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PAPER - IV - UNIT - II
ENVIRONMENT, BIODIVERSITY AND DISASTER MANAGEMENT

பொது அறிவு

GENERAL STUDIES

கால அளவு: மூன்று மணி நேரம் **மொத்த மதிப்பெண்: 250**

Duration : 3 Hours **Total Marks : 250**

பிரிவு - அ

SECTION - A

(10 x 10 = 100)

1. **சுற்றுச்சூழல் பிரமிடுகள் குறித்து குறிப்பெழுதுக.**
   Write a note on Ecological Pyramids.

   Ecological Pyramids:

   - An ecological pyramid is a graphical representation of the trophic levels within an ecosystem, illustrating the relationships among producers, consumers, and decomposers. Each horizontal bar in the pyramid depicts a specific trophic level, with the size of the bar representing the total number of organisms, biomass, or energy at that level.
   - **Base**: Composed of producers.
   - **Tip**: Occupied by top-level carnivores.
   - Intermediate bars represent other consumer trophic levels.

   Types of Ecological Pyramids:

   - Ecological pyramids are classified into three types:
     - **Pyramid of Numbers**
     - **Pyramid of Biomass**

- **Pyramid of Energy**

Pyramid of Numbers:

- This pyramid represents the total number of organisms at each trophic level.
- The structure of the pyramid depends on the ecosystem and organism sizes.
- Counting every individual in a population is challenging, so it may not always provide a complete picture.

Upright Pyramid of Numbers:

- Seen in ecosystems like grasslands and ponds.
- Producers, such as grasses, form a broad base due to their abundance.
- Herbivores (e.g., grasshoppers) form the next level, with fewer individuals than producers.
- Primary carnivores (e.g., rats) feed on herbivores and are fewer in number.
- Secondary carnivores (e.g., snakes) feed on primary carnivores, and the apex predators (e.g., hawks) form the smallest group.

Inverted Pyramid of Numbers:

- Seen in ecosystems like forests.
- A single large producer (e.g., a tree) may support numerous herbivores, creating a narrower base.
- Higher trophic levels have progressively fewer individuals.

Pyramid of Biomass:

- This pyramid illustrates the total dry weight of organisms (biomass) at each trophic level, overcoming the size-related challenges seen in the pyramid of numbers.

Upright Pyramid of Biomass:

- Common in terrestrial ecosystems.
- Producers (e.g., plants) have the largest biomass.
- Primary consumers (e.g., herbivores) have less biomass than producers.
- Secondary consumers and top carnivores form progressively smaller biomass levels.

Inverted Pyramid of Biomass:

- Typical in aquatic ecosystems.
- Tiny producers like phytoplankton, despite rapid reproduction, have a lower biomass than consumers (e.g., zooplankton).

- Consumer biomass can exceed producer biomass, resulting in an inverted structure.

Pyramid of Energy:

- This pyramid depicts the energy flow at each trophic level, always maintaining an upright structure due to energy loss during transfer.
  - Producers capture solar energy, but only a small portion is stored as energy-rich materials.
  - Herbivores that consume producers retain 10% of this energy, while the rest is lost in metabolism.
  - Higher trophic levels (e.g., carnivores) receive diminishing energy amounts, following the **10% energy transfer rule**.

Importance:

- Explains energy dynamics and biological magnification (the increasing concentration of toxic substances at higher trophic levels).

Ecological Efficiency and Energy Transfer:

- Ecological efficiency measures the percentage of energy transferred between trophic levels, restricted by:
  - Energy lost to respiration and metabolism.
  - Inefficiencies in energy conversion.

Limitations of Ecological Pyramids:

- Does not account for species that occupy multiple trophic levels.
- Simplifies complex food webs into linear food chains.
- Excludes saprophytes, which play crucial ecological roles.

2. **உயிர்மம் (Biome) என்ற சொல்லை வரையறுக்க. நிலப்பரப்பு உயிர்மம்களை பட்டியலிடுக மேலும் சவானா உயிர்மத்தின் பண்புகளை விவரிக்க.**

Define the term Biome. List out the terrestrial Biomes and describe the characteristics of savanna Biomes.

- A biome is a large, naturally occurring area with a specific climate, vegetation, and animal life. Biomes are named and classified based on the plants, animals, and atmosphere in the area. Terrestrial biomes are land-based biomes, and are usually defined by the type of vegetation.

The eight major terrestrial biomes are:

- Tropical rainforests, Savannas, Deserts, Chaparral, Temperate grasslands, Temperate forests, Boreal forests, and Arctic tundra.

Characteristics of the Savanna Biome:

- The savanna biome is known for its unique climate, vegetation, soil, and diverse wildlife. It serves as a transitional zone between forested and grass-dominated ecosystems.

Climate:

- Features a transitional climate with two distinct seasons:
  - **Rainy summer**
  - **Dry winter**
- Temperatures remain warm year-round, ranging from 68°F to 86°F (20°C to 30°C).

Vegetation:

- Dominated by grasses interspersed with scattered trees, shrubs, and other vegetation.
- Grasses are short and grow close to the ground, enabling water conservation during dry periods.
- Certain tree species store water in their roots and produce leaves only during the wet season.

Soil:

- The soil is predominantly barren with a reddish hue, owing to its high iron content.
- Highly porous soil facilitates rapid drainage, limiting water retention.

Animals:

- Home to large herds of grazing animals such as elephants, zebras, and antelopes.

Location:

- Acts as a transitional biome, situated between forested regions and grass-dominated areas.

3. **இழப்பீட்டு காடு வளர்ப்பு நிதி (CAMPA) குறித்து எழுதுக, மற்றும் அதனுடன் தொடர்புடைய பல்வேறு சவால்களை குறித்து விவாதிக்க.**

Write about the Compensatory Afforestation Fund (CAMPA) and discuss the various challenges associated with it.

Compensatory Afforestation Fund Management and Planning Authority (CAMPA):

- The **Compensatory Afforestation Fund Management and Planning Authority (CAMPA)** is a key initiative in India's environmental conservation framework. It is designed to mitigate the environmental

impact of deforestation caused by industrial and developmental activities through afforestation and related conservation measures.

Key Functions:

- **Afforestation:** Facilitate compensatory afforestation on non-forest land to replace forest areas diverted for non-forest purposes.
- **Fund Management:** Administer funds collected from user agencies, including the Net Present Value (NPV) of diverted forest land and project-specific payments.
- **Conservation:** Support projects such as watershed management, soil conservation, and wildlife protection as part of the afforestation and reforestation efforts.

Compensatory Afforestation Fund Act, 2016:

- Recognizing the need for formalization, the Compensatory Afforestation Fund Act, 2016, established a clear framework for managing afforestation funds.

Key Provisions:

Funds Establishment:

- **National Compensatory Afforestation Fund (NCAF):** Under the Public Account of India.
- **State Compensatory Afforestation Funds (SCAFs):** Under the Public Accounts of respective states.

Revenue Sources:

- Payments for compensatory afforestation.
- Net Present Value (NPV) of forests.
- Project-specific contributions by user agencies.

Fund Allocation:

- 10% of the funds allocated to NCAF.
- 90% allocated to respective SCAFs.

Statutory Oversight:

- Annual audits of accounts by the Comptroller and Auditor General (CAG) to ensure accountability.

Challenges in CAMPA Implementation:

- Despite its structured framework, CAMPA faces significant challenges that hinder its effectiveness:

Availability of Non-Forest Land:

- Finding suitable non-forest land for afforestation is a persistent issue, particularly in smaller or heavily forested states like Chhattisgarh.
- The requirement to locate compensatory land contiguous to the diverted forest exacerbates the problem, limiting options.

Fund Utilization Diversion:

- CAMPA funds are sometimes used for broader environmental initiatives, such as Green India programs, instead of direct afforestation efforts.
- This dilution of focus calls for strict monitoring to ensure funds are utilized appropriately.

Impact on Tribal and Forest Dweller Rights:

- Tribal communities and forest dwellers, who depend on forests for their livelihood, often feel side-lined.
- Decisions on fund utilization are made unilaterally by forest bureaucracies, undermining the participatory approach mandated by laws like the Forest Rights Act, 2006.

Monitoring and Accountability:

- While the Act mandates audits, on-ground implementation suffers from lack of transparency and inefficiency.
- Weak monitoring systems make it difficult to track progress and outcomes of afforestation projects.

Quality of Afforestation Efforts:

- Many afforestation projects prioritize planting monocultures instead of native species, leading to ecological imbalances and reduced biodiversity.

4. **பல்லுயிர் இனங்களின் பல்வேறு வகைகளை விளக்குக.**

Explain the various types of Biodiversity species.

Species Diversity:

- Species diversity refers to the variety of species present in a specific region or ecosystem, including plants, animals, fungi, and microorganisms.

Key Features:

- Measured by species richness (the number of species) and species evenness (the distribution of individuals among species).
- Higher species diversity contributes to ecosystem resilience, enabling ecosystems to withstand environmental changes.

Examples:

- The Amazon rainforest has high species diversity, with millions of species of plants, animals, and microorganisms.
- Coral reefs host diverse marine species, from colorful fish to coral polyps and sea turtles.

Genetic Diversity:

- Genetic diversity refers to the variety of genetic material within a species population.

Key Features:

- Provides the raw material for evolution and adaptation to changing environments.
- Essential for species survival, as greater genetic diversity reduces vulnerability to diseases and environmental changes.

Examples:

- Different breeds of domesticated animals, such as dogs, exhibit genetic diversity within a single species.
- Wild rice species contain genetic traits that provide resistance to pests and drought, which can be crucial for agricultural improvement.

Ecosystem Diversity

- Ecosystem diversity refers to the variety of ecosystems found within a region or globally.

Key Features:

- Encompasses both the biological communities and the physical environments they inhabit.
- Includes natural ecosystems like forests, deserts, wetlands, and human-modified landscapes.

Examples:

- Coastal ecosystems include mangroves, coral reefs, and estuaries, each supporting distinct life forms.
- Mountain ecosystem feature alpine meadows, coniferous forests, and glaciers, all interconnected in a unique ecological network.

Other Aspects of Biodiversity:

Ecological Biodiversity:

- Refers to the interactions among species within ecosystems, including food chains and food webs.
- Essential for maintaining ecosystem stability and functionality.

- **Example:** The relationship between predators, prey, and plant species in a grassland ecosystem.

Invasive Alien Species:

- Non-native species that invade ecosystems, often outcompeting or harming native species.
- Impact biodiversity by altering habitats, food chains, and ecosystem dynamics.
- Example: The introduction of **water hyacinth** in freshwater ecosystems, which outcompetes native aquatic plants and reduces oxygen levels.

Pollution:

- Air, soil, and water pollution directly harm species by degrading habitats and increasing vulnerability to diseases or predation.
- Example: **Oil spills** in marine environments harm aquatic life by reducing oxygen levels and contaminating the food chain.

5. **கடல் சுற்றுச்சூழல் அமைப்புகளில் 'இறந்த மண்டலங்கள்' பரவுவதால் ஏற்படும் விளைவுகள் யாவை?**

What are the consequences of the spreading of 'Dead Zones' on marine ecosystems?

Dead Zone:

- A Dead Zone is an area of the ocean with low or no oxygen levels, where marine life cannot survive.

Consequences of Spreading Dead Zones:

- Dead zones, areas in oceans or freshwater bodies with low or no oxygen (hypoxic zones), have far-reaching consequences on marine ecosystems, economic livelihoods, and human health. The spread of dead zones, primarily due to nutrient pollution and eutrophication, has emerged as a significant environmental concern.

Environmental Consequences:

Loss of Marine Biodiversity:

- Oxygen deprivation causes mass deaths of marine organisms such as fish, crabs, and mollusks.
- Keystone species' loss can disrupt food chains and weaken ecosystem resilience.

Alteration of Food Webs:

- Hypoxic conditions favor more resilient species, such as jellyfish, over others, disrupting ecological balance.

- Decline in predatory species impacts the structure and functionality of ecosystems.

Proliferation of Harmful Algal Blooms (HABs):

- Dead zones encourage the growth of harmful algal blooms, producing toxins harmful to marine life and humans.

Increased Carbon Emissions:

- Decomposition of organic matter in dead zones releases carbon dioxide and methane, potent greenhouse gases that exacerbate climate change.

Economic Consequences:

Impact on Fisheries:

- Depletion of fish stocks directly affects the livelihood of fishing communities.
- Loss of commercially valuable species reduces revenue for the fishing industry.

Tourism Losses:

- Poor water quality and visible signs of ecosystem distress deter tourists, negatively impacting coastal economies.

Reduced Aquaculture Productivity:

- Hypoxic conditions impair aquaculture operations, leading to lower yields and increased operational costs.

Human Health Consequences:

Contamination of Seafood:

- Toxins from harmful algal blooms can accumulate in seafood, posing risks like shellfish poisoning.

Water Quality Degradation:

- Hypoxic water bodies may harbor pathogenic bacteria, increasing the risk of waterborne diseases for local communities.

Examples of Dead Zones:

- **Gulf of Mexico Dead Zone:** Among the largest, caused by agricultural runoff from the Mississippi River.
- **Baltic Sea Dead Zone:** One of the most persistent, fueled by nutrient runoff from surrounding nations.
- **Chesapeake Bay Dead Zone:** Affected by urban and agricultural runoff.
- **Black Sea Dead Zone:** Improved with reduced industrial discharge but still at risk.
- **Lake Erie Dead Zone:** Reoccurring issue tied to fertilizer runoff.

6. பல்லுயிர் அளவீடு குறித்து எழுதுக. வெப்ப மண்டல பகுதிகளில் பல்லுயிர் பெருக்கத்திற்கான காரணங்கள் யாவை?

Write about the measurement of Biodiversity. What are the reasons for the richness of Biodiversity in tropical areas?

- Biodiversity is measured by assessing the variety of living organisms within a given area, considering factors like species richness (the number of different species present), species evenness (the relative abundance of each species), and genetic diversity within populations.

Key methods to measure biodiversity:

Species richness:

- A simple count of the number of different species found in a particular habitat.

Species evenness:

- Measures how evenly distributed individuals are across the different species present in a community.

Diversity indices:

- Mathematical calculations that incorporate both species richness and evenness, such as the Shannon diversity index or Simpson's diversity index.

Habitat analysis:

- Identifying and mapping different types of habitats within a region to understand potential biodiversity variation.

Genetic analysis:

- Studying the genetic diversity within populations of a species to assess their potential resilience.
- Several factors contribute to the high biodiversity in tropical regions, including:

Stable climate:

- Tropical areas generally experience consistent temperatures and high rainfall throughout the year, providing favorable conditions for a wide variety of species to thrive.

High solar radiation:

- The intense sunlight in the tropics leads to high primary productivity, supporting a large biomass and diverse food webs.

Niche specialization:

- With a stable environment, species can evolve specialized traits to occupy specific ecological niches, allowing for greater species diversity.

Evolutionary history:

- Tropical regions have been relatively stable for long periods, allowing for extensive species diversification and evolution.

Complex vegetation structure:

- Tropical rainforests have multiple canopy layers and diverse plant structures, providing a wide range of habitats for different animal species.

Coevolutionary interactions:

- The close interactions between plant and animal species in tropical ecosystems drive coevolution, leading to further species diversification.

Important points to consider:

Latitudinal diversity gradient:

- The pattern where biodiversity generally decreases as you move away from the equator is known as the latitudinal diversity gradient.

Biodiversity hotspots:

- Certain tropical regions with exceptionally high biodiversity and high threat of species loss are identified as biodiversity hotspots.

Challenges in measuring biodiversity:

- Accurate assessment of biodiversity can be challenging due to the vast number of species, difficulty in accessing remote areas, and limitations in species identification.

7. உயிர்வேதியியல் சுழற்சி என்றால் என்ன? அவற்றை விளக்குக.

What is Biogeochemical cycle? and explain.

Biogeochemical Cycle

- The biogeochemical cycle refers to the continuous movement and transformation of chemical elements between living (biotic) and non-living (abiotic) components of Earth, recycling nutrients essential for life.

Key Points About Biogeochemical Cycles

Definition:

- The term "biogeochemical" combines "biological," "geological," and "chemical," reflecting interactions among living organisms, Earth's processes, and chemical reactions.

Major Cycles:

- Carbon Cycle

- Nitrogen Cycle
- Water Cycle
- Phosphorus Cycle
- Sulfur Cycle

Processes in a Cycle:

- **Absorption**: Elements are absorbed by plants from the environment.
- **Consumption**: Animals obtain these elements by eating plants or other animals.
- **Decomposition**: Microbes break down organic matter, returning nutrients to the environment.
- **Release**: Elements are released back into air, water, or soil.

Importance:

- Maintains the balance of essential nutrients in ecosystems.
- Ensures availability of nutrients for survival and growth of organisms.

Example: The Carbon Cycle

Photosynthesis:

- Plants absorb atmospheric CO_2 and convert it into organic compounds.

Food Chain:

- Carbon moves through the food chain when animals consume plants or other animals.

Respiration:

- Plants and animals release CO_2 back into the atmosphere during cellular respiration.

Decomposition:

- Dead organisms are broken down by decomposers, releasing carbon into the soil and atmosphere.

8. **வனவிலங்குகள் மற்றும் தாவரங்களின் அழிந்துவரும் உயிரினங்களில் சர்வதேச வர்த்தகத்திற்கான மாநாட்டின் (CITES) நோக்கம், குறிக்கோள் மறறும் முக்கியத்துவம் குறித்து விவாதிக்க.**

Discuss the aim, objective, and importance of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Aim:

- Ensure that international trade does not threaten the survival of wild animals and plants.
- Maintain ecological balance and safeguard biodiversity.

Objectives:

- Promote Cooperation Among Member Countries
- Foster collaboration between nations to regulate and monitor wildlife trade.

Ensure Sustainability:

- Emphasize sustainable use of species to prevent population decline or extinction.

Regulate International Trade of Species:

- Use a system of permits and certificates to ensure legal and traceable trade.

Protect Species from Illegal and Unsustainable Exploitation:

- Combat illegal wildlife trade and overexploitation of species.

Contribute to Sustainable Development Goals (SDGs):

- Support global environmental and economic goals through biodiversity protection.

Importance:

Prevention of Extinction:

- Protects species from extinction and prevents irreversible ecological damage.

Ecological Balance:

- Maintains ecosystem stability and vital services like pollination and water purification.

Economic and Social Benefits:

- Supports livelihoods dependent on biodiversity and mitigates negative economic impacts.

Global Cooperation:

- Strengthens international efforts to combat wildlife crime and implement conservation strategies.
- CITES is a critical international agreement that ensures the survival of endangered species while contributing to environmental, social, and economic sustainability globally.

9. **சூழலியல் என்றால் என்ன? அதன் செயல்பாடுகளை விளக்குக.**

What is Ecology? Explain the functions of the Ecosystem.

- Ecology is a branch of biology that explores the interactions between living organisms and their environment, studying relationships at various levels, from individual organisms to the entire biosphere.

- Ecologists investigate diverse environments and organisms, ranging from microscopic bacteria to complex ecosystems like forests and deserts.
- Understanding ecology is essential for improving environmental conditions, managing resources sustainably, and protecting human health.

What is an Ecosystem?

- An ecosystem is a natural system where living (biotic) components, such as plants, animals, and microorganisms, interact with non-living (abiotic) components like air, water, and soil.

Functions of an Ecosystem:

Energy Flow:

- Solar energy is captured by producers (plants) and transferred through the food chain to consumers and decomposers.

Nutrient Cycling:

- Elements like carbon, nitrogen, and phosphorus are recycled through biogeochemical cycles, ensuring their availability for organisms.

Water Cycling:

- Water moves through the ecosystem via processes like evaporation, precipitation, and transpiration, supporting life.

Soil Formation:

- Decomposition of organic matter and weathering of rocks contribute to the formation of fertile soil essential for plant growth.

Pollination:

- Pollinators like bees and birds facilitate the reproduction of flowering plants, essential for ecosystem stability.

Climate Regulation:

- Ecosystems regulate local and global climates by absorbing CO_2, releasing oxygen, and maintaining humidity.

Habitat Provision:

- Ecosystems provide shelter and resources for a diverse range of organisms.

Cultural and Recreational Services:

- Ecosystems offer aesthetic, spiritual, educational, and recreational value to humans.

10."இந்தியாவின் பல பெரிய நகரங்களில் நகர்ப்புற காற்று மாசுபாடு ஒரு தீவிர பிரச்சனை" - பகுப்பாய்வு செய்க.

"Urban air contamination is a serious problem in many of the India's big cities" – Analyse.

Causes of Urban Air Pollution:

High Vehicular Emissions:

- A large number of private, often poorly maintained vehicles contribute to high levels of particulate matter (PM) and other harmful pollutants.

Industrial Activities:

- Industries in and around urban areas emit pollutants like sulfur dioxide (SO_2) and nitrogen oxides (NO_x), exacerbating air quality issues.

Construction Dust:

- Large-scale construction projects release significant dust particles, contributing to particulate pollution.

Poor Waste Management:

- Burning garbage and improper waste disposal add toxic pollutants to the air, especially in densely populated areas.

Weather Conditions:

- Stagnant air, low wind speeds, and high humidity trap pollutants, worsening urban air quality.

Impacts of Urban Air Contamination:

Health Concerns:

- Increased cases of respiratory diseases (e.g., asthma, COPD), heart diseases, lung cancer, and premature deaths, especially in vulnerable populations like children and the elderly.

Economic Losses:

- Reduced productivity, higher healthcare costs, and a decline in tourism due to poor air quality.

Environmental Damage:

- Contributes to acid rain, crop damage, and adverse effects on ecosystems.

Efforts to Address Urban Air Pollution:

National Clean Air Programme (NCAP):

- Promotes cleaner fuels, stricter emission norms, and enhanced public transportation systems.

Urban Planning and Infrastructure:

- Investments in public transport, cycling tracks, and pedestrian-friendly zones to reduce private vehicle use.

Industrial Emission Controls:

- Implementation of stricter regulations and promotion of cleaner technologies in industrial units.

Public Awareness Campaigns:

- Educating citizens on the dangers of air pollution and encouraging practices like carpooling and switching to renewable energy sources.

11. இந்திய அரசாங்கத்தால் தொடங்கப்பட்ட தேசிய சுத்தமான காற்று திட்டத்தின் (NCAP) முக்கிய அம்சங்கள் யாவை?

What are the key features of the National Clean Air Programme (NCAP) initiated by the Government of India?

Launch and Objective:

- **Launched in 2019**, NCAP is a comprehensive, time-bound national strategy to tackle air pollution across India.
- It aims to achieve a **20-30% reduction in particulate matter** (PM) concentrations by **2024**, with **2017 as the base year**. The revised target is **40% reduction by 2026**.

Augmenting Air Quality Monitoring:

- NCAP focuses on enhancing the **air quality monitoring network** nationwide to ensure comprehensive and reliable data collection.

Collaborative Approach:

- The program emphasizes **multi-scale, cross-sectoral coordination** between central ministries, state governments, and local bodies for effective implementation.

Integration with Other Policies:

- NCAP aligns with existing frameworks like the **National Action Plan on Climate Change (NAPCC)** and incorporates missions such as **National Solar Mission**, **National Mission for Enhanced Energy Efficiency**, and others to promote clean air.

City-Specific Action Plans for Non-Attainment Cities:

- **131 non-attainment cities** (cities that failed to meet national air quality standards from 2011-2015) are targeted under NCAP, with city-specific action plans to improve air quality.

- The **Smart Cities** initiative is leveraged for implementing NCAP in cities listed as non-attainment cities.

Institutionalized Implementation:

- The **Central Pollution Control Board (CPCB)** executes the program nationwide, while coordination among ministries like **Finance**, **Health**, and **NITI Aayog** ensures inter-sectoral involvement.

Targeted Monitoring and Improvements:

- The program is **dynamic** and will evolve based on emerging scientific data and international best practices.

Challenges Faced by the NCAP:

Resource Allocation:

- The program faces challenges with **adequate financial and human resources** for effective implementation and monitoring.

Coordination:

- **Efficient coordination** among stakeholders, including government departments, industries, and local communities, remains a hurdle.

Data Transparency:

- There is a need for more accurate and transparent air quality data to assess progress and make informed decisions.

Public Participation:

- Engaging citizens and raising awareness about the importance of air quality is crucial for the program's success.

12. நீர்வாழ் அமைப்புகளில் நச்சுப் பாசிப் பூக்கள் எவ்வாறு உருவாகின்றன? விளக்குக.

How does a toxic algal bloom form in aquatic systems? Explain.

- A **toxic algal bloom (HAB)** forms in aquatic systems through a series of steps, primarily driven by an excess of nutrients and favorable environmental conditions. Here's how it develops:

Steps in the Formation of a Toxic Algal Bloom:

Nutrient Influx (Nutrient Overload):

- The primary cause of toxic algal blooms is an overload of **nutrients**, especially **nitrogen** and **phosphorus**, which often come from agricultural runoff (fertilizers), sewage, and urban stormwater.
- These nutrients act as fertilizers, stimulating rapid algae growth in water bodies like lakes, rivers, and coastal areas.

Algal Growth:

- With an abundant supply of nutrients, algae in the water begin to **rapidly multiply**.
- This is particularly prominent in nutrient-rich waters, as algae thrive in such conditions, growing in large numbers and forming dense populations.

Bloom Formation:

- As the algae grow exponentially, they gather in large visible clusters, creating a **"bloom"** on the water's surface.
- These blooms can discolor the water, often turning it green, red, or brown, depending on the algae species involved.

Toxin Production:

- Certain types of algae in these blooms can produce **harmful toxins**.
- These toxins can vary depending on the algae species and can have devastating effects on aquatic life and human health.

Favorable Environmental Conditions for Algal Blooms:

- **Warm temperatures** and **high sunlight levels** accelerate algal growth, as algae require warmth and sunlight for photosynthesis.
- **Calm, stagnant water** is also conducive to the formation of blooms, as there is less water circulation to disperse the algae and prevent them from accumulating in one area.

Impacts of Toxic Algal Blooms:

- **Fish Kills**: Toxins from the bloom can **suffocate fish** or poison them, leading to large-scale die-offs.
- **Wildlife Harm**: Animals such as birds and mammals consuming contaminated fish or water can also be harmed.
- **Human Health**: Consumption of contaminated shellfish or drinking polluted water can lead to health problems like **gastrointestinal issues**, **respiratory irritation**, and **neurological effects**.

Managing Toxic Algal Blooms:

- **Nutrient Reduction**: Limiting nutrient runoff through better waste treatment and sustainable agricultural practices can help prevent the bloom formation.
- **Water Quality Monitoring**: Regularly checking water bodies can help detect signs of algal blooms early and facilitate rapid response.

- **Water Flow Management**: Controlling water circulation to prevent stagnation can limit the conditions that favor bloom formation.

13. உயிரியல் பன்முகத்தன்மை (திருத்த) சட்டம் 2023 இன் முக்கிய அம்சங்களை ஆராய்க.

Explore the key features of the biological diversity (amendment) Act 2023.

- The **Biological Diversity (Amendment) Act, 2023** introduces significant updates to India's **Biological Diversity Act (BDA) of 2002**. The key features of the amended act are as follows:

State Biodiversity Boards:

- The Act empowers **State Biodiversity Boards** with **greater authority** to regulate and oversee biodiversity activities within their respective states.

Access to Biological Resources:

- The amended act aims to **streamline the process** for accessing biological resources, making it more efficient for research, commercial use, and conservation.

Fair Benefit-sharing:

- The Amended Act emphasizes fair benefit-sharing with local communities and indigenous people who contribute to the conservation and sustainable use of biological resources.

Protection of Wild Medicinal Plants:

- The Act seeks to reduce the pressure on wild medicinal plants by easing regulations on their collection and trade, while ensuring that conservation remains a priority.

Encouragement for Indian System of Medicine:

- The amended act provides a framework to encourage the growth of Indian traditional medicine systems like Ayurveda, Unani, and Siddha.
- It promotes the sustainable use of biodiversity in these fields, ensuring that traditional practices can flourish without causing harm to ecosystems.

Collaborative Research and Investments:

- The Act aims to foster collaboration between researchers, industries, and governmental bodies for biodiversity research and investments.

Decriminalization:

- One of the most contentious aspects of the Amended Act is the decriminalization of certain offenses under the BDA.

- Previously, violations related to the use of biological resources could lead to criminal charges.

பிரிவு - ஆ

SECTION - B

(10x 15 = 150)

14. ஈரநிலங்கள் என்றால் என்ன? மற்றும் ராம்சர் மாநாட்டின் கீழ் தமிழ்நாட்டில் உள்ள பல்வேறு ஈரநிலங்களின் முக்கியத்துவம் குறித்து விவாதிக்க.

What are wetlands? and discuss the importance of various wetlands in Tamil Nadu under the Ramsar Convention.

Wetlands:

- Wetlands are areas of land where water saturates the soil either permanently or seasonally, creating ecosystems distinct from other land types. These environments support specific types of plant and animal life adapted to waterlogged conditions.

Importance of Wetlands in Tamil Nadu under the Ramsar Convention:

- Tamil Nadu is home to several wetlands recognized under the **Ramsar Convention**, an international treaty for the conservation and sustainable use of wetlands. These wetlands are vital for ecological, socio-economic, and environmental functions.

Ecological Importance:

- **Biodiversity**: Tamil Nadu's wetlands are rich in biodiversity. They provide critical habitats for migratory birds, aquatic species, and a variety of plant life. These areas serve as breeding grounds for fish and other aquatic organisms, playing a significant role in the food chain.
- Wetlands support a wide range of species, including migratory birds, making them essential for both local and global biodiversity.

Water Regulation:

- **Flood Control**: Wetlands like the **Pallikaranai Marsh** act as natural buffers, helping to regulate water flow and reduce flood risks. During heavy rains, wetlands can absorb and store excess water, mitigating the impact of floods in surrounding areas.
- **Water Purification**: Wetlands help in filtering water, removing pollutants, and improving water quality before it reaches rivers, lakes, or the ocean.

Carbon Sequestration:

- **Climate Change Mitigation**: Wetlands, particularly mangrove ecosystems like the **Pichavaram Mangrove Forest**, act as significant carbon sinks. They absorb carbon dioxide from the atmosphere, helping to combat climate change by reducing greenhouse gases.

Socio-economic Benefits:

- **Livelihoods**: Wetlands provide various resources that support local communities. They are vital for **fishing** and act as sources of drinking water.
- **Tourism**: Wetlands, with their rich biodiversity, offer opportunities for eco-tourism, contributing to local economies.
- **Agriculture**: Wetlands also support agriculture by regulating water availability and providing nutrient-rich soils for farming.

Important Ramsar Wetlands in Tamil Nadu:

Pallikaranai Marsh:

- Located near Chennai, **Pallikaranai Marsh** is one of the last remaining natural wetlands in the region. It plays an essential role in water regulation, flood control, and is home to diverse bird species, making it crucial for both ecological health and local communities.

Vellode Bird Sanctuary:

- This wetland, situated in **Erode district**, provides a habitat for numerous bird species, particularly migratory birds, making it a key site for birdwatching and biodiversity conservation.

Cooum River Estuary:

- A coastal wetland, the **Cooum River Estuary** plays an essential role in water quality maintenance and is vital for local **fisheries**. It also supports a wide range of species, contributing to the health of coastal ecosystems.

Pichavaram Mangrove Forest:

- The **Pichavaram Mangrove Forest** is a large mangrove ecosystem known for its **biodiversity** and its role in protecting coastal areas from storm surges and erosion. It also serves as a critical habitat for various aquatic species and migratory birds.

Challenges to Wetland Conservation in Tamil Nadu:

- **Urbanization**: Rapid urban growth and infrastructure development around wetland areas pose significant threats to their ecological integrity. This leads to habitat loss and fragmentation.

- **Pollution**: Industrial, agricultural, and domestic waste can degrade wetland ecosystems, leading to reduced water quality and harmful impacts on wildlife.
- **Unsustainable Practices**: Overfishing, illegal fishing, and other unsustainable activities can further damage wetland habitats and disrupt their natural functions.

Conservation Efforts:

- **Tamil Nadu Wetlands Mission**: A dedicated initiative to protect and restore wetlands across the state, with a focus on sustainable management and conservation practices.
- **Community Involvement**: Local communities are being engaged in the protection and sustainable use of wetlands. This ensures that conservation efforts are more effective and sustainable.
- **Strict Enforcement**: Enforcement of regulations is essential to prevent illegal activities like land reclamation and unsustainable fishing practices within wetland areas.

15. உயிரினப்பன்மை வனமையங்கள் என்றால் என்ன? மற்றும் இந்தியாவில் உள்ள உயிரினப்பன்மை வனமையங்கள் அமைந்துள்ள முக்கிய இடங்களை விளக்குக.

What are Biodiversity hotspots? and explain the biodiversity hotspots present in India.

Biodiversity Hotspots:

- Biodiversity hotspots are regions that are both rich in endemic species (species found nowhere else) and are experiencing significant threats to their ecosystems, primarily from habitat loss.
- The concept of biodiversity hotspots was first proposed by Norman Myers in 1988 and was later adopted globally, with the International Union for Conservation of Nature (IUCN) providing guidelines for hotspot designation.

Biodiversity Hotspots in India:

The Himalayas:

- **Geographical Range**: Spans Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Sikkim, Arunachal Pradesh.
- **Ecological Significance**: Diverse ecosystems based on altitude, with endemic flora and fauna like **snow leopards**, **Himalayan tahr**.

- **Threats**: **Deforestation, illegal hunting, climate change, infrastructure development**.

The Western Ghats:

- **Geographical Range:** Spans states of Gujarat, Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu.
- **Ecological Significance:** Home to 7,000+ species of plants, and animals like lion-tailed macaque, Nilgiri tahr. Crucial for water regulation.
- **Threats:** Logging, mining, agriculture, climate change.

The Indo-Burma Region:

- **Geographical Range**: Includes northeastern India and parts of Myanmar, Laos, Thailand.
- **Ecological Significance**: Lush tropical forests with endemic species like **Hoolock gibbons**, **Red Panda**, and **Bengal florican**.
- **Threats**: **Deforestation, poaching, unsustainable agriculture, climate change**.

Sundaland (Andaman and Nicobar Islands):

- **Geographical Range:** Includes the Andaman and Nicobar Islands in the Bay of Bengal.
- **Ecological Significance:** Rich island ecosystems, home to species like the Nicobar pigeon, green sea turtles.
- **Threats:** Overfishing, illegal logging, tourism development, climate change.

Key Points about Biodiversity Hotspots in India:

- **High Endemism**: Home to unique species not found elsewhere in the world.
- **Ecological Importance**: Vital for global biodiversity conservation.
- **Threats**: Major threats include **deforestation, climate change, pollution,** and **unsustainable practices**.
- **Conservation Priority**: These hotspots are critical for both national and global conservation efforts.

16. **பின்வருவனவற்றை விளக்குக:**
    1. **மரபணு மாற்றப்பட்ட உயிரினங்கள்**.
    2. **குன்மிங்-மாண்ட்ரீல் உலகளாவிய பல்லுயிர் கட்டமைப்பு**.
    3. **நீலகிரி வரையாடு பாதுகாப்பு திட்டம்.**

Explain the following:

1. **Genetically Modified Organisms**

2. **Kunming-Montreal Global Biodiversity Framework**
3. **Project *Nilgiri Tahr.***

1. **Genetically Modified Organisms**

Definition:

- GMOs are organisms whose genetic material has been altered using biotechnology to introduce new traits or characteristics.

Methods of Genetic Modification:

- **Gene Cloning:** Involves transferring a specific gene from one organism to another.
- **Gene Editing:** Technologies like CRISPR allow precise changes in the DNA of organisms.

Types of GMOs:

- **GM Plants:** Crops engineered for improved resistance to pests, diseases, or environmental conditions, or enhanced nutritional content (e.g., Bt cotton, Golden Rice).
- **GM Animals:** Animals modified for agricultural purposes, scientific research, or biotechnology (e.g., transgenic salmon).
- **GM Microorganisms:** Bacteria or yeast modified for industrial uses like producing insulin, vaccines, or biofuels.

Benefits of GMOs:

- **Increased Crop Yield:** GMOs can be designed to resist pests, diseases, and drought, leading to higher agricultural productivity.
- **Enhanced Nutritional Value:** GMOs like Golden Rice are engineered to have higher levels of essential nutrients like Vitamin A.
- **Reduced Pesticide Use:** Certain GM crops, like Bt cotton, produce their own pest-resistant proteins, reducing the need for chemical pesticides.
- **Environmental Benefits:** GMOs can lead to reduced deforestation and land degradation by increasing crop efficiency.

Risks and Concerns:

- **Environmental Impact:** Concerns about GMOs potentially cross-breeding with wild species, leading to unintended ecological consequences.
- **Health Risks:** Some fear the long-term health effects of consuming GM foods, though scientific studies have shown GMOs to be safe for consumption.

- **Ethical Concerns:** Issues like animal welfare, the manipulation of genetic material, and the creation of "designer" organisms raise ethical questions.
- **Loss of Biodiversity:** GMOs could displace natural species or reduce genetic diversity within crops.

Regulation of GMOs:

- GMOs are regulated by national and international bodies to ensure their safety in terms of food consumption, environmental impact, and ethical considerations.
- Regulatory agencies such as the FDA, EPA, and WHO assess the safety of GMOs.

Examples of GMOs:

- **Bt Cotton:** Cotton engineered to resist insect pests.
- **Golden Rice:** Rice engineered to contain higher levels of Vitamin A to combat malnutrition.
- **Roundup Ready Crops:** Crops engineered to resist herbicides, allowing farmers to control weeds without harming the crops.

Public Opinion and Controversy:

- GMOs have sparked debate worldwide, with advocates highlighting the benefits of increased food security, while critics raise concerns about health, safety, and environmental impact.

Future of GMOs:

- The future of GMOs lies in advancements like gene editing (e.g., CRISPR), which may offer more precise and safer ways to modify organisms.
- GMOs are being explored for their potential to address challenges like climate change, food security, and sustainable agriculture.

2. **Kunming-Montreal Global Biodiversity Framework**
   - The Kunming-Montreal Global Biodiversity Framework was adopted at the 15th Conference of the Parties (COP15) to the Convention on Biological Diversity (CBD), held in Montreal, Canada in December 2022.
   - It is a landmark global agreement aimed at addressing the ongoing biodiversity crisis and promoting the protection, restoration, and sustainable use of the world's biodiversity.

Key Points of the Kunming-Montreal Global Biodiversity Framework

Overall Goal:

- The framework aims to halt and reverse the loss of biodiversity by 2030 and ensure the protection and sustainable use of ecosystems worldwide.

Targets:

- **23 Global Targets:** The framework includes 23 action-oriented global targets to be achieved by 2030. These targets aim to address the key drivers of biodiversity loss such as habitat destruction, pollution, climate change, and unsustainable use of natural resources.

Key Targets:

- **Target 1 (Protection of Land and Sea):** Protect 30% of the planet's land and marine areas by 2030, to safeguard biodiversity and ecosystems.
- **Target 2 (Pollution Reduction):** Reduce pollution from plastic waste and excess nutrients by 50%.
- **Target 3 (Financial Resources):** Mobilize at least $200 billion per year from public and private sources to support biodiversity conservation efforts.
- **Target 6 (Sustainable Agriculture):** Ensure that agriculture and food production systems are sustainable and contribute to biodiversity.
- **Target 7 (Incentives):** Eliminate harmful subsidies that drive biodiversity loss and introduce positive incentives for biodiversity protection.
- **Target 8 (Species Conservation):** Reduce the rate of extinction of threatened species by 2030.

Resource Mobilization:

- A key component of the framework is mobilizing funding for biodiversity conservation. The goal is to mobilize at least $200 billion per year from public and private sources to support biodiversity initiatives.

Mainstreaming Biodiversity:

- The framework emphasizes integrating biodiversity considerations into key sectors such as agriculture, fisheries, forestry, and tourism. It aims to make biodiversity a part of national and sectoral decision-making processes.

Inclusion of Indigenous and Local Knowledge:

- The framework stresses the importance of respecting and integrating indigenous and local knowledge in biodiversity conservation efforts. This includes recognizing the role of indigenous peoples in managing and conserving biodiversity.

3. **Project Nilgiri Tahr.**

Project Nilgiri Tahr - Key Highlights

Launch of Project Nilgiri Tahr:

- Date: October 12, 2023
- Location: Secretariat, Chennai
- Launched by: Tamil Nadu Chief Minister M.K. Stalin
- Objective: To conserve the Nilgiri Tahr, Tamil Nadu's state animal, which is an endangered species endemic to the Western Ghats.

Outlay:

- The project has a funding of ₹25 crore for wildlife conservation efforts aimed at the protection of Nilgiri Tahr.

Significance of Nilgiri Tahr:

- **Endemic Species:** Nilgiri Tahr is a mountain goat species found only in the Western Ghats of India.
- **Unique Characteristics:** Known for its gravity-defying climbing abilities, the Nilgiri Tahr is also referred to as the "Mountain Monarch" due to its impressive presence in the rugged terrain.
- **Sangam Tamil Literature:** The Nilgiri Tahr is mentioned in several ancient Tamil texts, including the great epics Silappatikaram and Sivakasindamani. The animal's habitat is depicted as part of the biodiversity richness of the region in these texts.

Cultural Significance:

- The Nilgiri Tahr is also mentioned in Tamil literature from over 2000 years ago, in works like Natrinai, Aingurunooru, Paripadal, Pathitruppathuu, and Patinapalai.
- In the Courtallar Kuravanji, a play written by Trikoodarasappak Kavirayar (1600-1700 AD), the Nilgiri Tahr is celebrated as part of the region's biodiversity.

Conservation Efforts and Awareness:

- Chief Minister M.K. Stalin distributed books to school students to raise awareness about the Nilgiri Tahr and the importance of wildlife conservation.
- The project aims to strengthen conservation measures, protect the habitat of the Nilgiri Tahr, and ensure its long-term survival.

Ecological Importance:

- The Nilgiri Tahr plays a crucial role in maintaining the ecological balance of the Western Ghats, which is one of the biodiversity hotspots of India.
- Protecting the Nilgiri Tahr also contributes to the conservation of the region's rich flora and fauna.

Project Goals:

- The project focuses on habitat preservation, anti-poaching measures, scientific research, and the involvement of local communities in conservation activities to protect this endangered species.
- Aiming to enhance the population of Nilgiri Tahr, the project intends to stabilize and increase the population of this iconic animal species.

17. உள்ளிட வளங்காப்பு குறித்து விரிவாக எழுதுக.

Write in detail about *insitu* conservation.

Definition:

- In-situ conservation refers to the conservation of species and ecosystems in their natural habitats.
- Focuses on maintaining biodiversity where species have evolved and adapted over time.

Natural Habitats:

- Protects species within their natural environments like forests, wetlands, grasslands, and coral reefs.
- Ensures that ecosystems remain intact, with minimal human interference.

Sustainable Ecosystem Functioning:

- Aims to allow ecosystems to function naturally, preserving processes like pollination, seed dispersal, and nutrient cycling.

Methods of In-Situ Conservation:

Protected Areas:

- Establishment of national parks, wildlife sanctuaries, biosphere reserves, and conservation reserves.

- Areas designated to protect biodiversity by restricting harmful human activities.

Community Conserved Areas:

- Managed by local communities, often without formal protection status but crucial for biodiversity.
- Communities play an active role in conservation efforts.

Wildlife Corridors and Migration Routes:

- Strips of natural habitat connecting larger protected areas, allowing species to migrate and maintain genetic diversity.

Conservation of Key Species:

- Efforts focus on protecting specific threatened species within their natural habitats, including controlled breeding programs and habitat restoration.

Ecological Restoration:

- Restoration of degraded ecosystems, such as reforestation or wetland restoration, to create conditions for species recovery.

Benefits of In-Situ Conservation:

Preservation of Natural Processes:

- Maintains species and ecosystem interactions (e.g., predator-prey dynamics, plant-pollinator relationships).

Cost-Effective:

- Less costly than ex-situ conservation methods as it involves managing habitats rather than creating artificial environments.

Genetic Diversity Preservation:

- Maintains genetic diversity, which is vital for species' adaptability and long-term survival.

Maintaining Ecosystem Services:

- Protects ecosystem services like clean water, fertile soil, and climate regulation, benefiting both wildlife and human populations.

Sustainability for Local Communities:

- Involves local communities in conservation, providing sustainable livelihoods through eco-tourism, agriculture, and the harvest of non-timber forest products.

Challenges to In-Situ Conservation

Human-Wildlife Conflict:

- As human populations grow, wildlife may enter agricultural or populated areas, leading to conflicts.

Habitat Destruction and Fragmentation:

- Urbanization, deforestation, and agricultural expansion threaten habitats, leading to fragmentation and loss of species.

Climate Change:

- Altered ecosystems and shifting species ranges due to climate change can affect the effectiveness of in-situ conservation.

Invasive Species:

- Non-native species can disrupt ecosystems, outcompete native species, and threaten biodiversity.

Insufficient Funding and Resources:

- Effective in-situ conservation requires adequate financial support, skilled personnel, and enforcement of protection measures
- In-situ conservation is a vital strategy for preserving biodiversity by maintaining ecosystems and species in their natural environments.
- It faces challenges but offers a holistic approach to preserving the intricate relationships within ecosystems.
- Sustained efforts, adequate funding, and collaborative management are essential for the success of in-situ conservation globally.

18. மேற்கு தொடர்ச்சி மலைப் பாதுகாப்பிற்கான பல்வேறு குழு அறிக்கைகளின் பரிந்துரைகள் மற்றும் முக்கியத்துவம் யாவை?

What are the recommendations and significance of various committee reports for Western ghat conservation?

Recommendations for Western Ghats Conservation:

Gadgil Committee Report (2011)

Ecologically Sensitive Areas (ESAs):

- Recommended 64% of the Western Ghats to be classified as ESAs for strict protection.

Banned Activities:

- Proposed a ban on mining, quarrying, thermal power plants, large-scale infrastructure projects, and non-forest industries in ESAs.

Sustainable Practices:

- Advocated for the adoption of sustainable agricultural and development practices, including preserving traditional knowledge.

Creation of Conservation Areas:

- Suggested creating biodiversity parks and reserves to protect sensitive ecosystems and regenerate degraded areas.

Community Involvement:

- Emphasized involving local communities and indigenous populations in conservation and decision-making processes.

Kasturirangan Commission Report (2013):

Reduced ESA Coverage:

- Recommended 37% of the Western Ghats to be classified as ESAs, focusing on high biodiversity areas.

Cultural Landscape Classification:

- Around 60% of the region to be classified as 'Cultural Landscape', allowing human settlements, plantations, and agriculture with sustainable practices.

Banned Activities:

- Similar to the Gadgil Committee, recommended banning ecologically harmful activities (mining, quarrying, thermal plants, etc.) in ESAs, and conducting environmental impact assessments for development projects.

UNESCO Heritage Status:

- Suggested seeking UNESCO World Heritage status to raise global recognition and attract international conservation support.

Holistic Conservation Approach:

- Recommended integrating threats and demands on forest land, including biodiversity protection, forest regeneration, and habitat restoration.

Ecological and Socio-Economic Balance:

- Emphasized balancing conservation with socio-economic needs, promoting eco-friendly livelihoods like ecotourism and sustainable agriculture.

Significance of Recommendations:

Biodiversity Preservation:

- Focuses on conserving endemic and endangered species, such as the Nilgiri Tahr and lion-tailed macaque.

Watershed Protection:

- Ensures the protection of vital watersheds that supply water to millions in southern India.

Sustainable Development:

- Encourages development practices that align with environmental protection, promoting responsible agriculture and minimizing urban impact.

Community-Led Conservation:

- Stresses the importance of involving local communities in conservation efforts for better outcomes.

Global Recognition:

- A UNESCO Heritage status would bring global attention and support for conservation efforts.

Human-Wildlife Conflict Mitigation:

- Seeks to balance human activities with wildlife protection to reduce conflicts.

Challenges in Implementation:

Economic Pressures:

- Conflict between conservation and the need for industrial development, such as mining and hydroelectric projects.

Political and Public Resistance:

- Local communities and political groups may oppose conservation measures due to concerns over livelihoods and development.

Enforcement Issues:

- Limited resources and administrative capacity pose challenges in enforcing conservation policies and managing ESAs.

Importance:

- The Gadgil Committee and Kasturirangan Commission provided frameworks for Western Ghats conservation, with a focus on protecting biodiversity while balancing socio-economic needs.
- Effective implementation requires addressing challenges related to economic pressures, community involvement, and enforcement of conservation measures.

19. இந்திய காடுகளின் அறிக்கை 2021 இன் முக்கிய கண்டுபிடிப்புகள் குறித்து எழுதுக.

Write about the Important findings of the India State of Forest Report 2021.

Increased Forest Cover:

- The total forest and tree cover in India stands at 21.71% of the country's geographical area, covering 7,13,789 square kilometers.
- This marks a slight increase of 1,540 square kilometers compared to the 2019 assessment, indicating a modest but positive trend in forest cover.

Top States with High Forest Cover:

Madhya Pradesh continues to have the largest forest area in India.

- Other states with significant forest areas include Arunachal Pradesh, Chhattisgarh, Odisha, and Maharashtra.
- When considering the percentage of forest cover relative to the state's geographical area, Mizoram, Arunachal Pradesh, Meghalaya, Manipur, and Nagaland have the highest forest cover.
- Decline in Forest Cover in North-eastern States:
- Five north-eastern states-Arunachal Pradesh, Manipur, Meghalaya, Mizoram, and Nagaland-experienced a decline in forest cover.
- The loss is largely attributed to natural calamities such as landslides and heavy rains, highlighting the vulnerability of the region's forests to environmental factors.

Increase in Mangrove Forests:

- The mangrove forest cover has seen a positive increase of 17 square kilometers.
- Mangroves play a critical role in coastal protection, biodiversity conservation, and carbon sequestration.

Bamboo Growth:

- The bamboo forest ecosystem has flourished, with a notable rise in the number of bamboo culms recorded.
- Bamboo is an important resource for local communities and has ecological benefits in terms of soil conservation and carbon absorption.

Carbon Stock Increase:

- The total carbon stock stored in India's forests has increased by 79.4 million tonnes since the 2019 report.
- This increase reflects the growing role of Indian forests in mitigating climate change by acting as carbon sinks.

Forest Fire Vulnerability:

- A significant portion of India's forest cover (around 35.46%) remains vulnerable to forest fires.
- This highlights the ongoing concern about forest fire management and the need for more effective fire prevention and control strategies.

Improvement in Tiger Corridors:

- Forest cover within tiger corridors has seen a positive increase.

- This is a significant development for tiger conservation as it helps maintain connectivity between tiger habitats, which is critical for their population growth and genetic diversity.

Key Takeaways and Future Needs

- The India State of Forest Report 2021 reveals a modest improvement in forest cover, particularly outside the Recorded Forest Area (RFA), with significant gains in mangroves and bamboo ecosystems.
- However, challenges such as deforestation in the Northeast, forest fire vulnerability, and the need for continued conservation efforts remain.
- The increase in carbon stock and positive developments in tiger corridors are encouraging, but a sustained focus on addressing forest fire risks and protecting vulnerable regions is crucial for future forest conservation.

20. இயற்கை பாதுகாப்பில் IUCN ன் பங்கினை விவாதிக்க மற்றும் அதன் Red Data Book குறித்து குறிப்பு வரைக.

Give detailed note of IUCN role in natural conservation and its red Data Book.

- Established in 1948, the IUCN is the world's largest and most diverse environmental network, bringing together over 1,400 member organizations and 15,000 experts from across the globe.
- One of the IUCN's most significant contributions to biodiversity conservation is its IUCN Red List of Threatened Species, commonly referred to as the Red Data Book.

Key Roles of IUCN in Natural Conservation:

IUCN Red List of Threatened Species:

- The Red List is a comprehensive and scientifically-based inventory that assesses the conservation status of species worldwide.
- The IUCN Red List classifies species into nine categories based on their extinction risk:
    - Extinct (EX) – No known individuals remain.
    - Extinct in the Wild (EW) – Known only to survive in captivity or cultivation.
    - Critically Endangered (CR) – Extremely high risk of extinction in the wild.
    - Endangered (EN) – Very high risk of extinction in the wild.
    - Vulnerable (VU) – High risk of extinction in the wild.

- Near Threatened (NT) – Likely to become endangered in the near future.
- Least Concern (LC) – Species are widespread and abundant.
- Data Deficient (DD) – Not enough information to assess the species' risk.
- Not Evaluated (NE) – Species has not yet been evaluated.

Global Conservation Policy Influence:

- The IUCN's Red List and other initiatives are key tools for shaping global and national conservation policies.
- The list helps governments, conservation organizations, and other stakeholders prioritize their efforts and allocate resources toward conserving the most threatened species.

Promoting Conservation Action:

- The IUCN uses the information from the Red List to foster collaboration between governments, civil society, and international organizations.
- It helps mobilize funding, raise awareness, and coordinate efforts to conserve biodiversity.

International Conventions and Agreements:

- The IUCN plays a significant role in the implementation of international conventions like the Convention on Biological Diversity (CBD), CITES (Convention on International Trade in Endangered Species), and other biodiversity-related treaties.
- The organization works to integrate biodiversity considerations into global agreements, ensuring sustainable use of natural resources and preventing the overexploitation of ecosystems.

Establishing the World Wide Fund for Nature (WWF) and the World Conservation Monitoring Centre (WCMC):

- The IUCN was instrumental in establishing the WWF and the WCMC, two key organizations that focus on global conservation and provide data, advocacy, and research on biodiversity.

Monitoring Ecosystem Health:

- The IUCN works to monitor not only species but also ecosystem health, recognizing that the preservation of ecosystems is essential for the survival of species.

- It advocates for the conservation of critical habitats such as tropical forests, wetlands, and marine ecosystems that support a vast range of biodiversity.

Scientific Research and Knowledge Sharing:

- The IUCN conducts scientific research and shares knowledge on conservation strategies and best practices.
- It compiles and disseminates valuable data through publications, conferences, and partnerships to guide the actions of conservationists globally.

The IUCN Red List (Red Data Book):

- The IUCN Red List (often called the Red Data Book) is an essential tool used to assess the conservation status of species around the world. Its purpose is to raise awareness about the extinction risk of species, guide conservation priorities, and inform policy development.

Key Features of the IUCN Red List:

Species Status Assessment:

- The Red List provides an accurate assessment of the conservation status of species across the globe.
- It uses scientific criteria to categorize species based on their risk of extinction, incorporating factors such as population size, rate of decline, geographic range, and habitat requirements.

Categories and Criteria:

- The Red List classifies species into nine categories, from Extinct (EX) to Least Concern (LC). Each category reflects the degree of threat faced by the species, with Critically Endangered (CR) and Endangered (EN) species being the most vulnerable.

Global Importance:

- The Red List is globally recognized as the most authoritative source for assessing species' extinction risk.
- It helps identify priority species for conservation and informs national action plans and conservation efforts.

Raising Awareness:

- The Red List highlights the conservation needs of threatened species, raising awareness among governments, policymakers, conservationists, and the general public.

- It also helps stimulate funding and resources for species conservation initiatives.

Tracking Changes Over Time:

- The Red List allows for the tracking of changes in species populations over time, providing an early warning system for species at risk of extinction.
- By tracking species status across years, it helps identify trends in biodiversity loss and the effectiveness of conservation efforts.

Catalyst for Conservation Programs:

- The Red List drives the development of targeted conservation programs for species, including protected areas, breeding programs, and habitat restoration projects.
- It also influences the development of legal frameworks to protect endangered species and control illegal activities like poaching and habitat destruction.

Global Collaboration:

- The Red List is the product of extensive collaboration among IUCN's global network of scientists, conservationists, and governments.
- This ensures that the list is updated and reflects the latest scientific data, helping inform global biodiversity policies and conservation strategies.

21. காட்டில் நெருப்பு சூழல் என்றால் என்ன? மேலும் பல்வேறு வகையான காட்டுத் தீயை விவரித்து மற்றும் தீ கோடுகளின் முக்கியத்துவத்தை எழுதுக.
What constitutes a fire environment in a forest? and describe different types of forest fires and write the significance of fire lines.

- A "fire environment" in a forest refers to the combination of factors that influence the likelihood and intensity of a wildfire. These factors include:

Fuel:

- The vegetation and organic materials (like trees, shrubs, grasses, and leaf litter) that can burn. A dense accumulation of dry, flammable vegetation, such as dead trees, fallen branches, and dry leaves, creates a higher fuel load, increasing the fire risk.

Weather Conditions:

- **Temperature:** High temperatures can dry out vegetation, making it more susceptible to ignition.
- **Humidity:** Low humidity levels dry out vegetation, increasing its flammability.

- **Wind:** Strong winds can carry embers over long distances, accelerating the spread of fire and making it harder to control.

Topography:

- **Slope:** Fires move faster uphill because heat rises, and steep slopes allow fires to spread more quickly. Fires can also burn hotter on slopes due to increased exposure to wind and sunlight.
- **Aspect:** The direction a slope faces affects moisture levels; south-facing slopes in the Northern Hemisphere receive more sunlight and tend to be drier, increasing the fire risk.

Ignition Sources:

- The presence of potential ignition sources, such as lightning, human activities (campfires, discarded cigarettes, etc.), and equipment sparks, plays a key role in determining whether a fire will start.

Types of Forest Fires:

Surface Fires:

- Definition: These fires burn on the forest floor, consuming low-lying vegetation such as grass, leaf litter, and small branches.

Characteristics:

- Generally, less destructive compared to other fire types.
- Can still damage young trees and affect soil structure.
- Typically move more slowly and can be easier to control than crown fires.
- **Impact:** While not as severe, they can weaken soil health and slow the regeneration of young trees if they recur frequently.

Crown Fires:

- **Definition:** These are the most destructive types of forest fires, which burn through the canopy of trees, rapidly spreading from treetop to treetop.

Characteristics:

- High-intensity fires that consume live foliage, branches, and sometimes entire trees.
- Often occur when surface fires reach high intensity, igniting the crowns of trees.
- Can cause widespread destruction, especially in dense forests with a continuous tree canopy.
- **Impact:** Devastating to mature trees and the overall forest ecosystem, crown fires often lead to long-term ecological damage and habitat loss.

Ground Fires:

- Definition: These fires burn beneath the forest floor in deep layers of organic material like peat and decayed vegetation.

Characteristics:

- Slow-moving and difficult to detect, as they often solder beneath the surface.
- Can last for long periods, sometimes months, continuing to burn even after surface fires have been extinguished.
- **Impact:** Ground fires can significantly alter soil properties, lead to long-term ecosystem changes, and may cause regrowth issues due to the destruction of soil nutrients and structure.

Significance of Fire Lines:

Firebreak Creation:

- **Definition:** A fire line is a cleared area of vegetation, often made by removing trees, brush, and other fuels, creating a barrier to stop or slow the spread of a wildfire.
- **Purpose:** By clearing vegetation, fire lines help prevent a fire from moving into new areas, as fires cannot easily jump over the gap created by the line.

Control and Suppression:

- **Strategic Use:** Fire lines are used by firefighters to control the direction of the fire, allowing them to guide it to safer areas where it can be contained or controlled.
- **Firefighter Advantage:** Fire lines help firefighters isolate the fire and reduce its intensity by removing access to fuel sources, enabling them to deploy suppression efforts more effectively.

Prevention and Early Response:

- **Proactive Approach:** In areas prone to wildfires, fire lines can be established ahead of time to prevent the rapid escalation of fires. They provide a ready-made barrier in case of an outbreak, which can slow down or halt the fire's spread.
- **Minimizing Fire Risk:** Fire lines can also be used as part of controlled burns to reduce fuel load in fire-prone areas, thus lowering the chances of more severe fires occurring in the future.

22. கதிரியக்க மாசு அபாயங்கள் என்றால் என்ன? கதிரியக்க மாசுபாட்டைக் குறைப்பதற்கான கொள்கைகள் மற்றும் விதிகளை ஆராய்ந்து, சுற்றுச்சூழலின் நீண்டகால நம்பகத்தன்மைக்கு உத்தரவாதம் அளிக்க கதிரியக்கக் கழிவுகளை நிர்வகிப்பதற்கான மேம்பட்ட வழிகளுக்கான பரிந்துரைகளை வழங்குக.

What are the Radioactive pollution hazards? Examine the policies and rules in place to reduce radioactive contamination and make recommendations for improved ways to manage radioactive waste to guarantee the long-term viability of the ecosystem.

Radioactive Pollution Hazards:

- Radioactive pollution arises from the release of radioactive materials into the environment, which can pose significant health risks due to exposure to ionizing radiation. These hazards include:

Cancer:

- Prolonged exposure to ionizing radiation can increase the risk of various types of cancers, particularly leukemia and thyroid cancer.

Genetic Mutations:

- Exposure to radioactive substances can cause genetic mutations in organisms, leading to inherited diseases and developmental abnormalities.

Radiation Sickness:

- Acute exposure to high levels of radiation can cause radiation sickness, with symptoms like nausea, vomiting, fatigue, and in severe cases, death.

Tissue Damage:

- Ionizing radiation can cause direct damage to tissues, including burns, organ failure, and long-term cellular damage that can lead to health problems years later.

Environmental Contamination:

- Radioactive pollutants can contaminate soil, water, and air, leading to long-lasting ecological damage and impacting wildlife and plant life.

The severity of these hazards depends on:

- The type of radiation (alpha, beta, gamma).
- The amount of radiation exposure.
- The duration of exposure.
- The proximity to the radiation source.
- Policies and Rules to Reduce Radioactive Contamination

Strict Regulations on Nuclear Power Plants:

- Regulatory bodies enforce safety standards for reactor design, operation, and waste management to minimize risks associated with nuclear power. These include requirements for:
- Safe containment of radioactive materials.
- Regular safety checks and maintenance.
- Emergency response plans in case of accidents.

Waste Classification and Disposal Protocols:

Radioactive waste is categorized based on activity levels:

- **High-level waste (HLW):** Requires long-term storage in deep geological repositories due to its high radiation and long half-life.
- **Low-level waste (LLW):** Can be disposed of in near-surface facilities with adequate shielding.
- Waste disposal protocols ensure proper containment and isolation from the environment to prevent contamination.

Monitoring and Surveillance:

- Ongoing monitoring of environmental radiation levels, especially around nuclear facilities, helps detect any signs of contamination.

Personal Protective Equipment (PPE):

- Workers handling radioactive materials are required to use appropriate PPE such as gloves, suits, and dosimeters. These safeguards minimize direct exposure and ensure radiation levels remain within safe limits.

International Agreements:

- Treaties like the Nuclear Non-Proliferation Treaty (NPT) and the Convention on Nuclear Safety aim to promote safe nuclear practices and prevent the spread of nuclear weapons, ensuring international collaboration on nuclear safety and waste management.

Recommendations for Improved Radioactive Waste Management

Advanced Waste Treatment Technologies:

- Vitrification: Encapsulating high-level waste in glass to reduce its mobility and ensure long-term containment. This technique immobilizes the radioactive material, reducing the risk of leakage into the environment.

Reprocessing of Spent Nuclear Fuel:

- Developing technologies for the reprocessing of spent nuclear fuel to extract reusable fissile materials. This would reduce the volume of waste that needs to be disposed of and make better use of nuclear resources.

Long-term Repository Development:

- Prioritize identifying and constructing secure, deep geological repositories for high-level radioactive waste. These sites must be chosen based on:
- **Geological stability:** To ensure that the repository remains secure over thousands of years.
- **Isolation from the biosphere:** To prevent contamination of the surrounding environment and groundwater.

Public Engagement and Transparency:

- Increasing public awareness about radioactive waste management practices is critical for transparency. It includes open communication regarding potential risks, mitigation strategies, and public involvement in decision-making processes related to waste disposal.

Investment in Research and Development:

- Ongoing research is needed to develop innovative solutions for radioactive waste management, including methods like transmutation (converting long-lived isotopes into shorter-lived ones) to reduce the long-term impact of radioactive materials.

Key Considerations for Long-term Ecosystem Viability

Site Selection:

- Choosing repository locations that are geologically stable and unlikely to contaminate groundwater over time.
- This includes considering seismic activity, soil properties, and the overall integrity of the site for long-term safety.

Monitoring and Remediation:

- Establishing continuous, robust monitoring systems to detect any potential leaks or migration of radioactive material.
- These systems should be able to provide early warnings and trigger prompt remediation actions if necessary.

Intergenerational Responsibility:

- Ensuring that future generations are fully informed about the location, risks, and management strategies associated with radioactive waste repositories.
- This may involve creating databases, educational programs, and ensuring the long-term maintenance and surveillance of waste sites.

23. இனங்களை தனிமைப்படுத்தி பாதுகாக்கும் உத்தி குறித்தும் அதன் தாக்கம் மற்றும் சவால்கள் குறித்து விவாதித்து, உலகின் பல்வேறு பகுதிகளிலிருந்து பொருத்தமான உதாரணங்களுடன் விளக்குக.

Discuss the concept of species relocation as a conservation strategy its impact and challenges. Illustrate with relevant examples from different parts of the world.

Species Relocation as a Conservation Strategy:

- Species relocation, or translocation, is the intentional movement of animals or plants from one area to another to improve their chances of survival, address habitat loss, combat climate change effects, or reinforce dwindling populations.

Key Aspects of Species Relocation

Goal of Species Relocation:

- **Population Enhancement:** Establishing new populations in areas where species have declined or where the environment has changed and no longer supports them.
- **Ecological Balance Restoration:** Reintroducing species that are key to maintaining ecological processes, such as apex predators or pollinators, to restore balance to ecosystems.
- **Climate Change Adaptation:** Moving species outside of their historical range to more favorable environments due to shifting climatic conditions.

Types of Relocation:

- **Reintroduction:** Moving species back to habitats where they have become locally extinct. Example: The reintroduction of the grey wolf in Yellowstone National Park.
- **Augmentation:** Adding individuals to an existing population to increase genetic diversity or population size. Example: The augmentation of California condors through captive breeding and reintroduction.
- **Assisted Colonization:** Moving a species to a new area outside its historical range to ensure its survival as environmental conditions change due to climate change. Example: The translocation of species like the mountain pine beetle to new areas due to warmer climates.

Examples of Species Relocation Around the World:

North America:

- **Grey Wolves in Yellowstone National Park:** In the 1990s, grey wolves were reintroduced to Yellowstone after being extirpated from the area.

This helped control the overpopulation of elk, allowing vegetation to recover and restoring the balance of the ecosystem.

- **California Condor:** Due to population decline, California condors, one of the world's largest birds, were moved into captive breeding programs.
- Their reintroduction into the wild has been crucial in stabilizing the species' numbers, though it remains critically endangered.

Africa:

- **Black Rhinoceros in South Africa:** Due to poaching pressures, the black rhinoceros is being translocated to safer, more protected areas within South Africa.
- **Eastern Black Rhinoceros in Kenya:** In Kenya, captive-bred Eastern black rhinoceros have been reintroduced to their historical range to boost the population and maintain genetic diversity.

Australia:

- **Eastern Quolls in Tasmania:** The Eastern quoll, a carnivorous marsupial, was reintroduced to Tasmania after becoming extinct on the Australian mainland due to predation by invasive species like foxes.

Challenges and Concerns of Species Relocation:

Ecological Disruption:

- The introduction of a new species into an unfamiliar ecosystem can disrupt existing food webs and competition dynamics. For example, non-native species may outcompete or prey on native species, leading to unforeseen ecological consequences.

Disease Transmission:

- Relocated species might carry diseases that could harm native populations. For instance, introducing a species that is immune to certain diseases but carries them can jeopardize local wildlife health.

Genetic Concerns:

- If the relocated species comes from a small founding population, there might be a reduction in genetic diversity, leading to inbreeding.

Adaptation Challenges:

- Species may struggle to adapt to the new environment. Changes in climate, food availability, or predators can hinder the survival of relocated species.

Ethical Considerations:

- Some critics argue that humans should not intervene in natural species migration patterns or introduce species to new ecosystems. There are concerns about altering ecosystems that have developed their own natural dynamics.

Key Considerations for Successful Species Relocation

Thorough Scientific Assessment:

- Comprehensive research on the target species, potential impacts on the new ecosystem, and disease risks is essential before initiating relocation.

Strict Monitoring:

- Continuous monitoring of relocated species is necessary to evaluate their adaptation to the new environment. Regular assessments allow conservationists to intervene early if issues such as disease outbreaks, food shortages, or ecological imbalances arise.

Community Engagement:

- Involving local communities in decision-making processes is important to address concerns and ensure long-term success. Public involvement can foster support for relocation efforts and promote a sense of shared responsibility.

Adaptive Management:

- Ongoing adjustment of relocation strategies based on real-time data is crucial for long-term success. As challenges arise, management strategies must be flexible to mitigate unforeseen problems.

24. வனவிலங்கு பாதுகாப்புச் சட்டம் 2022 இன் முக்கிய அம்சங்களைப் குறித்து விவாதித்து, விலங்குகளுக்கு எதிரான குற்றங்களைக் கையாள்வதில் அதன் முக்கியத்துவத்தை எழுதுக.

Discuss the salient features of the Wildlife Protection Act 2022 and write its significance in dealing with Wildlife offences.

Salient Features of the Wildlife (Protection) Amendment Bill, 2022

Implementation of CITES:

- The Bill seeks to implement CITES provisions, regulating international trade of endangered species.
- Designates Management Authority and Scientific Authority to oversee trade in wildlife specimens.
- Introduces the use of identification marks on specimens to prevent illegal trade and trafficking.

- Requires registration certificates for those possessing live specimens of scheduled animals.

Rationalizing Schedules:

- Reduces the number of schedules from six to four.
- Specially Protected Animals are now classified into two schedules.
- Removes the schedule for vermin species.
- Adds a new schedule for CITES-listed specimens.

Control of Invasive Alien Species:

- Empowers the government to regulate or prohibit the import, trade, possession, or proliferation of invasive species that can harm native wildlife.

Conservation Reserves:

- Central government can now notify Conservation Reserves in addition to state governments.

Surrender of Captive Animals:

- Voluntary surrender of captive animals or animal products to Chief Wildlife Warden.
- Surrendered items become the property of the state government, but no compensation is provided.

Sanctuary Management:

- The Chief Wildlife Warden must follow sanctuary management plans, ensuring structured wildlife area management.

Significance in Dealing with Wildlife Offences:

Enhanced Protection for Endangered Species:

- Stricter protection for species listed under CITES.
- Helps prevent illegal hunting, poaching, and trade of endangered species.

Stronger Regulatory Framework:

- Establishment of Management and Scientific Authorities for better enforcement of wildlife laws.
- Identification marks and registration certificates make it harder for traffickers to move wildlife illegally.

Combatting Invasive Alien Species:

- Provides measures to control the import and spread of invasive species, preserving native ecosystems and wildlife.

Promoting Voluntary Surrender of Captive Animals:

- Encourages voluntary surrender of illegally held captive wildlife, helping curb illegal wildlife trade.

Conservation Reserve Expansion:

- Allows central government to designate Conservation Reserves, increasing protected wildlife habitats.

Increased Penalties for Wildlife Offences:

- Expected to strengthen penalties for crimes like poaching and illegal wildlife trade, acting as a deterrent.

International Cooperation and Compliance:

- Aligns India's laws with CITES, improving global cooperation and enforcement against wildlife trafficking.

Improved Wildlife Management:

- Ensures more scientific and organized management of protected areas, improving wildlife conservation efforts.

25. **மீத்தேன் உமிழ்வுகளுக்கு காரணமான இயற்கை மற்றும் மானுடவியல் காரணிகளை பட்டியலிடுக, மீத்தேன் வெளியேற்றத்தை சமாளிக்க தேசிய மற்றும் உலகளாவிய முன்முயற்சிகளை முன்னிலைப்படுத்துக.**

List out the natural and anthropogenic factors responsible for the Methane emissions, Highlight the national and global initiatives to tackle the methane emissions.

Natural Sources of Methane Emissions:

- **Wetlands:** Swamps, marshes, and flooded rice paddies are significant natural sources of methane.
- **Termites:** Methane is produced by termite colonies through digestion processes.
- **Oceans:** Methane is released from marine sediments.
- **Permafrost:** As temperatures rise, methane trapped in frozen soil is released.
- **Forest Fires:** Natural wildfires can release methane.
- **Geological Sources:** Methane naturally escapes from the Earth's crust, such as through seeps.

Anthropogenic (Human-Caused) Sources of Methane Emissions:

Agriculture:

- Livestock digestion (cattle, sheep, pigs)
- Manure management

- Rice cultivation

Fossil Fuel Production:

- Oil and gas extraction (leakage from wells and pipelines)
- Coal mining

Waste Management:

- Landfills
- Wastewater treatment plants

Energy Production:

- Natural gas flaring
- Combustion in power plants

Global Initiatives to Reduce Methane Emissions:

Global Methane Pledge:

- A voluntary commitment by countries to reduce global methane emissions by 30% by 2030 from 2020 levels.
- Led by the United States and the European Union.

Climate and Clean Air Coalition (CCAC):

- An international initiative focused on tackling short-lived climate pollutants like methane.

International Energy Agency (IEA) Methane Tracker:

- Provides data and analysis on global methane emissions to support mitigation efforts.

National Initiatives (Examples) to Reduce Methane Emissions:

Livestock Management Programs:

- Promoting improved feed management, manure collection systems, and manure digestion to reduce methane emissions from livestock.

Oil and Gas Regulations:

- Implementing stricter standards for methane leak detection and repair at oil and gas production sites.

Landfill Gas Capture:

- Utilizing technologies to capture and utilize methane generated in landfills.

Rice Cultivation Practices:

- Promoting water management techniques to minimize methane emissions from rice paddies.

Summary:

- **Natural Sources:** Wetlands, termites, oceans, permafrost, forest fires, and geological sources are key contributors to methane emissions.
- **Human-Caused (Anthropogenic) Sources:** Agriculture (livestock, rice cultivation), fossil fuel production, waste management, and energy production contribute significantly to methane emissions.
- **Global Initiatives:** The Global Methane Pledge, CCAC, and IEA Methane Tracker are key efforts aimed at reducing global methane emissions.
- **National Initiatives:** Livestock management, oil and gas leak regulations, landfill gas capture, and improved rice cultivation practices are critical actions to reduce methane emissions.

26. இந்திய நகரங்களில் பெருகிவரும் திட கழிவு மேலாண்மை சார்ந்த பிரச்சினையைத் தீர்க்கப் பயன்படுத்தக்கூடிய நவீன திடக்கழிவு மேலாண்மை உத்திகள் குறித்து விவாதிக்க.

Discuss modern solid waste management strategies that can be used to address the growing problem associated with solid waste management in Indian Cities.

Source Segregation:

Color-Coded Bins:

- Implement separate bins for different waste types (e.g., dry, wet, e-waste, hazardous waste) at the household and commercial level. This ensures that waste is sorted at the point of origin and can be processed accordingly.

Awareness Campaigns:

- Conduct educational outreach programs to raise public awareness about the importance of source segregation. Media campaigns, school initiatives, and community programs can engage citizens in better waste management practices.

Improved Collection Systems:

Door-to-Door Collection:

- Regular, scheduled waste collection services should be provided to all households, ensuring that segregated waste is collected properly. This reduces littering and improves urban cleanliness.

Automated Waste Collection Bins:

- Use smart bins equipped with sensors that monitor waste levels and send alerts when they are full. This enables efficient waste collection, minimizing truck movements and reducing fuel consumption.

Community-Based Collection Points:

- Designate collection points for specific types of waste such as e-waste, hazardous materials, and recyclables. These drop-off points make it easier for citizens to dispose of certain types of waste responsibly.

Advanced Treatment Technologies:

Composting:

- Set up large-scale composting facilities for organic waste, such as food scraps and garden waste. This helps in converting waste into valuable compost that can be used for agricultural purposes, reducing landfill waste.

Waste-to-Energy (WtE) Plants:

- Use incineration technologies to convert non-recyclable waste into energy. These plants can produce electricity or heat, while also ensuring that harmful emissions are controlled through advanced filtration systems.

Anaerobic Digestion:

- Implement anaerobic digestion systems to process organic waste and produce biogas. This process helps in generating renewable energy and also reduces methane emissions from landfills.

Recycling Facilities:

- Develop efficient recycling centers that process materials like plastic, paper, metal, and glass. This ensures the reuse of valuable resources and reduces the amount of waste sent to landfills.

Technological Innovations:

Waste Tracking Systems:

- Digital platforms and mobile applications can be used to track the collection, disposal, and treatment of waste in real-time. These systems help in identifying areas that require improvement and ensure better monitoring of waste management activities.

AI-Powered Waste Sorting:

- Artificial Intelligence (AI) and machine learning can be employed to automate waste sorting at treatment facilities. This enhances recycling efficiency by accurately sorting materials like plastics, metals, and paper.

Policy and Regulatory Measures:

Strict Enforcement of Waste Management Regulations:

- Enforce laws that penalize improper waste disposal, such as littering and illegal dumping. Regulations must be backed by regular inspections and fines to ensure compliance with environmental standards.

Extended Producer Responsibility (EPR):

- Introduce policies that hold manufacturers accountable for the entire lifecycle of their products, including the disposal and recycling of packaging materials. EPR ensures that companies design products with recyclability in mind and take responsibility for waste management.

Incentives for Sustainable Practices:

- Provide financial incentives or subsidies to businesses and communities that implement innovative waste management solutions, such as waste reduction, recycling, and energy recovery practices.

Challenges to Overcome:

Lack of Awareness and Public Participation:

- A major barrier is the lack of public awareness and participation in waste segregation and responsible disposal. Ongoing educational programs and community outreach are needed to encourage people to adopt sustainable waste management practices.

Inadequate Infrastructure:

- Many cities still lack proper infrastructure for waste collection, segregation, and treatment. Investments in waste management infrastructure, including bins, trucks, treatment plants, and recycling centers, are crucial.

Financial Constraints:

- Large-scale waste management projects require significant funding, which may not always be available. Public-private partnerships (PPP) and government funding should be explored to secure resources for waste management infrastructure and technology.

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பொது அறிவு

GENERAL STUDIES

கால அளவு: மூன்று மணி நேரம்
Duration : 3 Hours

மொத்த மதிப்பெண்: 250
Total Marks : 250

பிரிவு - அ

SECTION - A

(10 x 10 = 100)

1. **"மேக வெடிப்பு" என்பதை வரையறுத்து, அதற்கான காரணங்களை பகுப்பாய்வு செய்க.**

Define cloud burst and analyse the reasons.

- A cloudburst is a sudden and extremely intense rainfall event that occurs within a short period of time, often over a localized area. Typically, cloudbursts are associated with thunderstorms and can lead to flash floods, causing significant damage to both human and environmental resources.
- The volume of rainfall in a cloudburst is far higher than in normal rainstorms, and it usually occurs in a matter of minutes.

Reasons for Cloudbursts:

Thunderstorms:

- Thunderstorms are associated with violent upward air currents, which can prevent raindrops from falling to the ground. As the air currents become weaker, the water that had accumulated in the clouds falls all at once, resulting in a cloudburst.

- This sudden release of a large amount of water in a short time leads to rapid accumulation of rainwater, causing flash floods and localized flooding.

Orographic Lift:

- This phenomenon occurs when moist air is forced to rise over a mountain range or elevated terrain. As the air rises, it cools and condenses, leading to the formation of dense clouds and heavy rainfall.
- In areas where mountains or hills cause the air to lift rapidly, cloudbursts can occur as the condensed moisture is released suddenly, resulting in intense rainfall in those regions.

Warm Air Mixing with Cooler Air:

- Cloudbursts can also occur when warm, moist air collides with cooler air, causing the warm air to cool and condense rapidly. This sudden condensation creates an intense rainfall event, especially in areas where the temperature difference is significant.
- The sudden condensation of large amounts of moisture can overwhelm drainage systems, resulting in flooding and damage to infrastructure.

Global Warming:

- Rising global temperatures, particularly in the oceans, lead to higher levels of evaporation. As the atmosphere becomes saturated with more moisture, the potential for intense rainfall events, such as cloudbursts, increases. This is a result of the enhanced water cycle, where warmer air holds more moisture.
- Climate change contributes to more frequent and intense cloudbursts, which, in turn, exacerbates flooding, especially in vulnerable regions.

2. சுற்றுச்சூழல் சுகாதாரம் மற்றும் துப்புரவு சீர்கேட்டால் விளையும் பிரச்சனைகள் குறித்து விவாதிக்க.

Discuss the problems resulting from environmental health and sanitation.

- Poor environmental health and sanitation can lead to numerous problems that significantly impact human well-being, public health, and socio-economic development. These issues are interconnected, and their effects are often far-reaching.

Health Problems:

Communicable Diseases:

- Unsafe sanitation and poor environmental conditions can promote the spread of infectious diseases. Lack of proper waste disposal, contaminated water, and poor hygiene practices lead to waterborne diseases like cholera,

dysentery, and typhoid. Additionally, poor sanitation contributes to the spread of intestinal worm infections and diseases like polio.

- These diseases result in high morbidity and mortality rates, particularly in developing countries, and place a strain on healthcare systems.

Noncommunicable Diseases:

- Poor air quality, often from pollution and exposure to harmful chemicals in the environment, increases the risk of chronic diseases. Air pollution, especially from vehicles and industrial activities, can trigger respiratory diseases, stroke, heart failure, and other cardiovascular conditions.
- These diseases can lead to long-term health issues and premature death, with high medical costs for individuals and communities.

Allergies:

- Mold, damp conditions, and poor air quality can trigger allergies. Exposure to allergens in the home, workplace, or environment, such as pollen or dust mites, can cause symptoms ranging from mild to severe.
- Allergies lead to discomfort, reduced quality of life, and can increase healthcare costs due to ongoing treatments.

Cancers:

- Environmental pollution, such as exposure to harmful substances like radon, asbestos, and heavy metals like mercury, can increase the risk of cancers like leukemia and skin cancer.
- Increased cancer rates result in public health crises, with heavy emotional, financial, and social burdens on individuals and communities.

Other Health Issues:

- Exposure to environmental toxins like heavy metals (e.g., mercury) can cause a range of health problems, including asthma, hearing loss, and dehydration.
- These long-term health effects reduce life expectancy and quality of life, placing additional pressure on public health resources.

Malnutrition:

- Poor sanitation can lead to food contamination, malabsorption of nutrients, and increased vulnerability to diseases, which collectively contribute to malnutrition.
- Malnutrition leads to stunted growth, weakened immune systems, and a reduced ability to work or study, contributing to a cycle of poverty and poor health.

Social and Economic Problems:

Reduced Human Well-Being:

- Poor environmental conditions, such as lack of sanitation and unsafe drinking water, directly affect people's physical and mental health. The constant threat of disease, discomfort, and environmental hazards leads to stress, anxiety, and psychological strain.
- Reduced quality of life, increased burden on mental health resources, and a general decline in community well-being.

Reduced Social and Economic Development:

- Communities affected by poor environmental health and sanitation face significant barriers to social mobility and economic development. Poor health and the cost of treating diseases drain resources that could otherwise be spent on education or business development.
- People are unable to work or study effectively, leading to lower productivity, reduced economic growth, and widening social inequality.

Anxiety and Psychological Stress:

- The constant exposure to health risks, pollution, and unhygienic living conditions can cause psychological stress. People living in areas with poor sanitation often experience anxiety, fear of disease outbreaks, and a general sense of insecurity.
- This leads to a diminished sense of well-being, and can result in long-term psychological issues, including depression and social isolation.

Risk of Sexual Assault:

- In areas where sanitation facilities are inadequate, particularly for women and girls, the lack of safe public or private restrooms can lead to risky behaviors such as going out at night or using unsafe locations. This creates an environment where women are at greater risk of sexual assault.
- This compromises women’s safety and autonomy, restricting their freedom and limiting their participation in work, education, and social activities.

Lost Opportunities for Education and Work:

- Poor sanitation often leads to children missing school due to illness or lack of clean water. Adults may also miss work due to health-related issues caused by poor sanitation.
- This reduces human capital, limits access to education, and further entrenches poverty and inequality.

Environmental and Public Health Concerns:

Spread of Antimicrobial Resistance (AMR):

- Inadequate sanitation and improper waste management contribute to the spread of antimicrobial-resistant pathogens, especially in healthcare settings and through contaminated water. Overuse or misuse of antibiotics can create drug-resistant diseases.
- AMR threatens the effectiveness of medical treatments, making once-treatable infections harder to cure and leading to higher mortality rates.

Food Deserts:

- Poor sanitation in urban or rural areas can prevent people from accessing nutritious and safe food. Inadequate waste management systems contribute to the creation of food deserts where access to healthy food is limited.
- This can lead to malnutrition and diet-related diseases, especially in low-income communities where people rely on unsafe or low-quality food sources.

3. **நகர்ப்புற வெப்ப தீவு என்றால் என்ன? நகர்ப்புற வெப்பத் தீவுகளுக்கு (UHI) பங்களிக்கும் காரணிகள் குறித்து விவாதிக்க.**

What is an urban heat island? and discuss the factors contributing to urban heat islands (UHI).

Urban Heat Island (UHI) Definition:

- An Urban Heat Island (UHI) is a localized area in a city that experiences higher temperatures than surrounding rural areas due to human activities and the modification of land surfaces.

Factors Contributing to Urban Heat Islands (UHI):

Impervious Surfaces:

- Roads, sidewalks, parking lots, and buildings absorb and retain heat during the day and release it at night, increasing urban temperatures.

Reduced Vegetation:

- Less green space in cities means fewer plants and trees that can cool the environment through evapotranspiration.

Waste Heat:

- Heat generated by air conditioning, vehicles, industries, and factories adds additional warmth to urban areas.

Altered Wind Patterns:

- Tall buildings and dense urban structures alter natural wind flow, reducing cooling airflow and trapping heat.

Greenhouse Gas Emissions:

- Increased emissions from vehicles, energy use, and industrial activities contribute to higher temperatures through both the global warming effect and localized heating.

Air Pollution:

- Air pollutants like particulate matter and ozone absorb heat and contribute to higher urban temperatures.

Heat-Absorbing Properties of Buildings:

- Buildings and infrastructure, especially those made from dark materials, absorb and retain more solar radiation, increasing temperatures in urban areas.

Consequences of Urban Heat Island (UHI):

Increased Energy Use for Cooling:

- Higher temperatures lead to greater demand for air conditioning, increasing energy consumption and utility costs.

Increased Heat-Related Illnesses and Deaths:

- Prolonged exposure to heat can cause heat-related illnesses like heatstroke, especially among vulnerable populations.

Elevated Emissions of Air Pollutants and Greenhouse Gases:

- Higher energy consumption from cooling systems increases emissions of air pollutants and greenhouse gases.

Compromised Human Health and Comfort:

- Higher urban temperatures reduce outdoor comfort and quality of life, affecting mental and physical well-being.

Impaired Water Quality:

- Warmer water temperatures in urban rivers and lakes reduce oxygen levels, harming aquatic ecosystems.

4. **தமிழ்நாட்டின் பருவமழை முறையில் காலநிலை மாற்றத்தால் ஏற்படும் பாதிப்புகளை விவரிக்க.**

   Describe the impacts of climate change on the monsoon pattern of Tamil Nadu.

   - The impacts of climate change on the monsoon patterns of Tamil Nadu are becoming increasingly evident, particularly affecting the northeast

monsoon (October-December), which is the state's primary source of rainfall.

Key Impacts of Climate Change on Tamil Nadu's Monsoon Patterns:

Erratic Rainfall:

- **Increased variability in rainfall:** The northeast monsoon is becoming more erratic, with unpredictable fluctuations in rainfall. Some years may witness intense downpours, while others may see extended dry spells, making water availability less reliable.
- This erratic pattern significantly disrupts the predictable seasonal water supply critical for agriculture, especially for crops like rice.

Increased Intensity of Rainfall:

- **Heavy rain events:** While the overall total rainfall may not significantly increase, the intensity of individual rain events is observed to be higher. This leads to flash floods in several areas, especially during short periods of heavy rain.
- Such extreme rainfall events contribute to soil erosion, loss of crops, and damage to infrastructure.

Delayed Onset and Early Withdrawal:

- Climate change is affecting the timing of the monsoon. There are instances of delayed onset and early withdrawal of the rains, further disrupting agricultural cycles that rely on predictable rainfall patterns.
- Farmers may face difficulties in planting and harvesting crops, impacting agricultural productivity and food security.

Impact on Agriculture:

- Inconsistent water availability complicates crop planning. The agriculture sector, which is highly dependent on the northeast monsoon, struggles with altered sowing and harvesting cycles.
- Farmers face challenges in deciding when to plant crops, and inconsistent rainfall puts crops at risk, leading to reduced yields and financial instability for farmers.

Regional Variations:

- The impact of climate change is not uniform across Tamil Nadu. While some areas might experience an increase in rainfall, others might face significant reductions, leading to regional disparities in water access.
- Areas dependent on rain-fed agriculture are particularly vulnerable to these regional imbalances, exacerbating water scarcity in already dry areas.

Potential for Sea Level Rise Impact:

- Rising sea levels linked to climate change can worsen the impacts of coastal flooding during the monsoon, particularly in vulnerable coastal areas of Tamil Nadu.
- Coastal cities and villages could face increased vulnerability to storm surges and flooding, further complicating the socio-economic conditions in these regions.

Possible Reasons for Changes in Monsoon Patterns:

Warmer Ocean Temperatures:

- Rising sea surface temperatures in the Indian Ocean influence monsoon dynamics by altering the amount of moisture available for rainfall.
- Warmer ocean temperatures lead to changes in the strength and timing of the monsoon winds, which can result in erratic rainfall patterns.

Changes in Atmospheric Circulation:

- Climate change can also alter atmospheric circulation patterns, affecting the movement of the monsoon winds.
- Shifts in these patterns influence the distribution and timing of rainfall, making it more difficult to predict monsoon behavior in Tamil Nadu.

Adaptation Strategies to Address Climate Change Impacts:

Improved Water Management:

- Investing in rainwater harvesting systems, constructing more reservoirs, and enhancing irrigation infrastructure can help manage water resources more efficiently and reduce the impact of irregular rainfall patterns.

Climate-Resilient Agriculture:

- Promoting the use of drought-resistant crops and diversifying farming systems can help farmers adapt to changing rainfall conditions.
- Implementing precision agriculture practices that use technology for more efficient water use and soil management.

Early Warning Systems:

- Developing robust weather forecasting systems to provide timely warnings about potential extreme weather events, like floods or droughts, can help communities prepare in advance and minimize losses.

Community-Based Preparedness:

- Raising awareness and building community resilience through education and training programs can help people manage the risks posed by floods

and droughts, ensuring that there are coordinated response measures during extreme weather events.

5. **பின்வருவனவற்றை குறித்து எழுதுக.**
   1. **ஸ்டாக்ஹோம் மாநாடு.**
   2. **வியன்னா மாநாடு.**

   Write a note on the following.
   1. **Stockholm convention.**
   2. **Vienna convention.**

   1. **Stockholm convention.**
      - The Stockholm Convention on Persistent Organic Pollutants (POPs) is a global treaty aimed at protecting human health and the environment from the harmful effects of persistent organic pollutants. It was adopted on May 22, 2001, and entered into force on May 17, 2004. The Convention seeks to eliminate or reduce the release of POPs worldwide through the regulation of production, use, and disposal of these harmful chemicals.

      Key Objectives of the Stockholm Convention:
      - Eliminate or restrict the production and use of intentionally produced POPs: This includes chemicals like DDT, PCBs, and dioxins.
      - Minimize and eliminate the releases of unintentionally produced POPs: These are chemicals produced as by-products of industrial processes like dioxins and furans.
      - Manage and dispose of stockpiles and wastes containing POPs: Ensure safe handling, disposal, and treatment of chemical waste.
      - Promote environmentally sound alternatives: Encourage the use of safer, non-toxic chemicals to replace POPs in industrial and agricultural sectors.
      - Evaluate the effectiveness of the measures implemented to reduce POPs emissions and assess their impact on human health and the environment.

      Key Features:
      - The Convention lists 12 initial POPs (sometimes referred to as the "dirty dozen"), including chemicals like DDT, polychlorinated biphenyls (PCBs), and dioxins. Over time, the list has expanded to include other harmful chemicals.

- Annexes A, B, and C: These annexes list chemicals that must be eliminated (Annex A), chemicals that must be restricted (Annex B), and chemicals that must be reduced (Annex C).
- The Convention is legally binding, and parties are required to take action to comply with its provisions.

India's Response:

- India ratified the Stockholm Convention on January 13, 2006.
- **Exemption for DDT:** India is allowed to use DDT for vector control, especially in the fight against malaria. This exemption is based on specific criteria and is reviewed periodically.

2. **Vienna convention.**
   - The Vienna Convention for the Protection of the Ozone Layer is an international treaty aimed at protecting the ozone layer by coordinating efforts to minimize the depletion of ozone-depleting substances (ODS). It was adopted on March 22, 1985, in Vienna, Austria, and entered into force on September 22, 1988.

   Key Objectives of the Vienna Convention:

   - **Protect the ozone layer:** The primary goal of the Vienna Convention is to safeguard the ozone layer, which is essential for life on Earth as it absorbs and blocks most of the sun's harmful ultraviolet (UV) radiation.
   - **Promote international cooperation:** Encourage countries to collaborate in the scientific assessment of ozone depletion, share research data, and implement measures to reduce the use of substances that damage the ozone layer.
   - Encourage the development and use of alternative substances: Support the development of alternative chemicals that do not harm the ozone layer.

   Key Features:

   - The Vienna Convention sets a framework for future action against ozone depletion but does not itself impose binding controls on the use of ozone-depleting chemicals.
   - The Montreal Protocol, which was adopted in 1987 as a protocol to the Vienna Convention, establishes legally binding commitments to phase out the use of substances that deplete the ozone layer, such as chlorofluorocarbons (CFCs), halons, and other ODS.

Key Provisions of the Vienna Convention:

- **Scientific Research:** The Convention established a framework for conducting scientific research to understand the ozone depletion process and its environmental and health impacts.
- **Monitoring and Assessment:** It set up the mechanism for monitoring the ozone layer and assessing the data regularly through the Scientific Assessment Panel.
- **Exchange of Information:** Encouraged parties to share information on research, monitoring, and alternative technologies.

Amendments and Protocols:

- **Montreal Protocol (1987):** The most significant amendment and protocol to the Vienna Convention, the Montreal Protocol is a legally binding treaty aimed at the reduction and elimination of ODS. The protocol includes specific timetables for phasing out the production and consumption of ODS, as well as financial support for developing countries to transition to alternatives.
- The protocol has been ratified by 197 countries, making it one of the most universally adopted environmental agreements.

Importance:

- The Vienna Convention and its Montreal Protocol have been highly successful in reducing the global use of ozone-depleting substances, leading to a slow but steady recovery of the ozone layer.
- The treaty has contributed significantly to protecting human health by reducing the incidence of skin cancers, cataracts, and other UV-related health problems.
- It has also contributed to the protection of ecosystems and biodiversity, as many species are sensitive to increased UV radiation.

6. **பேரிடருக்கு முந்தைய மற்றும் பிந்தைய பேரிடர் மேலாண்மையின் அத்தியாவசிய கூறுகள் யாவை?**

What are the essential components of Pre-Disaster and Post-Disaster Management?

Pre-Disaster Management Components:

Preparedness:

- An ongoing process of planning, training, and awareness-building for individuals, communities, businesses, and organizations on how to respond during a disaster.

- Involves emergency plans, training programs, and mock drills to ensure readiness.

Resilience:

- The capacity to integrate disaster risk reduction (DRR) measures into the recovery and restoration of physical infrastructure and everyday life to minimize the impact of future disasters.
- Focuses on building resilient communities through sustainable practices, awareness, and infrastructure development.

Pre-Disaster Recovery Planning:

- Focuses on creating systems and strategies to help communities withstand, respond to, and recover from disasters.
- Involves the development of contingency plans, resource allocation, and identifying critical infrastructure and services that need protection.

Disaster Risk Reduction (DRR) Strategies:

- Aiming to reduce the vulnerability of communities to disasters through early warning systems, risk assessments, and public education campaigns.
- Includes efforts to address both natural and man-made hazards through preventive actions like land-use planning, sustainable building codes, and disaster-resistant infrastructure.

Mitigation:

- Measures taken to reduce the severity of hazards or the conditions that make communities vulnerable to them.
- Includes structural measures like flood barriers, environmental measures like deforestation prevention, and policy measures like disaster-proof infrastructure design.

Backup Management:

- Developing disaster recovery plans (DRPs) that outline how essential data and resources are backed up.
- Details the processes and systems for restoring data and operations after a disaster, ensuring minimal disruption to critical services.

Post-Disaster Management Components:

Immediate Response:

- Search and rescue, providing emergency relief, and meeting immediate needs (food, water, shelter) for affected communities.
- Establishing temporary shelters, restoring communication channels, and mobilizing local and international aid.

Recovery and Rehabilitation:

- Long-term recovery efforts involve rebuilding infrastructure, restoring public services, and returning the affected community to normal functioning.
- Focuses on physical, economic, and psychosocial recovery including mental health support, livelihood restoration, and rebuilding homes.

Damage and Needs Assessment:

- Conducting assessments to evaluate the extent of damage, the needs of the affected communities, and the resources required for recovery.
- Helps prioritize response efforts and mobilize the necessary resources efficiently.

Reconstruction and Restoration:

- Rebuilding infrastructure, housing, and public services to restore normalcy.
- Incorporates resilience-building measures to ensure future disasters do not cause similar damage.

Disaster Risk Reduction (DRR) in Recovery:

- Integrating DRR measures into recovery efforts to minimize future risks.
- Includes strengthening infrastructure, improving early warning systems, and enhancing community preparedness for future hazards.

Community Involvement and Support:

- Involving local communities in the recovery process, especially in terms of decision-making, to ensure that recovery efforts are inclusive, sustainable, and community-oriented.
- Provides mental health and psychosocial support to help individuals cope with the aftermath of disasters.

Monitoring and Evaluation:

- Monitoring the effectiveness of disaster recovery efforts, assessing progress, and evaluating outcomes to make adjustments if necessary.
- Helps identify lessons learned for improving future disaster response and management strategies.

7. **சுற்றுச்சூழல் செயல்திறன் குறியீடு (EPI) 2024-ன் முக்கிய கண்டுபிடிப்புகளை குறித்து விவாதிக்க.**

Discuss the major findings of the Environmental Performance Index (EPI) 2024.

- The 2024 Environmental Performance Index (EPI), compiled by the Yale Center for Environmental Law & Policy, highlights the global state of environmental health and the effectiveness of environmental policies. Below are the key findings from the report:

India's Ranking:

- India ranked 176th out of 180 countries with a score of 27.6, placing it near the bottom of the index.

Poor Performance Areas:

- **Air Quality:** India faces significant air pollution, which is a major health hazard.
- **Water Quality:** Poor water quality remains a serious issue, with inadequate access to safe drinking water and sanitation.
- **Biodiversity Protection:** India struggles with protecting its ecosystems and wildlife.

Top Performing Countries:

- **Estonia:** Ranked 1st with a score of 75.7. It showed strong performance in environmental sustainability, clean energy, and biodiversity protection.
- **Luxembourg:** Ranked 2nd with a score of 75.1. This small country is highly efficient in managing its environmental footprint and ecosystem protection.
- **Germany:** Ranked 3rd with a score of 74.5. Germany stands out for its efforts in renewable energy, air quality, and water management.

New Metrics Introduced:

- The 2024 EPI introduced pilot indicators to measure the effectiveness of protected areas in conserving biodiversity. These indicators assess whether protected areas are truly safeguarded from commercial exploitation or if they are merely “paper parks” where conservation laws are not effectively enforced.

Ecosystem Loss:

- The EPI found that many protected areas are not effectively protected, with commercial activities continuing in these regions, undermining conservation efforts.

- Ecosystem loss remains a significant challenge globally, as human activity continues to threaten natural habitats, even within designated conservation areas.

Sanitation and Drinking Water:

- The EPI's Sanitation & Drinking Water category focuses on how countries manage water quality and sanitation to protect human health. Poor sanitation infrastructure and unsafe drinking water are linked to disease outbreaks, especially in low-ranking countries like India.

Environmental Challenges in India:

- **Coal Dependency:** India's heavy reliance on coal as a primary energy source contributes significantly to greenhouse gas emissions and worsens air pollution. This ongoing reliance hinders progress toward cleaner air and a reduction in emissions.
- **Urgent Action Needed:** The EPI emphasizes the need for urgent action in India to address its critical environmental challenges, including air pollution, water management, and biodiversity conservation.

Steps Taken by India:

- **Improvements:** India has initiated efforts to improve air quality, water quality, and biodiversity protection.
- However, despite some positive steps, the environmental challenges remain vast and require more focused efforts and sustained commitments to achieve meaningful progress.

Recommendations for India:

- **Reducing Emissions:** Significant investments in renewable energy are needed to reduce reliance on fossil fuels like coal.
- **Transforming Food Systems:** Sustainable agricultural practices and changes in food systems are necessary to reduce environmental degradation and greenhouse gas emissions.
- **Urban Planning:** Redesigning cities to be more sustainable, with better waste management, energy efficiency, and green infrastructure, will help mitigate environmental impacts.

8. **பவள வாழ்க்கை அமைப்பில் புவி வெப்பமடைதலின் தாக்கத்தை எடுத்துக்காட்டுகளுடன் மதிப்பிடுக.**

Assess the impact of global warming on the coral life system with examples.

Impact of Global Warming on Coral Life Systems:

- Coral reefs, often referred to as the "rainforests of the sea," are crucial ecosystems that support around 25% of all marine life. However, these delicate systems are increasingly under threat due to the effects of global warming. Below are the major impacts of global warming on coral life systems, with specific examples:

Coral Bleaching:

- Coral bleaching occurs when corals expel the symbiotic algae (zooxanthellae) that live within their tissues. These algae are crucial for the corals' nutrition and give them their color. When corals expel the algae due to stress, such as rising ocean temperatures, the corals appear white, or "bleached."
- While corals can survive bleaching for a short period, prolonged bleaching leads to coral death due to a lack of energy and nutrients. If the temperature remains high, the coral may not recover, leading to widespread coral mortality.
- The Great Barrier Reef in Australia has experienced mass bleaching events in recent years due to rising ocean temperatures. In 2016 and 2017, the reef suffered from severe bleaching, with some areas losing up to 50% of their coral cover.

Ocean Acidification:

- The absorption of excess carbon dioxide (CO_2) from the atmosphere by oceans leads to a decrease in the ocean's pH, making it more acidic. This phenomenon, known as ocean acidification, poses significant risks to coral reefs.
- Increased acidity reduces the availability of calcium carbonate, which corals need to build their skeletons. This makes corals weaker and more susceptible to damage from storms, disease, and other environmental stressors.
- Studies have shown that coral reefs in areas with high levels of CO_2 are experiencing slower growth rates and weaker skeletons. The Caribbean and the Pacific Ocean have seen increased coral mortality and reduced reef-building capacity due to ocean acidification.

Coral Mortality:

- Coral mortality refers to the death of coral colonies, often caused by prolonged bleaching, disease outbreaks, and the impacts of warming seas.
- As corals die off, entire reef ecosystems collapse. Coral reefs are biodiversity hotspots, supporting thousands of species. The loss of coral leads to a dramatic reduction in biodiversity, affecting fish populations, marine invertebrates, and other marine organisms that depend on coral habitats for food and shelter.
- The Caribbean has experienced widespread coral mortality due to a combination of coral bleaching, disease outbreaks, and storm damage, which has significantly impacted the region's marine biodiversity and local fisheries.

Loss of Biodiversity:

- Coral reefs support about 25% of marine species, including fish, mollusks, and crustaceans. The loss of coral reefs due to global warming has severe consequences for marine biodiversity.
- The destruction of coral reefs leads to a decline in species that depend on them for food, shelter, and breeding grounds. This disrupts entire marine ecosystems and can lead to the collapse of local fisheries, which millions of people rely on for their livelihoods.
- In regions like the Seychelles and Maldives, coral reef degradation has directly impacted fish populations and local economies, as fishing communities depend heavily on healthy reefs for sustenance and trade.

Economic Impacts:

- Coral reefs play a vital role in the economy, particularly in coastal and island nations. They support fisheries, tourism, and coastal protection, providing jobs and income to millions of people worldwide.
- The loss of coral reefs due to climate change and other human activities can lead to significant economic losses, affecting industries such as fishing, tourism, and coastal protection. Coral reefs act as natural barriers against coastal erosion, and without them, coastal communities are at greater risk from storms and rising sea levels.
- The Philippines and Indonesia heavily rely on coral reefs for tourism and fishing. Coral degradation in these regions has led to declines in fish catches, affecting both food security and the tourism sector, which brings in substantial revenue.

9. **இந்தியாவின் தேசிய அளவில் தீர்மானிக்கப்பட்ட பங்களிப்புகளின் (NDCs) கீழ் செய்யப்பட்ட பல்வேறு இலக்குகளை குறித்து விவாதிக்க.**

Discuss the various targets made under India's Nationally Determined Contributions (NDCs).

India's Nationally Determined Contributions (NDCs):

- India's NDCs, submitted under the Paris Agreement, outline the country's commitments to combat climate change while pursuing sustainable development. These targets focus on reducing greenhouse gas emissions, enhancing renewable energy adoption, and promoting sustainable practices.

Key Targets in India's NDCs:

Reducing Emissions:

- **Target:** Reduce the emissions intensity of its GDP by 45% by 2030 compared to 2005 levels.
- **Significance:** This ensures decoupling economic growth from carbon emissions, demonstrating India's commitment to sustainable development without compromising industrial and economic progress.

Creating Carbon Sinks:

- Target: Create an additional 2.5 to 3 billion tonnes of carbon dioxide equivalent (CO_2e) carbon sink by 2030.

Methods:

- **Afforestation and Reforestation:** Massive tree plantation drives and forest management programs.
- **Programs like CAMPA:** Compensatory Afforestation Fund Management and Planning Authority supports this target.

Expanding Renewable Energy:

- **Target:** Achieve 50% of energy capacity from non-fossil fuel sources by 2030, amounting to the installation of 500 GW of renewable energy capacity.

Efforts:

- Development of solar energy under the International Solar Alliance.
- Expansion of wind, hydro, and biomass energy projects.
- Initiatives like the National Solar Mission and Green Energy Corridors.

Climate Adaptation Strategies:

- **Target:** Enhance resilience to climate change by increasing investments in vulnerable sectors like:

- **Agriculture:** Promoting climate-resilient crops and sustainable farming techniques.
- **Water Resources:** Implementing water conservation projects like Atal Bhujal Yojana.
- **Disaster Management:** Strengthening disaster preparedness through early warning systems and mitigation infrastructure.

Accelerating E-Mobility:

- **Target:** Transition to electric mobility to reduce dependency on fossil fuels.

Initiatives:

- **FAME Scheme (Faster Adoption and Manufacturing of Hybrid and Electric Vehicles):** Encouraging the adoption of electric vehicles (EVs) by offering subsidies and infrastructure development.

Expansion of EV charging stations:

Broader Goals and Context:

- **Alignment with Global Targets:** India's NDCs align with the global goal to limit temperature rise to well below 2°C, aiming for 1.5°C above pre-industrial levels.
- **Periodic Revision:** Under the Paris Agreement, NDCs are updated every five years to reflect increased ambition.

Challenges in Achieving NDC Targets:

- **Financial Constraints:** Large-scale investments are required for renewable energy, afforestation, and climate adaptation projects.
- **Infrastructure Gaps:** Developing adequate EV infrastructure and renewable energy grids.
- **Dependence on Coal:** India's energy sector is still heavily reliant on coal, making the transition challenging.

10. **"அடிக்கடி ஏற்படும் நகர்ப்புற வெள்ளம் மனிதனால் உருவாக்கப்பட்ட பேரழிவு" - கருத்துரைக்க, அதைத் தீர்ப்பதற்கான நடவடிக்கைகளை பரிந்துரைக்க.**

Frequent urban floods are manmade disaster" - Comment, suggest measures to resolve it.

- Urban floods are increasingly becoming a common phenomenon in cities worldwide, especially in developing nations like India. While natural factors such as heavy rainfall and climate change contribute to these events, human activities exacerbate their frequency and intensity, making them a largely manmade disaster.

Manmade Causes of Urban Floods:

Unplanned Urbanization:

- Rapid and unplanned urban growth reduces natural drainage systems.
- Encroachment on wetlands, floodplains, and riverbeds disrupts water flow.

Poor Drainage Infrastructure:

- Inefficient and outdated drainage systems fail to handle heavy rainfall.
- Clogging of drains due to poor waste management worsens waterlogging.

Excessive Paving and Loss of Green Cover:

- Increased concrete surfaces prevent natural water infiltration, leading to runoff.
- Deforestation and loss of green spaces exacerbate the problem.

Climate Change:

- Global warming leads to erratic rainfall patterns, increasing the intensity and frequency of urban floods.

Encroachment and Illegal Construction:

- Illegal construction on water bodies and floodplains blocks natural waterways.
- Unregulated development in low-lying areas makes them prone to flooding.

Improper Solid Waste Management:

- Accumulation of plastic and waste in drainage systems causes blockages.

Impact of Urban Floods:

- **Economic Losses:** Damages to property, infrastructure, and businesses.
- **Public Health Risks:** Outbreaks of waterborne diseases like cholera and dengue.
- **Displacement:** Floods displace vulnerable populations, especially in slum areas.
- **Environmental Degradation:** Contamination of water bodies and soil erosion.

Measures to Resolve Urban Flooding:

Urban Planning and Zoning:

- Restrict construction on floodplains and low-lying areas.
- Implement land-use planning to conserve natural water retention areas like wetlands.

Improving Drainage Systems:

- Upgrade existing drainage infrastructure to accommodate heavy rainfall.

- Regular maintenance and de-silting of drains and stormwater systems.

Restoration of Natural Ecosystems:

- Rejuvenate wetlands, lakes, and rivers to act as natural flood buffers.
- Promote afforestation and green spaces to improve water infiltration.

Adoption of Sustainable Urban Development Practices:

- Encourage the use of permeable paving to allow water infiltration.
- Implement rainwater harvesting to reduce surface runoff.

Early Warning Systems and Disaster Preparedness:

- Develop robust weather forecasting systems to predict heavy rainfall.
- Establish flood response plans with designated shelters and evacuation routes.

Public Awareness and Participation:

- Educate citizens about the importance of keeping drains clean.
- Promote community-based initiatives for maintaining local water bodies.

11."சென்டாய் கூட்டமைப்பு (பேரிடர் அபாய தடுப்பு) 2015 - 2030" என்பதை விளக்குக மேலும் இந்தியா செயல்படுத்தியிருக்கும் ஏராளமான பேரிடர் அபாயக் குறைப்பு (DRR) உத்திகளை விவரிக்க. இந்த கட்டமைப்பு "ஹியோகோ கூட்டமைப்பு, 2005" இலிருந்து எவ்வாறு வேறுபடுகிறது?

Describe "Sendai Framework for (Disaster Risk Reduction) DRR (2015-2030)" and Explain various Disaster Risk Reduction strategies implemented by India. How does this framework differ from the "Hyogo Framework for Action, 2005"?

The Sendai Framework for Disaster Risk Reduction (2015–2030):

- The Sendai Framework for Disaster Risk Reduction (DRR) is a global agreement adopted at the Third UN World Conference on Disaster Risk Reduction in Sendai, Japan, in March 2015. It aims to prevent and reduce disaster risks and build resilience across nations. It emphasizes proactive risk management, addressing the underlying factors that lead to disasters.

Key Features of the Sendai Framework:

- To prevent new disaster risks, reduce existing ones, and strengthen resilience.

Seven Global Targets:

- Substantially reduce global disaster mortality by 2030.
- Reduce the number of affected people.
- Minimize direct economic loss in relation to global GDP.
- Cut disaster damage to critical infrastructure and basic services.

- Enhance the number of countries with disaster risk reduction strategies.
- Improve international cooperation for disaster risk reduction.
- Increase availability and access to multi-hazard early warning systems.

Four Priorities for Action:

- **Understanding Disaster Risk:** Improve risk assessments and education.
- **Strengthening Disaster Risk Governance:** Establishing policies, legal frameworks, and coordination mechanisms.
- **Investing in DRR:** Allocate resources to reduce disaster vulnerabilities.
- Enhancing Disaster Preparedness: Focus on efficient response and recovery systems.
- **Holistic Approach:** The framework integrates economic, social, and environmental dimensions in disaster management and risk mitigation.
- Disaster Risk Reduction Strategies Implemented by India:
- India, prone to various natural and manmade disasters, aligns its DRR strategies with the Sendai Framework. Key initiatives include:

Institutional Frameworks:

- **National Disaster Management Authority (NDMA):** Formulates policies, plans, and guidelines for disaster risk reduction and response.
- **State and District Authorities (SDMAs and DDMAs):** Manage state and district-specific disaster risks.

Risk-Informed Development:

- Integration of DRR into urban planning, infrastructure, and housing to minimize vulnerabilities.
- Guidelines for disaster-resilient construction practices.

Early Warning Systems:

- Advanced meteorological systems for cyclones, floods, and tsunamis.
- Dissemination of real-time alerts via mobile and electronic platforms.
- Community-Based Initiatives:
- Conducting evacuation drills, awareness programs, and training.
- Engaging local communities in flood and cyclone preparedness.

Climate Adaptation and Mitigation:

- Measures to counter climate change impacts, such as promoting renewable energy and enhancing ecosystem resilience.
- Initiatives like the National Action Plan on Climate Change (NAPCC).

Disaster Insurance:

- Financial protection schemes for individuals, agriculture, and small businesses.

Capacity Building:

- Establishing training centers for disaster management.
- Promoting research and development in disaster risk reduction technologies.
- **Comparison:** Sendai Framework vs. Hyogo Framework for Action:
- Aspect Hyogo Framework for Action (2005-2015) Sendai Framework (2015-2030)
- Focus Emphasized post-disaster response and recovery. Focuses on proactive risk reduction and resilience.
- Scope Narrowly focused on hazard-specific mitigation strategies.
- Broad scope, incorporating economic, social, and environmental factors.
- Global Targets No specific measurable targets. Seven measurable global targets.
- Accountability Limited provisions for monitoring progress. Emphasizes accountability and periodic review of progress.
- Community InvolvementLess emphasis on local participation. Strong focus on community and stakeholder involvement.
- Risk Management Approach Primarily reactive. Comprehensive and proactive, addressing underlying risk factors.

12. உயிரி எரிபொருளை நிலையான ஆற்றல் மூலமாகப் பயன்படுத்துவதன் நன்மைகள் மற்றும் குறைபாடுகள் குறித்து விவாதிக்க.

Discuss the advantages and drawbacks of using biofuels as a sustainable energy source.

Advantages of Biofuels:

Renewable Energy Source:

- Biofuels are derived from biological materials such as crops, algae, or agricultural residues, which can be replenished naturally.
- Unlike finite fossil fuels, biofuels are sustainable over time when sourced responsibly.

Reduced Greenhouse Gas Emissions:

- Biofuels release carbon dioxide during combustion, but this is offset by the carbon absorbed by the feedstocks during their growth phase.

- They have the potential to reduce net greenhouse gas emissions compared to traditional fossil fuels.

Energy Security:

- By reducing reliance on imported fossil fuels, biofuels contribute to domestic energy independence and security.

Economic Development:

- The biofuel industry can boost rural economies by creating jobs in feedstock cultivation, processing, and distribution.

Utilization of Waste:

- Biofuels can be produced from agricultural residues, municipal waste, and non-food crops, helping to manage waste effectively.

Biodegradability:

- Biofuels are less harmful to the environment in case of spills compared to fossil fuels, as they degrade more quickly.

Drawbacks of Biofuels:

Land Use Competition:

- Large-scale biofuel production competes with food crops for arable land, potentially leading to higher food prices and food insecurity.

Water-Intensive Production:

- Growing crops for biofuels often requires significant water resources, which can exacerbate water scarcity in regions already facing water stress.

Deforestation and Habitat Loss:

- Clearing forests or converting natural ecosystems to cultivate biofuel feedstocks can lead to deforestation, loss of biodiversity, and increased carbon emissions.

Energy Balance Concerns:

- The energy required for growing, harvesting, and processing biofuel feedstocks may exceed the energy they provide, undermining their sustainability.

Environmental Pollution:

- Improper management of waste from biofuel production processes can lead to soil, air, and water pollution.

Infrastructure Challenges:

- Existing fuel infrastructure, such as engines and distribution systems, may require modifications to accommodate biofuels.

Seasonal and Regional Dependence:

- The production of biofuels is often tied to specific climatic and regional conditions, potentially limiting their availability.

Key Considerations for Sustainable Biofuel Production:

Feedstock Selection:

- Use non-food crops (e.g., algae or switchgrass) or waste materials to avoid competition with food production and reduce environmental impacts.

Sustainable Farming Practices:

- Implement practices like crop rotation, agroforestry, and conservation tillage to maintain soil health and minimize deforestation.

Efficient Water Management:

- Develop water-efficient methods for growing biofuel feedstocks, especially in water-scarce regions.

Life Cycle Analysis (LCA):

- Evaluate the entire life cycle of biofuels, from feedstock cultivation to end use, to ensure a positive energy and environmental balance.

Policy Support:

- Governments should incentivize research and development of second- and third-generation biofuels (e.g., algae-based biofuels) to address the shortcomings of conventional biofuels.

Carbon Accounting:

- Develop robust methods to measure the net carbon impact of biofuels and ensure they meet emission reduction targets.

13. வேளாண் காடுகள் என்றால் என்ன? பருவநிலை மாற்றத்தின் பின்னணியில் இந்தியாவிற்கு அதன் முக்கியத்துவத்தை விவரிக்க.

What is agroforestry? Describe its significance for India in the context of climate change.

- Agroforestry is a mixture of components that consist of woody plants (timber, clump, palm, bamboo, and other cambium-borne plant species) with agricultural plants (seasonal species) and/or cattle, which are set in temporal arrangements and spatial arrangement as well.

National Agroforestry Policy,2014:

Benefits of agroforestry:

Environmental benefits:

- Reduction of pressure on natural forests.

- Agroforestry is known to have the potential to mitigate the climate change effects through microclimate moderation and natural resources conservation in the short run.
- **Carbon sequestration:** Agroforestry species are known to sequester as much carbon in below-ground biomass as the primary forests, and are far greater than the crop and grass systems.

Economic benefits:

- Tree products and tree services also contribute robustly to rural livelihoods.
- Fruit, fodder, fuel, fiber, fertilizer, and timber add to food and nutritional security, income generation, and work as insurance against crop failure.
- It provides an alternative for landowners to manage their agricultural land in absence of family labor.
- Agroforestry has significant potential to employ the rural and urban population through production, industrial application, and value addition ventures.

Social benefits:

- Agroforestry provides better and stable income, improving the living standards.
- Self-dependent villages will be a reality.

Sustainable Agriculture:

- Agroforestry could provide a variety of ecosystem services that can help to ensure long-term agricultural sustainability in the following manner:
    - Income security is improved by diversifying agricultural products like firewood, medicinal herbs, and various crops.
    - Food security and nutrition were improved through restoring soil fertility, crop diversification, and food crop resistance to environmental shocks.
    - Reduce soil erosion and regulate water accessibility to restore the land.
    - Crop cultivation and livestock grazing are two examples of multifunctional site usage.
    - By delivering farm-grown firewood, deforestation and strain on woods can be reduced.
    - Reduced chemical inputs, for example, owing to better fertiliser usage, enhanced insect resistance, and enhanced ground cover, which decreases weeds.

- Cultivating space for therapeutic plants, for example, in situations when people's access to conventional treatments is limited

பிரிவு - ஆ

SECTION - B

(10x 15 = 150)

14. **சுற்றுச்சூழல் தாக்க மதிப்பீடு (EIA) என்றால் என்ன? சுற்றுச்சூழல் தாக்க மதிப்பீட்டில் (EIA) சம்பந்தப்பட்ட செயல்பாடுகள் மற்றும் பொதுவான நடைமுறைகளை விவரிக்க.**

What is environmental impact assessment (EIA)? Describe the activities involved and general procedure in Environmental impact assessment (EIA).

Environmental Impact Assessment (EIA):

- An Environmental Impact Assessment (EIA) is a systematic process used to evaluate the potential environmental, social, and economic effects of a proposed project or development. Its primary aim is to identify, predict, and mitigate adverse impacts on the environment and ensure sustainable decision-making before project implementation.

Key Activities Involved in the EIA Process:

Screening:

- Determines whether a project requires a full EIA based on criteria such as project size, location, and potential environmental risks.
- Example: Small-scale projects might not require an EIA, while large infrastructure projects typically do.

Scoping:

- Identifies key environmental issues and establishes the scope of the assessment.
- Involves stakeholder engagement to prioritize significant impacts.

Baseline Data Collection:

- Gathers detailed information about the current environmental conditions at the project site (air, water, soil, biodiversity, and social factors).
- Serves as a reference point for assessing the project's potential impacts.

Impact Prediction:

- Analyzes the potential positive and negative impacts of the project using tools like modeling, simulations, and expert judgment.
- Impacts assessed include those on air quality, water resources, biodiversity, and socio-economic factors.

Mitigation Planning:

- Proposes strategies to minimize, eliminate, or compensate for identified adverse impacts.
- Includes design modifications, operational changes, and restoration plans.

Public Consultation:

- Involves engaging with local communities, stakeholders, and experts to share project details and gather feedback.
- Ensures transparency and incorporates stakeholder concerns into the decision-making process.

Environmental Impact Statement (EIS):

- A comprehensive report summarizing baseline data, predicted impacts, proposed mitigation measures, and alternatives considered.

Decision Making:

- Regulatory agencies review the EIA report to decide whether to approve the project, often with conditions for mitigation and monitoring.

Post-Implementation Monitoring:

- Tracks the implementation of mitigation measures and monitors the project's ongoing environmental performance.
- Identifies unforeseen impacts and adjusts measures as needed.

General Procedure in EIA:

Project Initiation:

- The project proponent submits a proposal to the regulatory authority, initiating the EIA process.

Screening:

- Evaluates whether the project requires a full EIA based on criteria like project type, size, and location.

Scoping:

- Defines the scope of the assessment, identifies key issues, and establishes a framework for stakeholder engagement.

Baseline Data Collection:

- Collects existing environmental data to understand pre-project conditions.

Impact Analysis:

- Predicts the potential impacts of the project on environmental, social, and economic factors.

Mitigation Planning:

- Proposes measures to address potential adverse impacts and enhance positive impacts.

Public Consultation:

- Engages stakeholders to incorporate their feedback into the EIA process.

EIS Preparation:

- Documents all findings, including alternatives considered, impacts predicted, and mitigation measures proposed.

Significance of EIA:

- **Environmental Protection:** Ensures that potential environmental impacts are identified and addressed early.
- **Sustainable Development:** Balances economic development with environmental conservation.
- **Legal Compliance:** Helps projects comply with environmental regulations.
- **Stakeholder Engagement:** Builds public trust by involving communities in the decision-making process.

15. சுற்றுச்சூழல் பாதுகாப்புச் சட்டம் 1986-ன் முக்கிய அம்சங்கள் குறித்து விவாதிக்க மேலும் சுற்றுச்சூழல் குற்றங்களைக் கையாள்வதில் அதன் முக்கியத்துவத்தை எழுதுக.

Discuss the salient features of environmental protection act 1986, and write its significance in dealing with environmental offences.

The Environment Protection Act (EPA), 1986:

- The Environment Protection Act, 1986 was enacted by the Government of India in response to the Bhopal Gas Tragedy.
- The Act is an umbrella legislation that supplements other existing laws like the Water (Prevention and Control of Pollution) Act, 1974, and the Air (Prevention and Control of Pollution) Act, 1981.

Salient Features of the Environment Protection Act, 1986:

Comprehensive Scope:

- Covers pollution of air, water, soil, and noise to provide holistic environmental protection.

Safe Standards for Pollutants:

- Empowers the Central Government to set environmental standards, such as permissible pollutant levels in air and water, to ensure safety.

Regulation of Hazardous Substances:

- Bans or restricts the use of hazardous materials, with exemptions only allowed under specific permissions from the Central Government.

Creation of Regulatory Authorities:

- Establishes authorities tasked with implementing and enforcing environmental laws, including monitoring pollution and ensuring compliance.

Coordination of Agencies:

- Provides a framework to coordinate activities of various regulatory agencies, avoiding overlaps and ensuring integrated action.

Control of Discharge and Emissions:

- Regulates the discharge of pollutants into the environment, and mandates proper handling and disposal of hazardous substances.

Environmental Laboratories:

- Empowers the Central Government to establish laboratories for testing environmental samples and analyzing pollution levels.

Appointment of Analysts:

- Analysts appointed under the Act are authorized to examine samples, contributing to evidence in environmental cases.

Penalties for Violations:

Provides for stringent penalties:

- Imprisonment of up to five years, or
- Fines up to ₹1 lakh, or both.
- Continuing offenses attract an additional fine of ₹5,000 per day.

Significance of the EPA in Dealing with Environmental Offenses:

Deterrent Effect:

- The Act imposes strict penalties, including imprisonment and fines, which act as a deterrent to environmental violations.

Accountability:

- Ensures that both private companies and government departments are held accountable for environmental damage, promoting responsible behavior.

Comprehensive Enforcement:

- Provides a centralized mechanism to regulate and monitor all forms of pollution, ensuring better enforcement of environmental standards.

Prevention of Hazardous Activities:

- By regulating hazardous substances and activities, the Act helps prevent industrial accidents and large-scale environmental damage.

Scientific Support:

- Establishing environmental laboratories and appointing analysts provides scientific backing for legal actions and policymaking.

Facilitates Sustainable Development:

- The EPA promotes sustainable practices by enforcing strict environmental standards and encouraging the adoption of cleaner technologies.

Public Interest and Justice:

- Empowers authorities to take action in the interest of public health and safety, ensuring that violators are held accountable for harming the environment.

16. IPCC ஆறாவது மதிப்பீட்டு அறிக்கையின் முக்கிய அம்சங்களை இந்தியாவை குறித்த சிறப்புக் குறிப்புடன் விவாதிக்க.

Discuss the salient features of IPCC sixth assessment report with special reference to India.

The IPCC Sixth Assessment Report (AR6):

- The Intergovernmental Panel on Climate Change (IPCC) released its Sixth Assessment Report (AR6) to provide the latest scientific understanding of climate change, its impacts, and potential solutions.
- The report underscores the growing urgency for global action, focusing on the effects of human-induced climate change and the necessity for immediate mitigation and adaptation measures.

Salient Features of the IPCC AR6:

Human Influence on Climate Change:

- High confidence that human activities are the primary drivers of global warming, causing unprecedented changes in the Earth's climate system.
- Global warming has already reached approximately 1.1°C above pre-industrial levels and is expected to exceed 1.5°C in the next two decades without drastic action.

Increased Extreme Weather Events:

- Significant increase in the frequency, intensity, and duration of extreme weather events, including heatwaves, heavy rainfall, and cyclones.
- Changes in precipitation patterns and more intense droughts are anticipated globally.

Sea Level Rise:

- Global mean sea level has risen by approximately 20 cm since 1900 and is projected to rise further, increasing the risks to coastal regions.

Urgency of Mitigation and Adaptation:

- Limiting warming to 1.5°C requires immediate and substantial greenhouse gas reductions across all sectors.
- Adaptation strategies must be prioritized to protect vulnerable communities and ecosystems.

Climate Justice Perspective:

- Acknowledges the disproportionate historical contributions of developed nations to global emissions and the need for equitable climate action.
- Supports the principle of "common but differentiated responsibilities and respective capabilities" (CBDR-RC).

Renewable Energy and Sustainable Development:

- Highlights renewable energy as a critical component in transitioning to a low-carbon economy and achieving sustainable development goals (SDGs).

India-Specific Findings from IPCC AR6:

Vulnerability to Extreme Weather Events:

India is highly vulnerable to the rising intensity and frequency of:

- Heatwaves, particularly in northern and central regions.
- Heavy rainfall and flash floods, especially during monsoon seasons.
- Cyclones, with increased intensity along the eastern and western coasts.

Impacts on Agriculture and Food Security:

- Erratic rainfall patterns and temperature extremes could reduce crop yields, disrupting food security.
- Water stress in agricultural regions may exacerbate challenges in food production.

Sea Level Rise and Coastal Vulnerability:

- Coastal areas, including cities like Mumbai, Chennai, and Kolkata, are at high risk of flooding and displacement due to rising sea levels.

Marginalized Communities at Risk:

- Marginalized populations with limited access to resources and infrastructure are more vulnerable to climate change impacts, particularly in rural and low-income urban areas.

Low Per Capita Emissions:

- Despite being the world's third-largest emitter, India's per capita emissions are among the lowest globally, aligning with its developmental status and commitment to sustainable growth.

Renewable Energy Potential:

- The report emphasizes India's leadership in renewable energy, particularly its ambitious targets under the Nationally Determined Contributions (NDCs), including achieving 500 GW of renewable energy capacity by 2030.

Implications for India's Climate Policy:

Focus on Adaptation:

- Enhance disaster preparedness and resilience, particularly for infrastructure and agriculture.
- Strengthen community-based adaptation strategies for vulnerable populations.

Mitigation Efforts:

- Accelerate the transition to renewable energy and reduce dependence on fossil fuels, particularly coal.
- Promote energy efficiency across industries and urban planning.

International Cooperation:

- Leverage climate finance and technology transfer mechanisms to achieve adaptation and mitigation goals.
- Advocate for equitable climate action based on CBDR-RC principles.

Sustainable Development Integration:

- Ensure climate policies align with socio-economic goals, addressing poverty alleviation and job creation.

17. காலநிலை மாற்றம் தொடர்பான ஐக்கிய நாடுகளின் கூட்டமைப்பு மாநாட்டின் (UNFCCC) (COP) 28வது அமர்வின் முக்கிய விளைவுகளை விவரிக்க. இந்த மாநாட்டில் இந்தியா அளித்த உறுதிமொழிகள் யாவை?

Describe the major outcomes of the 28th session of conference of the parties (COP) to the United Nations framework convention on climate change (UNFCCC). What are the commitments made by India in this conference?

- The 28th session of the Conference of the Parties (COP28) to the United Nations Framework Convention on Climate Change (UNFCCC), held in

Dubai, was a landmark event aimed at accelerating global climate action and addressing the urgent challenges posed by climate change.

Key Outcomes of COP28:

Fossil Fuel Phase-Out:

- Emphasis on transitioning away from fossil fuels.
- Commitment to triple renewable energy capacity and double energy efficiency by 2030.

Global Stocktake Conclusion:

- First Global Stocktake under the Paris Agreement completed, assessing global climate action progress.
- Gaps identified in achieving climate goals, underscoring the need for stronger actions.

Enhanced Climate Adaptation Efforts:

- Increased focus on climate adaptation for vulnerable countries.
- Call for more funding and capacity building for adaptation initiatives.

Methane Emission Reduction:

- Urgent push to reduce methane emissions from sectors like agriculture and fossil fuels.

India's Commitments at COP28:

Green Credit Initiative:

- Launch of the Green Credit Initiative to incentivize private sector involvement in environmental sustainability (e.g., tree planting, water conservation).

Advocacy for Climate Finance:

- Strong advocacy for increased and accessible climate finance for developing nations.
- Calls for developed countries to honor financial commitments to assist vulnerable countries.

Highlighting Vulnerabilities of the Global South:

- India raised concerns about the disproportionate impacts of climate change on developing nations.
- Emphasized the need for solidarity and support for the Global South in addressing climate challenges.

Sustainable Development Approach:

- India emphasized land degradation, ecosystem restoration, and biodiversity enrichment as part of a holistic approach to climate action.

Leadership in Regional Collaborations:

- Active participation in regional climate initiatives such as the Quad Climate Working Group and the Mangrove Alliance for Climate.
- Focus on promoting climate resilience and ecosystem protection in the region.

Significance of COP28:

- **Global Impact:** Focus on scaling up renewable energy and reducing fossil fuel dependence, alongside a critical Global Stocktake.
- **India's Role:** Advocated for climate justice, increased climate finance, and regional cooperation, reinforcing the concerns of the Global South.

18. கரிம உமிழ்வைக் குறைக்க கரிம பிடிப்பு மற்றும் சேமிப்புத் தொழில்நுட்பத்தைப் பயன்படுத்துவதன் சாத்தியக்கூறுகளை விரிவாக விளக்குக. கரிம பிடிப்பு மற்றும் சேமிப்பு தொழில்நுட்பங்களின் பரவலான பயன்பாட்டிற்கான முக்கிய தடைகள் குறித்து விவாதிக்க.

Give a brief summary of the viability of using carbon capture and storage technology to reduce carbon emissions. Discuss the main obstacles to the widespread use of carbon capture and storage technologies.

Viability of Carbon Capture and Storage (CCS) Technology:

- Carbon Capture and Storage (CCS) has the potential to significantly reduce carbon emissions by capturing CO2 from power plants and industrial facilities, transporting it, and storing it underground.
- This technology could play a key role in mitigating emissions from hard-to-abate sectors, such as heavy industry, and could even contribute to negative emissions through direct air capture (DAC). However, its widespread use is currently limited by several significant challenges.

Main Obstacles to Widespread Use of CCS:

High Cost:

- The initial capital investment required to build CCS infrastructure, along with ongoing operational costs, makes it economically unfeasible for many industries and power plants.

Energy Intensive Process:

- Capturing and compressing CO2 requires substantial amounts of energy, which could reduce the overall efficiency of the power plants, making the process more expensive.

Storage Challenges:

- Suitable geological formations for CO2 storage are limited, and ensuring the long-term stability of the CO2 storage to prevent leakage remains a significant concern.

Public Perception:

- Concerns regarding the safety and environmental impact of storing CO2 underground, as well as the fear that CCS might delay the transition to renewable energy, may hinder public support for the technology.

Regulatory and Policy Challenges:

- The lack of robust regulatory frameworks and clear carbon pricing mechanisms discourages investment and development of CCS technologies. There is a need for incentives like carbon pricing or subsidies to make CCS economically viable.

Potential Benefits of CCS:

Mitigating Emissions from Hard-to-Abate Sectors:

- CCS is particularly beneficial for industries like cement and steel manufacturing, where deep decarbonization is challenging.

Enabling Fossil Fuel Use with Lower Emissions:

- CCS could allow continued use of fossil fuels while significantly reducing their carbon emissions, extending the life of fossil fuel infrastructure.

Negative Emissions Potential:

- CCS, in combination with Direct Air Capture (DAC) technologies, could potentially remove CO2 directly from the atmosphere, contributing to global efforts to reduce atmospheric CO2 levels.

Current Developments:

- Ongoing technological advancements aim to improve the efficiency and reduce the costs of CCS systems.
- Governments are exploring policy incentives, such as carbon pricing and subsidies, to promote CCS adoption.

19.பின்வருவனவற்றை விளக்குக:

1. **காலநிலை ஸ்மார்ட் கிராமங்கள்.**
2. **பாரிஸ் ஒப்பந்தத்தின் பிரிவு 6.**
3. **தமிழ்நாடு பசுமை காலநிலை நிறுவனம்.**

Explain the following:

1. **Climate Smart Villages.**
2. **Article 6 of the Paris agreement.**

3. **Tamil Nadu green climate company.**

1. **Climate Smart Villages.**
   - A Climate Smart Village (CSV) is a community-driven initiative that adopts climate-smart agricultural practices to address challenges posed by climate change. CSVs aim to enhance food security, build resilience, and reduce greenhouse gas emissions by integrating sustainable farming practices with local and scientific knowledge. These initiatives are tailored to specific regional conditions, ensuring their relevance and effectiveness.

Key Features of Climate Smart Villages

Focus on Adaptation and Mitigation:

- Helps farmers adapt to changing weather patterns while minimizing environmental impacts.
- Encourages sustainable farming techniques to mitigate climate change.

Participatory Approach:

- Actively involves local communities, farmers, and stakeholders in decision-making.
- Ensures that practices are aligned with the needs and capacities of the community.

Context-Specific Solutions:

- Tailors solutions to local climate conditions, soil types, and agricultural practices.
- Promotes flexible and practical approaches for diverse regions.

Research and Development:

- Involves testing innovative technologies and strategies through partnerships with research organizations.
- Facilitates the dissemination of knowledge and best practices across different villages.

Examples of Practices in Climate Smart Villages:

Drought-Resistant Crops:

- Planting crop varieties that can withstand erratic rainfall and prolonged dry periods.

Efficient Water Management:

- Adoption of techniques like drip irrigation, rainwater harvesting, and efficient canal systems.

Agroforestry:

- Integrating trees into agricultural landscapes to enhance carbon sequestration and biodiversity.

Organizations Leading Climate Smart Village Initiatives:

CGIAR:

- Led by the CCAFS (Climate Change, Agriculture, and Food Security) program.
- Focuses on research and scaling up of climate-smart practices globally.

Government Agencies and NGOs:

- Partner with local communities, scientists, and policymakers to implement CSV initiatives.
- Support capacity building and provide funding and resources.

Significance of Climate Smart Villages:

Improves Food Security:

- Enhances agricultural productivity and resilience to climate stress.

Empowers Communities:

- Encourages active participation and knowledge sharing among stakeholders.

Supports Sustainable Development Goals (SDGs):

- Aligns with goals like zero hunger (SDG 2), climate action (SDG 13), and life on land (SDG 15).

2. **Article 6 of the Paris agreement.**

- Article 6 of the Paris Agreement establishes a framework to facilitate international cooperation in achieving climate change mitigation targets. It enables countries to collaborate using market and non-market mechanisms, fostering cost-effective and efficient methods to meet their Nationally Determined Contributions (NDCs).

Key Features of Article 6:

Cooperative Implementation:

- Encourages countries to voluntarily collaborate to achieve climate goals.
- Supports both market-based (carbon credit trading) and non-market approaches.

Carbon Credit Trading:

- Allows countries to transfer emission reductions (carbon credits) from one country to another.

- Helps nations meet NDCs by investing in emissions-reducing projects abroad.

Environmental Integrity:

- Emphasizes that carbon credits must represent genuine, measurable, and additional emission reductions.
- Prevents loopholes that could undermine global climate action.

Sustainable Development:

- Projects under Article 6 should contribute to economic, social, and environmental sustainability.
- Ensures that climate action supports broader development goals.

Criticisms and Challenges of Article 6:

Risk of Double Counting:

- A major concern is the possibility of emission reductions being counted by both the country where the project is implemented and the country purchasing the credits.

Transparency and Oversight:

- Robust rules and monitoring systems are needed to ensure the integrity of carbon credits.
- There is a risk of market manipulation or low-quality credits undermining trust in the system.

Unequal Access:

- Developing countries may face challenges in participating effectively in carbon markets due to limited resources and technical capacity.

Significance of Article 6:

Facilitates Global Cooperation:

- Strengthens international partnerships by enabling resource sharing and cost-effective climate action.

Promotes Cost-Effective Solutions:

- Allows countries to achieve emissions reductions at a lower cost by investing in mitigation projects where it is most economical.

Encourages Innovation:

- Stimulates the development of new technologies and practices for emissions reductions.

3. **Tamil Nadu green climate company.**

Tamil Nadu Green Climate Company (TNGCC)

- The Tamil Nadu Green Climate Company (TNGCC) is a pioneering initiative by the Government of Tamil Nadu aimed at addressing climate change, enhancing climate resilience, and promoting sustainable development within the state.

Key Objectives of TNGCC:

Climate Change Mitigation and Adaptation:

- Develop and implement strategies to reduce greenhouse gas emissions.
- Enhance the state's capacity to adapt to climate impacts.

Conservation and Restoration:

- Protect biodiversity and restore ecosystems.
- Focus on afforestation, wetland conservation, and marine biodiversity.

Sustainability and Resilience:

- Promote sustainable practices across sectors, including agriculture, industry, and energy.
- Build resilient infrastructure to withstand climate-related challenges.

Major Initiatives by TNGCC:

Tamil Nadu Climate Change Mission:

- A comprehensive mission to address climate challenges in the state.
- Focuses on integrating climate action into all government sectors.

Tamil Nadu Green Mission:

- Aims to increase green cover in the state through afforestation and sustainable forestry practices.

Tamil Nadu Wetlands Mission:

- Focuses on the conservation and restoration of wetlands, which are vital for biodiversity and climate resilience.

Marine and Coastal Ecosystem Protection:

- Special attention is given to conserving mangroves and coral reefs along the Tamil Nadu coast.

Functions of TNGCC:

Policy Implementation:

- Serve as a nodal agency for executing state-level climate policies.

Research and Development:

- Promote studies and innovative solutions for climate adaptation and mitigation.

Public-Private Partnership:

- Encourage collaborations between government, private stakeholders, and civil society for sustainable projects.

Funding and Resource Mobilization:

- Secure financial resources from state, national, and international agencies for climate initiatives.

20. பசுமை ஹைட்ரஜன் என்றால் என்ன? அதனுடன் தொடர்புடைய அதன் நன்மைகள், சவால்கள் மற்றும் முன்முயற்சியை விளக்குக.

What is green hydrogen? explain its benefits, challenges and initiative associated with it.

- Green hydrogen is a clean and sustainable energy source produced by splitting water (H_2O) into hydrogen (H_2) and oxygen (O_2) through electrolysis, using electricity derived from renewable sources like solar or wind. It emits zero greenhouse gases during production and combustion, making it a critical component of efforts to achieve carbon neutrality.

Benefits of Green Hydrogen:

Decarbonization Potential:

- Replaces fossil fuels in hard-to-decarbonize sectors such as heavy industries (steel, cement) and transportation (aviation, shipping).

Energy Storage:

- Offers long-term storage solutions for renewable energy, addressing the intermittency of sources like solar and wind power.

Energy Independence:

- Reduces reliance on imported fossil fuels, enhancing energy security for nations.

Versatility:

- Used in fuel cells, industrial processes, power generation, and as a feedstock in chemical production.

Environmental Benefits:

- Produces water vapor as the only by-product during combustion, ensuring no harmful emissions.

Challenges of Green Hydrogen:

High Production Cost:

- Electrolysis technology is expensive, and renewable energy required for the process adds to costs.

Infrastructure Limitations:

- Storage, transport, and distribution infrastructure for hydrogen are underdeveloped globally.

Dependence on Renewable Energy:

- Hydrogen production is reliant on renewable energy availability, which can be inconsistent in certain regions.

Water Usage:

- Requires substantial quantities of water for electrolysis, posing challenges in water-scarce areas.

Safety Concerns:

- Hydrogen is highly flammable, necessitating strict safety measures during handling and transport.

Initiatives Associated with Green Hydrogen:

National Green Hydrogen Mission (India):

- **Objective:** To make India a global hub for green hydrogen production and export.

Key Features:

- Set targets for green hydrogen production capacity.
- Provide incentives for technology development and infrastructure.
- Promote domestic industries to adopt green hydrogen, reducing carbon emissions in key sectors.

Global Green Hydrogen Projects:

- Several countries, including the EU, Japan, and Australia, have launched initiatives to invest in green hydrogen technologies and build a hydrogen-based economy.

21. இந்தியாவில் பாலைவனமாதல் பிரச்சினையை குறித்து விவாதிக்க, மேலும் பாலைவனமாதலை எதிர்த்து ஐக்கிய நாடுகளின் மாநாட்டின் முக்கியத்துவத்தையும் விளக்குக.

Discuss about desertification problem in India and also explain the importance of United Nations convention to combat desertification.

- Desertification is a significant environmental challenge in India, primarily impacting arid, semi-arid, and dry sub-humid regions. It is characterized by the degradation of land in dry areas, resulting from various natural and human-induced factors.

Affected Areas

- Severely affected regions: Rajasthan, Gujarat, Haryana, Madhya Pradesh, and Maharashtra.
- Manifestations include declining vegetation cover, soil erosion, and reduced land productivity.

Causes:

Overgrazing:

- Excessive livestock grazing depletes vegetation, leading to soil erosion and reduced land fertility.

Deforestation:

- Removal of forests for agriculture, timber, and fuelwood exposes soil to erosion and reduces water retention.

Unsustainable Farming Practices:

- Improper crop rotation, overuse of chemical fertilizers, and poor irrigation practices exacerbate land degradation.

Climate Change:

- Erratic rainfall patterns, rising temperatures, and increased drought frequency intensify desertification.

Impacts:

Agricultural Productivity Loss:

- Degraded soils yield lower crops, threatening food security.

Loss of Biodiversity:

- Habitat destruction affects native species of flora and fauna.

Economic Losses:

- Reduced agricultural income impacts rural economies and livelihoods.

Migration:

- Desertification forces rural populations to migrate to urban areas in search of better opportunities.

Importance of the United Nations Convention to Combat Desertification (UNCCD):

- The UNCCD is a global initiative aimed at combating desertification, land degradation, and the effects of drought. It provides a framework for international cooperation and capacity building.

Key Roles of UNCCD:

Global Framework:

- Provides a legally binding structure for countries to collaborate on sustainable land management.

Capacity Building:

- Offers technical expertise, funding, and training to countries like India to implement effective land restoration strategies.

Policy Development:

- Encourages the development of National Action Plans (NAPs) tailored to local conditions.

Monitoring and Evaluation:

- Facilitates data sharing, progress tracking, and dissemination of best practices globally.

Community Engagement:

- Advocates for involving local communities in decision-making and restoration activities to ensure sustainable outcomes.

India's Role in UNCCD:

Ratification:

- India is a signatory to the UNCCD and participates actively in its initiatives.

National Action Plan:

- India has formulated a National Action Programme to Combat Desertification, focusing on sustainable land management.

Restoration Efforts:

- Promotes afforestation, agroforestry, watershed management, and land restoration projects.

Global Advocacy:

- Hosted the 14th Conference of Parties (COP14) to the UNCCD in 2019, emphasizing global cooperation and innovation in combating desertification.

22. **பேரிடர் மேலாண்மை (திருத்தம்) மசோதா, 2024 இன் முக்கிய விதிகளைப் குறித்து விவாதிக்க மேலும் இந்தியாவில் பேரிடர் மேலாண்மை செயல்முறைகளில் அவற்றின் சாத்தியமான தாக்கத்தை பகுப்பாய்வு செய்க.**
Discuss the key provisions of the Disaster Management (Amendment) Bill, 2024 and analyse their potential impact on disaster management processes in India.

Key Provisions of the Disaster Management (Amendment) Bill, 2024:

- The Disaster Management (Amendment) Bill, 2024 aims to strengthen disaster management frameworks at urban, state, and national levels.

Urban Disaster Management Authorities (UDMAs):

- Establishment of UDMAs in state capitals and cities with municipal corporations.
- Led by the Municipal Commissioner, UDMAs will prepare localized disaster management plans tailored to urban challenges.

State Disaster Response Forces (SDRFs):

- Mandates states to establish SDRFs, akin to the National Disaster Response Force (NDRF), for faster state-level disaster response.

Statutory Status for NCMC and HLC:

- Grants legal recognition to the National Crisis Management Committee (NCMC) as the apex body for managing national-level disasters.
- The High-Level Committee (HLC), responsible for disaster-related financial assistance, also receives statutory status.

Enhanced NDMA Powers:

- Empowers the National Disaster Management Authority (NDMA) to formulate regulations, conduct risk assessments, and identify emerging threats.

Comprehensive Disaster Database:

- Requires the creation of national and state-level databases, including disaster assessments, risk registers, and mitigation plans, to guide policy and planning.

Shift in Responsibility for Disaster Management Plans:

- Transfers the responsibility of drafting disaster management plans from executive committees to the NDMA and State Disaster Management Authorities (SDMAs).

Potential Impact on Disaster Management Processes in India:

Positive Impacts:

Improved Urban Preparedness:

- The establishment of UDMAs will address urban-specific vulnerabilities such as floods, earthquakes, and industrial accidents, enhancing preparedness and response.

Enhanced State-Level Response:

- SDRFs will enable quicker disaster response at the state level, facilitating localized, timely interventions.

Centralized Coordination:

- Statutory recognition of the NCMC will improve coordination during major disasters by clarifying roles and strengthening decision-making processes.

Data-Driven Decision-Making:

- The mandated disaster database will provide critical insights, enabling proactive planning and mitigation strategies.

Streamlined Planning:

- Shifting the responsibility for disaster management plans to NDMA and SDMAs ensures a more cohesive and expert-driven approach.

Concerns and Challenges:

Centralization Concerns:

- Critics fear that empowering the NDMA with greater regulatory authority could centralize disaster management, potentially undermining state-specific initiatives.

Resource Allocation Issues:

- Effective implementation of UDMAs and SDRFs requires significant financial and technical resources, which may strain states with limited capacities.

Community Engagement Gaps:

- The bill's top-down approach may inadequately involve local communities in disaster preparedness, reducing grassroots resilience.

Implementation Challenges:

- Coordinating among multiple stakeholders and integrating new frameworks with existing systems may face administrative bottlenecks.

23. புவி வெப்பமடைதல் மற்றும் காலநிலை மாற்றத்தைத் தணிப்பதில் சர்வதேச சூரியக் கூட்டணியின் முக்கியத்துவம் குறித்து விவாதிக்க.

Discuss the significance of the international solar alliance in mitigation of global warming and climate change.

- The International Solar Alliance (ISA) is a collaborative platform aimed at promoting solar energy adoption globally to mitigate climate change, reduce greenhouse gas (GHG) emissions, and accelerate the transition to renewable energy. Its initiatives play a crucial role in addressing the challenges posed by global warming.

Key Roles of ISA in Climate Change Mitigation:

Promotion of Solar Energy Adoption:

- ISA encourages member countries to harness solar energy, substituting fossil fuels with clean, renewable sources.
- Solar energy reduces GHG emissions, directly contributing to climate goals like those outlined in the Paris Agreement.

Mobilization of Investments:

- ISA aims to attract large-scale investments in solar projects, particularly in developing countries, enabling solar energy development at scale.
- Through its "Towards 1000" strategy, it plans to mobilize $1 trillion for solar capacity of 1000 GW by 2030.

Improved Energy Access:

- Solar energy solutions facilitated by ISA address energy shortages in underserved areas, especially in developing nations.
- Access to clean energy enhances socio-economic conditions while reducing dependency on non-renewable energy sources.

Advancement of Solar Technology:

- ISA fosters innovation by supporting research and development in solar technologies.
- It aims to lower the costs of solar energy production and improve energy efficiency, making solar power more accessible and sustainable.

International Cooperation and Knowledge Sharing:

- ISA facilitates collaboration between member nations to share expertise, strategies, and best practices for solar energy deployment.
- This global cooperation accelerates the adoption of effective solar solutions.

Contribution to Climate Goals:

- By focusing on renewable energy, ISA aligns with global efforts to limit temperature rise under 1.5°C as stipulated by the Paris Agreement.
- Solar energy projects supported by ISA have a direct impact on reducing the carbon footprint of member nations.

Strategic Aspects of ISA:

Focus on High Solar Potential Regions:

- Initially targeting countries between the Tropics of Cancer and Capricorn with abundant solar resources, ISA has expanded to include all UN member states.

India's Leadership:

- India, as a founding member, leads ISA initiatives by sharing its expertise in large-scale solar projects.
- Indian policies, like the National Solar Mission, act as models for other nations.

"Towards 1000" Strategy:

- This ambitious goal of $1 trillion in solar investments by 2030 demonstrates ISA's commitment to scaling renewable energy solutions globally.

Impact on Global Warming Mitigation:

Reduction in GHG Emissions:

- Solar energy adoption offsets emissions from coal and gas-based power generation, significantly reducing global GHG levels.

Sustainable Development:

- Solar energy projects improve energy security and support economic growth, particularly in energy-deficient regions.

Climate Resilience:

- Enhanced access to reliable and clean energy helps communities adapt to the adverse impacts of climate change.

24. நகர்ப்புற காடுகளின் நன்மைகள் மற்றும் இந்தியாவில் நகர்ப்புற வனவளத்தை ஆதரிக்க அரசாங்கம் எடுத்துள்ள நடவடிக்கைகளை விவரிக்க.

Describe the advantages of urban forests and the measures the government has taken to support urban forestry in India.

- Urban forests play a vital role in enhancing environmental sustainability, public health, and economic growth in cities. Here are the key benefits:

Environmental Benefits:

- **Air Pollution Mitigation:** Trees absorb harmful pollutants like particulate matter, nitrogen oxides, and carbon monoxide, improving air quality.
- **Climate Regulation:** Tree canopies reduce the urban heat island effect by providing shade and cooling through evapotranspiration.
- **Water Management:** Trees intercept rainfall, reducing stormwater runoff and enhancing groundwater recharge.
- **Carbon Sequestration:** Urban forests absorb carbon dioxide, helping mitigate climate change.
- **Biodiversity Enhancement:** They create habitats for various species, promoting biodiversity in urban settings.

Social and Health Benefits:

- Improved Mental Wellbeing: Green spaces help reduce stress and improve mental health.
- Encouragement of Physical Activity: Parks and tree-lined paths promote outdoor recreation and healthier lifestyles.
- Community Engagement: Tree planting and urban forestry initiatives foster community participation and social cohesion.

Economic Benefits:

- Increased Property Values: Areas with abundant greenery tend to have higher property values due to aesthetic appeal.
- Energy Savings: Shade from trees lowers energy demand for cooling buildings, reducing utility bills.
- Tourism Potential: Well-maintained urban forests attract tourists, boosting local economies.
- Government Measures to Support Urban Forestry in India
- Recognizing the importance of urban forests, the Indian government has implemented various measures to promote and support urban forestry:

Nagar Van Yojana:

- Aimed at creating dedicated urban forests ("Nagar Vans") in cities to enhance green cover.
- These forests serve as recreational spaces while providing ecological benefits.

Green Building Norms:

- Incorporating mandatory green spaces and tree planting in urban development projects.

- Encouraging rooftop gardens and vertical greenery in buildings.

Public Awareness Campaigns:

- Promoting the significance of urban trees through campaigns and events.
- Encouraging citizens to participate in tree planting drives and adopt sustainable practices.

Integration into Urban Planning:

- Including green belts, street trees, and public parks in city master plans.
- Promoting sustainable land-use practices to enhance urban canopy cover.

Financial Incentives:

- Providing grants, subsidies, and tax benefits to individuals and communities for planting and maintaining trees.
- Offering incentives to housing societies and corporations that integrate green spaces into their infrastructure.

Promotion of Native Species:

- Encouraging the use of indigenous and climate-resilient tree species that are well-suited to local ecosystems.
- Ensuring species selection aligns with water availability and urban environmental conditions.

25.2030 ஆம் ஆண்டிற்குள் நிலையான வளர்ச்சி இலக்குகளை அடைய இந்தியா எடுத்த பல்வேறு நடவடிக்கைகளை மதிப்பிடுக.

Evaluate the various measures taken by India to achieve the sustainable development goals by 2030.

- India has aligned its national development agenda with the Sustainable Development Goals (SDGs), implementing numerous programs targeting critical areas such as poverty reduction, education, healthcare, clean energy, and gender equality. Here is an evaluation of these measures, including achievements and challenges:

Key Initiatives by SDG:

Health and Wellbeing (SDG 3):

- **Ayushman Bharat:** World's largest health assurance scheme, providing insurance coverage for low-income families.
- **National Health Mission:** Improved maternal and child health outcomes, and strengthened primary healthcare systems.
- **Evaluation:** While significant progress has been made in expanding healthcare access, rural areas still face gaps in infrastructure, staff, and specialized care.

Quality Education (SDG 4):

- **Sarva Shiksha Abhiyan:** Ensures free and compulsory education for children aged 6-14.
- **Skill India Mission:** Focused on vocational training to improve youth employability.
- **Evaluation:** Enrollment rates in primary education have improved, but challenges remain in addressing drop-out rates, especially among marginalized communities, and ensuring quality education.

Clean Water and Sanitation (SDG 6):

- **Swachh Bharat Mission:** Declared India open defecation-free (ODF) in 2019 by constructing over 110 million toilets.
- **Jal Jeevan Mission:** Aims to provide piped water to all households by 2024.
- **Evaluation:** Access to sanitation and drinking water has increased, but issues like water quality, long-term maintenance, and behavioral change need further attention.

Affordable and Clean Energy (SDG 7):

- **National Solar Mission:** Installed solar capacity reached over 70 GW by 2023, contributing to India's renewable energy targets.
- **PM Ujjwala Yojana:** Distributed over 96 million LPG connections to reduce indoor air pollution.
- **Evaluation:** India is on track to meet renewable energy targets, but infrastructure for grid integration and affordability for low-income households remain challenges.

Poverty Reduction (SDG 1):

- **National Rural Livelihood Mission (NRLM):** Empowered millions of rural women through self-help groups.
- **Direct Benefit Transfer (DBT):** Reduced leakages and ensured targeted delivery of benefits.
- **Evaluation:** Poverty levels have decreased, but ensuring consistent income growth and access to opportunities in remote areas is vital.

Gender Equality (SDG 5):

- **Beti Bachao, Beti Padhao:** Promoted awareness and improved female enrollment in education.
- **Self-Help Groups:** Enabled financial independence for millions of women through microfinancing.

- **Evaluation:** Progress in gender parity in education and employment has been made, but addressing entrenched societal norms and gender-based violence remains crucial.

PM Gati Shakti NMP:

- The PM Gati Shakti NMP is a comprehensive plan designed to provide better multimodal connectivity to economic zones across India. The platform integrates various stakeholders, including government ministries, state authorities, and key infrastructure sectors.

How it works?

- The NMP works by integrating 44 central ministries and 36 states and union territories, ensuring that infrastructure projects are planned and executed cohesively. It coordinates sectors like transportation (rail, road, air, and water), logistics, and communication, facilitating timely and transparent delivery of projects.
- **Economic Growth:** The plan aims to contribute to a 5 trillion-dollar economy and increase it to 20 trillion dollars by 2040 by improving infrastructure and logistics across the country.
- **Improved Efficiency and Transparency:** By using geospatial data, Gati Shakti NMP enhances the monitoring of current projects, improves project execution times, and boosts transparency by making information about ongoing and upcoming projects accessible to the public.
- **National Schemes:** The plan consolidates and coordinates national initiatives such as Bharatmala (national highways), Sagarmala (port development), and UDAN (regional air connectivity).
- **Industrial Corridors:** It connects key industrial hubs and logistics corridors, optimizing transport and infrastructure connectivity for industries.
- **Integration of Ministries:** It integrates critical sectors like Indian Railways, Roadways, Airways, and Waterways, ensuring smooth connectivity across different modes of transport.

Achievements:

- **Improved Metrics:** Significant progress in sanitation, renewable energy, and healthcare.
- **Global Recognition:** India's initiatives like Ayushman Bharat and Swachh Bharat Mission have been lauded globally.

- **Community Involvement:** Programs like NRLM and self-help groups have effectively mobilized communities.

Challenges and Areas for Improvement:

Regional Disparities:

- Development indicators show stark differences between states; targeted interventions in underserved regions are required.

Funding and Resource Allocation:

- Many programs face funding gaps, and states with weak governance often struggle to implement schemes effectively.

Sustainability of Projects:

- Ensuring long-term maintenance and operational efficiency of infrastructure projects like toilets, water pipelines, and solar installations is critical.

Awareness and Behavioural Change:

- Campaigns to encourage sustainable practices, such as waste segregation or water conservation, need reinforcement.

Monitoring and Accountability:

- Stronger mechanisms are required to track progress, ensure accountability, and minimize bureaucratic inefficiencies.

26. தமிழகத்தில் நிலச்சரிவு ஏற்படக்கூடிய பல்வேறு பகுதிகளை விளக்கி தேசிய நிலச்சரிவு அபாய மேலாண்மை உத்தி குறித்து விவாதிக்க.

Explain the various landslide-prone areas in Tamil Nadu and discuss the national landslide risk management strategy.

- In Tamil Nadu, landslides are a significant concern, especially in areas characterized by steep slopes, heavy rainfall, and geological conditions conducive to soil erosion. The primary landslide-prone regions in the state include:

Nilgiri District (Western Ghats):

- The Nilgiri Hills, located within the Western Ghats, are particularly vulnerable to landslides due to their steep terrain and heavy monsoon rainfall.
- The Nilgiri district, including popular areas like Ooty, is prone to frequent landslides, especially during the monsoon season. The region experiences high rainfall, and its rugged topography makes it more susceptible to slope failure.

Kodaikanal Hills:

- Kodaikanal, another hill station in Tamil Nadu, located in the southern Western Ghats, is also vulnerable to landslides. Its slopes and the heavy rainfall it experiences during the monsoon make it prone to landslide activity.

Southern Western Ghats (Bordering Kerala):

- The areas in the southern Western Ghats, bordering Kerala and extending into Tamil Nadu, are known for their steep slopes and high rainfall, which increases the risk of landslides.

National Landslide Risk Management Strategy:

- The National Landslide Risk Management Strategy (NLRMS) is a comprehensive framework aimed at reducing landslide risks and minimizing their impact through a multi-faceted approach. The key components of the strategy are as follows:

Hazard Mapping:

- **Landslide Susceptibility Mapping:** A detailed mapping system identifies high-risk zones, allowing authorities to prioritize areas for mitigation. This mapping is crucial in understanding where landslides are most likely to occur, especially in hill stations like Nilgiri and Kodaikanal.

Monitoring and Early Warning Systems:

- **Real-Time Monitoring:** Establishing monitoring systems, such as ground sensors and remote sensing technologies, to detect early signs of landslides in vulnerable areas. This includes rainfall gauges, soil moisture monitoring, and GPS sensors to detect ground movements.
- **Early Warning Systems:** These systems help provide advance notice to communities in landslide-prone areas to evacuate and prepare for potential disasters.

Awareness Campaigns:

- **Community Education:** Raising awareness about landslide risks, the early warning signs of impending landslides (e.g., cracks in the ground, soil erosion, unusual rainfall patterns), and the importance of following evacuation procedures.
- **Training Local Communities:** Ensuring that residents in landslide-prone areas know how to respond to alerts and warnings and how to protect themselves during a disaster.

Capacity Building and Training:

- **Training Disaster Management Teams:** Offering specialized training for local authorities, disaster management personnel, and geologists on how to assess landslide risks, implement mitigation measures, and respond to landslide emergencies effectively.
- **Geotechnical Expertise:** Strengthening the technical capacity of experts to analyze slope stability and design appropriate mitigation measures in vulnerable areas.

Policy Development and Regulations:

- **Land Use Planning:** Strict land-use regulations to control construction activities in landslide-prone areas, avoiding excessive deforestation and uncontrolled urbanization that could exacerbate the risk of landslides.
- **Environmental Protection Measures:** Implementing environmental safeguards, such as maintaining vegetation cover, controlling soil erosion, and using sustainable construction practices to reduce the landslide risk.

Slope Stabilization Measures:

- **Engineering Solutions:** Various engineering techniques are applied to stabilize slopes, including:
  - Retaining walls to prevent soil erosion.
  - Rock bolting and netting to secure loose rocks.
  - Drainage systems to prevent water accumulation on slopes, which can trigger landslides.

Key Components of the Strategy:

Landslide Atlas of India:

- This document compiles data on past landslide events, including damage assessments, providing a reference for future risk analysis and mitigation planning.

National Landslide Susceptibility Mapping (NLSM) Programme:

- Initiated by the Geological Survey of India (GSI), this program aims to generate comprehensive landslide susceptibility maps across the country to better understand high-risk areas and implement targeted mitigation strategies.

Landslide Risk Mitigation Scheme (LRMS):

- The LRMS provides financial assistance for projects aimed at mitigating landslide risks in vulnerable states. This includes funding for

infrastructural improvements, slope stabilization, and landslide monitoring systems.

Challenges in Implementing the Strategy:

Limited Monitoring Infrastructure:

- Many landslide-prone areas, especially remote regions, lack adequate monitoring systems. Establishing a robust monitoring network across such regions is challenging due to limited resources and accessibility.

Poor Awareness and Community Participation:

- There is a need for better engagement with local communities in landslide-prone areas. Many residents are not fully aware of the risks or the measures they need to take in case of an impending disaster.

Coordination Issues:

- Effective coordination between various government agencies, local authorities, scientific institutions, and NGOs is critical for the success of the strategy. Fragmented responsibilities and lack of collaboration can delay mitigation efforts.