genetically diverse individuals for reintroduction is difficult, as most remaining populations are related.
 - ◆ **Human-Wildlife Conflict:** Conflicts between cheetahs and local communities, particularly livestock herders, have resulted in negative attitudes and opposition to their re-introduction.
 - ◆ **Legal and Regulatory Issues:** Complex legal and regulatory frameworks concerning captive breeding, translocation, and reintroduction are challenging to navigate.
 - ◆ **Lack of Infrastructure:** Inadequate infrastructure, monitoring mechanisms, and trained personnel for managing reintroduced cheetah populations pose significant hurdles.
- ◆ **Examples of Cheetah Re-introduction Challenges:**
 - ◆ **Namibia's Cheetah Conservation:** Namibia faced challenges when reintroducing cheetahs, including livestock predation leading to conflicts between cheetahs and farmers.
 - ◆ **South Africa's Reintroduction Efforts:** Despite successful re-introductions, South Africa continues to face challenges related to genetic diversity and maintaining a balanced predator-prey dynamic.
 - ◆ **Cheetah Re-introduction Failures in India:** India's efforts to reintroduce cheetahs have faced setbacks, with several reasons contributing to the failure:
 - ◆ **Infection:** Three cheetahs have been lost to the infection septicaemia, caused by winter coat. Tblicy / Dhatri, the last female Namibian cheetah died of infection as she was skittish and could not be darted for capture and treatment.
 - ◆ **Ecological Adaptation:** The cheetahs reintroduced will require more time to adapt to Indian weather conditions. In southern Africa, cheetahs often give birth in late summer or early autumn and if the litters are lost in the seasons, the replacement births are given in late winter or early spring. The reintroduced female cheetahs are yet to adapt to opposite seasons in Asia and hence the mortality is expected to be high during initial years.
 - ◆ **Habitat Assessment:** Identifying suitable and safe habitats for cheetahs within their historical range has proven difficult due to habitat degradation and human presence.

- ◆ **Scientific Concerns:** Some conservationists question the feasibility of the reintroduction given the challenges related to habitat, prey availability, and genetic diversity.

44. VULTURES: ISSUES AND CHALLENGES IN THEIR CONSERVATION

- ◆ Vultures, as nature's clean-up crew, play a vital role in maintaining ecosystem health by feeding on carrion and preventing the spread of diseases. However, vulture populations worldwide have been facing severe declines due to a range of issues and challenges.
- ◆ **Challenges in Vulture Conservation:**
 - ◆ **Toxicity of Diclofenac:** Despite regulatory bans on diclofenac in veterinary use, its illegal use and availability in the market continue to poison vultures. For example: In India, diclofenac use led to a 97% decline in vulture populations in just a few years.
 - ◆ **Cultural Beliefs and Practices:** The use of vulture body parts in traditional medicine and rituals poses a challenge to conservation efforts. For example: In some parts of Southeast Asia, vulture parts are believed to possess medicinal and supernatural properties.
 - ◆ **Lack of Suitable Habitat:** Urbanization and habitat fragmentation have reduced available nesting and foraging sites, affecting vulture breeding success. For example: Vultures in Africa face habitat loss due to agricultural expansion and human settlements.
 - ◆ **Limited Breeding Success:** Vultures have slow reproductive rates, producing few chicks each year, making population recovery challenging. For example: Egyptian Vultures in Europe have low breeding success due to factors such as nest disturbance and lack of food.
 - ◆ **Delayed Action:** Conservation efforts often begin only after populations have significantly declined, making recovery more difficult. For example: The drastic decline of the California Condor prompted captive breeding programs to ensure their survival.
- ◆ **Examples of Successful Conservation Efforts:**
 - ◆ **Indian Vulture Crisis:** In India, organizations like the Vulture Conservation Foundation have been working on safe vulture restaurants, captive breeding, and advocacy to combat the diclofenac issue.
 - ◆ **Gyps Vulture Restoration Project, Nepal:** The project has focused on captive breeding and raising awareness, resulting in the release of captive-bred vultures into the wild.
 - ◆ **California Condor Recovery Program:** This program involves captive breeding, release, and monitoring of California Condors, which has resulted in population growth.

45. INDIAN RHINO VISION 2020: SUCCESS AND IMPACT ON ENVIRONMENT

- ◆ The Indian Rhino Vision 2020 (IRV 2020) is a significant conservation initiative aimed at ensuring the long-term survival of the Indian rhinoceros (*Rhinoceros unicornis*) population in Assam, India. Through a combination of habitat restoration, protection, and translocation efforts, the project has achieved remarkable success in reviving the population of this iconic species and has had a positive impact on the overall ecosystem.
- ◆ **Factors for the Success of Indian Rhino Vision 2020:**
 - ◆ **Collaboration and Partnership:** The success of IRV 2020 can be attributed to the strong collaboration between various stakeholders, including governmental agencies, non-governmental organizations, local communities, and international conservation bodies. For example: The partnership between the Assam Forest Department and organizations

like WWF-India and the International Rhino Foundation has contributed to effective implementation.

- ◆ **Translocation of Rhinos:** The project focused on establishing viable populations of Indian rhinos in protected areas beyond Kaziranga National Park. Rhinos were translocated to Manas National Park and other sites. For example: The successful translocation of rhinos to Manas National Park led to the establishment of a new population there, contributing to species dispersal and population growth.
- ◆ **Habitat Restoration:** Efforts were made to restore and expand suitable habitats for rhinos in protected areas. This involved anti-poaching measures, habitat management, and removal of invasive species. For example: In Kaziranga National Park, habitat management included controlled burning to prevent excessive growth of tall grasses, maintaining open areas preferred by rhinos.
- ◆ **Anti-Poaching Measures:** Strengthened anti-poaching measures, including deployment of well-trained forest guards and use of modern surveillance technology, played a critical role in reducing poaching incidents. For example: Increased vigilance and rapid response units helped deter poachers and protect the rhino population.
- ◆ **Community Engagement:** Involvement of local communities in conservation efforts through education, awareness, and providing livelihood alternatives reduced human-wildlife conflicts and garnered local support. For example: Awareness campaigns about the importance of rhino conservation helped foster a sense of ownership among nearby communities.

46. DOLPHIN: HABITAT FRAGMENTATION AND LOSS

- ◆ Dolphins, intelligent and charismatic marine mammals, inhabit diverse aquatic environments, ranging from oceans to rivers. However, their habitats are increasingly fragmented and lost due to human activities, endangering their populations. In India, various species of dolphins are facing habitat fragmentation and loss, leading to heightened extinction risks.
- ◆ **Types of Dolphins in India and their Habitat Challenges:**
 - ◆ **Ganges River Dolphin (*Platanista gangetica*):** This freshwater dolphin inhabits the Ganges, Brahmaputra, and Meghna river systems. Habitat fragmentation due to dam construction, pollution, and unsustainable fishing practices threatens their populations. For example: The Farakka Barrage on the Ganges has disrupted the dolphins' natural migration patterns and habitat connectivity.
 - ◆ **Indo-Pacific Humpback Dolphin (*Sousa chinensis*):** These dolphins inhabit coastal and estuarine waters along the Indian subcontinent. Urbanization, habitat degradation, and boat traffic lead to habitat loss and conflicts. For example: The construction of ports and harbors often results in habitat destruction and increases the risk of collisions with vessels.
 - ◆ **Irrawaddy Dolphin (*Orcaella brevirostris*):** These freshwater and estuarine dolphins reside in rivers and coastal areas of the Bay of Bengal. Habitat degradation, water pollution, and fisheries bycatch pose threats to their survival. For example: Dams and water extraction alter river flow, affecting the availability of suitable habitats for Irrawaddy dolphins.
- ◆ **Conservation Programs in India:**
 - ◆ **Project Dolphin:** Launched in 2020, this national conservation program aims to safeguard both river and marine dolphins in India. It focuses on habitat conservation, reducing threats, and raising awareness.
 - ◆ **Ganges River Dolphin Conservation Action Plan:** This plan outlines strategies for habitat protection, reducing pollution, promoting sustainable fishing practices, and establishing conservation reserves.

47. CLIMATE CHANGE MITIGATION: GLOBAL EFFORTS

Climate change mitigation refers to actions and strategies aimed at reducing greenhouse gas emissions to limit the extent of global warming and its adverse impacts. The global community has recognized the urgency of addressing climate change and has undertaken various efforts to mitigate its effects.

◆ **United Nations Framework Convention on Climate Change (UNFCCC):**

The UNFCCC, established in 1992, serves as the foundation for international cooperation on climate change. It has led to significant milestones and agreements aimed at mitigating climate change:

- ◆ **The Kyoto Protocol (1997)** established legally binding emission reduction targets for developed countries. Although it faced limitations, it laid the groundwork for future climate agreements.
- ◆ **The Paris Agreement (2015)** brought nearly all nations together to set voluntary emission reduction targets and aim to limit global warming to well below 2 degrees Celsius above pre-industrial levels.
- ◆ **Intergovernmental Panel on Climate Change (IPCC):** The IPCC's various assessment reports provide crucial scientific insights that inform global climate policies and actions.
- ◆ **Nationally Determined Contributions (NDCs):** The European Union pledged to reduce emissions by at least 40% by 2030 compared to 1990 levels. China committed to peak its emissions by 2030 and increase the share of non-fossil fuels in its energy mix.
- ◆ **Renewable Energy Transition:** The International Solar Alliance, launched in 2015, aims to promote solar energy adoption and mobilize investments in solar projects across the globe.
- ◆ **Reforestation and Afforestation:** The Bonn Challenge, launched in 2011, seeks to restore 350 million hectares of degraded land by 2030, thereby contributing to carbon sequestration and biodiversity conservation.
- ◆ **Carbon Pricing:** The European Union Emissions Trading System (EU ETS) is the world's largest carbon market, covering sectors responsible for about 40% of the EU's greenhouse gas emissions.
- ◆ **Global Renewable Energy Initiatives:** The International Renewable Energy Agency (IRENA) facilitates the exchange of knowledge and experiences, promotes policies, and supports capacity building for renewable energy deployment.
- ◆ **Sustainable Development Goals (SDGs):** SDG 7 aims to ensure access to affordable, reliable, sustainable, and modern energy for all, promoting a transition to clean energy sources.
- ◆ **Technology Transfer and Financing:** The Green Climate Fund was established to provide financial resources to developing countries to support climate action and adaptation.
- ◆ **Global Climate Finance:** The Adaptation Fund, established under the Kyoto Protocol, finances concrete adaptation projects and programs in developing countries.
