APPROACH – ANSWER: G. S. MAINS MOCK TEST - 2346 (2024)

Answer all the questions in NOT MORE THAN 200 WORDS each. Content of the answers is more important than its length. All questions carry equal marks.   *12.5X20=250*

1. **Mangroves play a critical role in the well-being of coastal communities and biodiversity. Elaborate. Also, discuss the recently launched MISHTI scheme in this context.**

Approach:

- Give a brief overview about mangroves in the introduction.
- Highlight the role played by mangroves in the well-being of coastal communities and biodiversity.
- Discuss the key features of the MISHTI scheme.
- Conclude appropriately.

Answer:

Mangroves are salt-tolerant vegetation that grow in intertidal regions of rivers and estuaries. They are the interface between terrestrial forests and aquatic marine ecosystems and are the characteristics of tropical and subtropical sheltered coastlines. India has a total mangrove cover of 4,992 sq km (0.15% of India's total geographical area).

Mangroves are of immense significance for the communities and biodiversity of coastal areas in the following ways:

- **Protect coastlines**: Mangroves act as a natural barrier against storms and waves, thus protecting the coastlines from erosion and damage. They help to reduce the impact of coastal hazards and protect human settlements and infrastructure.
- **Maintain biodiversity:** Being an interface between the terrestrial and aquatic ecosystems, mangroves are among the most productive ecosystems, supporting nearly 3000 fish species and unique diversity of flora. They provide a unique habitat for a variety of plants and animals, many of which are **endemic** to the mangrove ecosystem. They are also home to a wide range of mammals, reptiles, and invertebrates.
- **Provide food supplies and act as source of livelihood:** Mangrove coastal areas are inhabited by nearly 120 million people. Minor produce of wood, food and fish from these forests is a significant part of their diet and lifestyle. They also support eco-tourism activities, generating income for local communities.
- **Ecological services:** Mangroves act as water filters and have the potential to treat aquaculture effluents. The carbon storage capacity of mangroves is 3 to 5 times higher than that of the upland forests. They play a significant role in mitigating climate change by absorbing carbon dioxide from the atmosphere.

The Union Budget 2023-24 announced the **MISHTI (Mangrove Initiative for Shoreline Habitats & Tangible Incomes)** scheme for better regeneration and utilization of the mangrove ecosystem. **The key features of the scheme are as follows:**

- **Expansion of mangrove area:**
  - It aims to bring mangrove plantation along the coastline and on salt pan lands. The scheme envisages to bring 540 sq km area in 11 states and 2 UTs under mangrove in the next five years.
  - The scheme will focus on intensive afforestation of coastal mangrove forests both in the Eastern and Western coasts of India.

- **Convergence of various schemes:** Mangrove plantations will be taken up through the convergence of job guarantee scheme MGNREGS, Compensatory Afforestation Fund, and other funding sources.
- **Collaboration:** It will incorporate the best practices on plantation techniques, conservation measures, and management practices, resources mobilization through public-private partnership (PPP).
- **Green push**: The scheme is part of a larger green push with a focus on conserving the environment and mitigating climate change.

The scheme comes as a timely intervention, as the mangrove resources are under the threat of commercialization from aquaculture, coastal development, and industrial activities.

2. *According to a recent scientific assessment, the ozone hole, once considered to be the gravest danger to planetary life, is now expected to be repaired by 2066. In this context, discuss the various measures taken for ozone hole recovery.*

Approach:

- In the introduction, briefly discuss the phenomenon of ozone depletion and its impact.
- State the progress in ozone recovery due to global efforts.
- Mention the various measures taken for the protection of the ozone layer.
- Conclude accordingly.

Answer:

The ozone layer in the upper atmosphere blocks ultraviolet (UV) radiation that harms the living tissue, including humans and plants. In the 1980s, scientists discovered that certain human-made chemicals, such as chlorofluorocarbons (CFCs), were causing a depletion of the ozone layer, leading to the formation of a "hole" or depletion in the ozone layer over Antarctica.

Ozone depletion allows more radiation of the ultraviolet radiation on the earth's surface. It may lead to an increase in certain types of skin cancers, eye cataracts and immune deficiency disorders in human beings. It also affects the physiological and developmental processes of plants and marine ecosystems.

Due to its widespread negative impacts, a range of measures were taken for ozone repair. As a result of numerous global measures, a recent study concluded that if current policies remain in place, the ozone layer is expected to recover to 1980 values (before the appearance of the ozone hole) by around 2066 over the Antarctic, by 2045 over the Arctic and by 2040 for the rest of the world.

The various initiatives taken for the protection of ozone layer are as follows:

- **The Vienna Convention for the Protection of the Ozone Layer, 1985:** It aimed to protect the ozone layer by promoting international cooperation and research on ozone depletion. It established a framework for countries to work together to monitor the ozone layer, exchange information on the production and consumption of ozone-depleting substances, and develop strategies for reducing their use.
- **The Montreal Protocol on Substances that Deplete the Ozone Layer, 1987:** It is a legally-binding international treaty that aimed to phase out the production and consumption of nearly 100 man-made chemicals referred to as ozone depleting substances (ODS).
  - The Ozone Fund (Multilateral Fund for the Implementation of the Montreal Protocol) was established in 1990 to support developing countries in their efforts to phase out the use of ozone depleting substances.
- **Kigali Amendment to the Montreal Protocol, 2016:** It aims for the phase-down of hydrofluorocarbons (HFCs) by cutting their production and consumption. Given their zero impact on the depletion of the ozone layer, HFCs are currently used as replacements of hydrochlorofluorocarbons (HCFCs) and chlorofluorocarbons (CFCs), however, they are powerful greenhouse gasses. With the Kigali Amendment, the Montreal Protocol will be an even more powerful instrument against global warming.

Arresting ozone depletion is crucial to not only protect the earth's environment but also to protect its biodiversity. The complex interconnection between ozone depletion and climate change needs to be studied and understood in a more scientific manner to design proactive and collective policy responses.

3. *Recently, there has been a surge in the incidence of heatwaves in India. Discuss the reasons behind this and state the various mitigation measures in this regard.*

Approach:

- In the introduction, define heatwaves and discuss India's vulnerability to it.
- State the reasons for the surge in the incidence of heatwaves in India.
- Elaborate on the various steps needed to mitigate the impact of heatwaves.
- Conclude appropriately.

Answer:

According to the IMD, a heat wave is considered if the maximum temperature of a station reaches at least 40°C or more for plains and at least 30°C or more for hilly regions. Heat wave is a condition of air temperature, which becomes fatal to the human body when exposed. In the past few years, India has experienced some of the hottest summers on record. Between 1990 and 2019, summer temperatures on **average rose by 0.5-0.9°C across North India**. Further, in the next 30 years, the maximum temperature is expected to rise by **2-3.5°C in 100 districts** and **by 1.5– 2°C in around 455 districts.**

Temperature rises due to various natural and man-made factors. The following are the reasons for the increased incidences of heatwaves in the country:

- **Climate change**: It is a major contributor to increased heat wave incidences, which is causing a rise in global temperatures. As the planet heats up, it leads to more extreme weather events, such as heat waves.
- **Urbanization:** It is leading to the '**urban heat island effect'** where the temperature of urban areas can be several degrees higher than the neighboring areas. It is because of the absorption and retention of heat by concrete and asphalt surfaces.
- **Reduced natural vegetation:** Vegetation acts as a natural cooling system by absorbing and releasing water vapor through transpiration. In contrast, man-made surfaces are water-repellent and non-reflective, which increase the absorption of solar radiation leading to overall increase in the temperature.
- **Scarcity of water:** Encroachments into surface water resources can also increase temperature by reducing the amount of moisture in the air.

Various measures to mitigate the impact of heatwaves include:

- **Public awareness:** Proper awareness generation and education should be imparted about the impact of rising temperatures on health, environment, and economy. This can be done through public campaigns, schools, and dissemination of information by the media.
- **Integration of policy initiatives**: The National Disaster Management Authority (NDMA) and IMD are working with 23 States prone to high temperature towards heat action plans. These action plans need to be seamlessly integrated with local initiatives and there should be a focus on awareness generation.
- **Greening of cities**: Development plans for Tier 2 and Tier 3 cities should mandate an increase in the density and area of urban forests. Expanding wetlands and restoring dead and decaying ponds/lakes will also help in reducing the temperature.
- **Promoting green infrastructure**: Use of permeable materials in civic infrastructure and residential construction should be promoted.
  - Urban building standards should be upgraded to avoid usage of heat-absorbent galvanized iron and metal roof sheets.
  - Use of mud, insulated prefab walls should be done in construction, which will not only reduce the heat in the buildings but will also lead to lower electricity consumption for cooling.

The rising incidence of heat waves in India is a serious concern that needs to be addressed urgently. The impacts of rising temperatures on human health, the environment, and the economy are significant, but, with timely strategies in place, it is possible to minimize the ill-effects of heat waves.

4. *What do you understand by Nature-based Solutions (NBS)? Explain how NBS can help in adaptation with regard to various hazards.*

Approach:

- Explain the concept of Nature-based Solutions (NBS) in the introduction.
- Discuss how NBS can help in adaptation with regard to various hazards.
- Conclude accordingly.

Answer:

Nature-based Solutions (NBS) is an umbrella term that aims to protect, sustainably manage, and restore natural or modified ecosystems to meet critical societal needs while building long-term environmental and economic resilience. Examples include increasing green cover through forestry, green roofs, rain gardens, etc.

NBS use and work with nature in different ways, which can be broadly categorized as conservation, protection, restoration, management and sustainable use. NBS are solution-oriented, reflecting the fact that they can be used to address a range of social, economic and environmental challenges. NBS helps protect the biodiversity, helps in disaster risk reduction, aids in improving our health and is vital for the climate.

NBS can help in adapting to various hazards in the following ways:

- Protecting and restoring coral reefs is a potentially cost-effective approach in order to protect low-lying communities and shorelines against flooding, storm surges, and erosion.
    - Also, restoring coastal erosion and increasing density of mangroves will help in preventing hazards created due to **rising sea level and coastal erosion**.
- In urban areas, nature-based solutions such as green roofs, rain gardens, or constructed wetlands can minimize damaging runoff by absorbing storm water, reducing flood risks and safeguarding freshwater ecosystems.
    - Also, expanding green space in and around cities will help in adapting to heat stress due to urban heat islands.
- Forests act as significant carbon sinks, sequestering huge amounts of carbon in tree biomass and soils. By preventing deforestation and degradation, it is possible to reduce carbon emissions while staving off the worst impacts of a warming planet.
    - Also, forests help in stabilizing soil and slowing water-runoff due to intense rainfall, thus mitigating hazards like **landslides, soil loss and siltation**.
- NBS will help in case of loss of life and assets due to **intense wildfires.** For example, restoring degraded ecosystems, thinning overly dense forests, removing invasive species, restoring the water-retaining qualities of meadows and riparian ecosystems, etc. can lead to forest management in a natural way, which will reduce risk of super fires.
- Agroforestry will help to make better use of soil moisture and reduce evaporation and will help in adapting to **crop failures and livestock loss due to drought.**
- Due to their effectiveness in filtering water, wetlands are now being utilized around the world as low-cost, convenient, and effective alternatives to gray wastewater treatment facilities and they also play an important role as carbon sinks.
- Taking measures for water storage and increasing water retaining qualities of the riparian ecosystem will help in protecting and restoring watersheds and regulate flow in case of reduced or **intermittent river flow due to drought.**

India needs to scale up and improve targeting of investment in NBS along with mainstreaming of the NBS in governance and empower locally led actions on NBS. There is also a requirement of enhancing regional and international cooperation in this regard.

5. *The Environmental Impact Assessment (EIA) is one of the cornerstones in ensuring that the ecological costs of infrastructure development are minimal. In this context, discuss the concerns associated with the star rating system introduced in the EIA.*

Approach:

- Introduce by writing briefly about the Environmental Impact Assessment (EIA).
- Briefly bring out the significance and objectives of the EIA in protecting the ecology and the environment.
- Discuss the benefits and the concerns associated with the star rating system introduced in the EIA.
- Conclude accordingly.

Answer:

Environmental Impact Assessment (EIA) is a tool used to assess the significant effects of a project or development proposal on the environment. It is considered as one of the cornerstones in protecting ecology and environment due to its **significance,** given below:

- **Ensures sustainable development**: The EIA helps to connect development and environmental protection so that the state can achieve the goal of sustainable development.
- **Assesses the impact of developmental projects**: The EIA identifies, evaluates and predicts the environmental, economic, and social impact of new development activities.
- **Enhances people's participation**: It ensures that all the people who are going to be affected by a project are involved in public hearing.
- **Explores alternatives**: The EIA reports provide the most efficient method to reduce the impacts of the project on the environment, which saves both the environment and available resources.
- **Fair and equitable decision-making**: The EIA helps the stakeholders in decision-making, as the approval of the projects are based on the findings after assessment.

Recently, the government rolled out a **star rating system** for **State Environment Impact Assessment Authorities (SEIAAs)** to make them more efficient, transparent and accountable. The star rating system proposed is to "rank" and "incentivise" states on how "quickly" and "efficiently" they can accord environmental clearances to developmental projects. Though the rating system may accelerate the pace of decision-making with regard to environmental clearances, there are certain concerns associated with it, as given below:

- **Improper scrutiny:** The EIA Notification, 2006 mandates 'detailed scrutiny' of the applications for environmental clearances but pressure on state agencies for granting clearances faster will lead to hasty actions without proper review.
- **Lack of informed decision making**: The SEIAA needs to gather enough data to make an informed decision. However, according to the new rating system, states that ask project proponents to provide additional details multiple times are given fewer points, thus hampering informed decision-making.
- **Generates unhealthy competition:** State authorities whose mandate is to ensure protection of the environment will now compete to clear projects as early as possible in order to increase state rankings.
- **Lack of trained personnel:** State committees are currently hampered, as there are few independent environmental experts and decision-making is being left to bureaucrats who may prioritize associated economic benefits of the projects over the environmental concerns.
- **Hampers environmental governance:** According to experts, the environmental safeguards are viewed as bottlenecks in the ease of doing business by project proponents and the government. This pressure of speed, efficiency and incentivisation may skew environmental governance to favor the businesses.

There is a growing consensus that timely and broad-based stakeholder involvement is a vital ingredient for effective environmental impact assessment. Rather than diluting safeguards, it is necessary to take steps to ensure detailed scrutiny of the projects in the EIA process and ensure that SEIAAs have competent experts to conduct such scrutiny.

6. *What do you understand by community-based disaster preparedness? Explain the process and preparation strategy of community-based disaster management plans for resilience.*

Approach:

- Give a brief introduction about community-based disaster preparedness.
- Explain the step-by-step process and preparation strategy of community-based disaster management.
- Conclude accordingly.

Answer:

Community-based disaster preparedness (CBDP) is an approach to build the capacity of communities to assess their vulnerability to both human-induced and natural hazards and develop strategies and procure resources necessary to prevent and/or mitigate the impact of identified threats as well as respond, rehabilitate and reconstruct following their onset. Examples of CBDP include Chetna Initiative in Bihar, Odisha's community outreach system, Aapda Mitra scheme of Puducherry, etc.

The process and preparation strategy of community-based disaster management plans for resilience are given below:

- **Pre-disaster phase**:
  - **Community orientation**: A community-based disaster management plan should have measures towards community orientation, wherein the community needs to be briefed on the nature and effect of a disaster and their vulnerabilities.
  - **Stock-taking of resources**: A CBDP plan must involve stock taking of the available resources such as condition of schools, health centers, cyclone shelters, etc., which can help the community to make quick decisions when a disaster actually strikes.
  - **Risk and vulnerability assessment:** It is important to take stock of the elements at risk, viz., area, physical structures, economic assets, etc. and people at risk, viz., children, women, disabled, elderly, etc., so that preparedness measures are appropriately planned.
  - **Formulation of preparedness plan**: Preparedness plan should take into cognizance the needs of the community, clarify measures to be taken by the community before, during and after the disaster strikes, give an idea of resources available at various places, specify the roles and responsibilities of concerned officials, departments, Panchayati Raj Institutions, NGOs, etc.
- **During the occurrence of a disaster**:
  - **Organizing search, rescue and evacuation activities**: This includes identifying the victims of a disaster, bringing them to safer places, providing first-aid, distributing relief, adhering to evacuation plans, etc.
  - **Providing shelter to people and livestock**: While the place of shelter for people and livestock is pre-planned, plans should be made for other arrangements to be taken care of in the shelter, which include water supply, sanitation, kitchens, fodder for animals, medical services, first-aid, etc.
  - **Debris clearance and dead body identification:** Clearing of debris from collapsed buildings, bridges, etc. and disposing of dead humans and livestock is a major concern in this phase, which has to be planned appropriately.
- **Post-disaster phase:**
  - **Detailed damage assessment**: This is helpful in knowing the magnitude of loss both in terms of lives and other damages like infrastructure, damage to crops, etc.
  - **Preparation of rehabilitation plan**: Drawing up a comprehensive economic rehabilitation plan is necessary, which can include measures for restoration of livelihoods of people.
  - **Social rehabilitation**: The post-disaster plan should ensure social rehabilitation through strengthening of the existing health centers, schools, anganwadis, community centers, etc.
  - **Monitoring of community-based disaster management:** This can be done by building appropriate monitoring and evaluation mechanisms to facilitate proper utilization and implementation of resources.

While communities have built on local coping strategies and capacities to reduce some vulnerability, they alone cannot reduce all vulnerabilities on their own, as many structural mitigation measures involve big capital outlay. Therefore, apart from this, concerted efforts from multiple stakeholders like the government, civil society, etc. is necessary for effective disaster management.

7. *What are the impediments in disposing the huge quantity of e-waste being generated in India? Bring out ways to ensure timely and safe recycling of e-waste.*

Approach:

- Give some facts about increasing e-waste in India.
- Highlight the issues faced with respect to disposing e-waste in India.
- Suggest measures to ensure recycling of e waste in India.
- Conclude appropriately.

Answer:

As per **Global E-Waste Monitor 2020**, **India is the 3rd largest e-waste generator** (3.2 million tons annually) after China (10 MT) and USA (6.9 MT). Out of the total e-waste generated in India in 2019-20, only 22.7% was collected, dismantled and recycled or disposed-off. Further, it is expected that by 2030, India will generate 14 million tonnes of e-waste, or four times the current volume.

The major impediments in disposing the huge quantity of e-waste in India are as follows:

- **Lack of dedicated and robust e-collection chain:** The formal recycling units collect a mere 15 percent of the total e-waste generated in India. Rest is done by the informal sector workers, using hazardous methods such as open-air incineration and acid leaching.
- **Lack of infrastructure:** At present, the CPCB has just 567 authorized recyclers in 22 states, with a total recycling capacity of 1.7 million tons, which is insufficient for the amount of waste generated in the country.
- **Limited coverage:** E-Waste (Management) Rules, 2016 covered only 21 types of electrical and electronic equipment. However, this problem has been done away by including more than 100 types of equipment including PV cells in e-waste management rules 2022 (effective from FY 2023).
- **Limited involvement of urban local bodies (ULBs):** E-waste typically does not feature in the list of municipal solid waste and therefore not a direct mandate for the cities to collect, transport, and manage. ULBs are only responsible for collection and channelisation of 'orphan products' to the authorised dismantler or recycler.
- **Lack of Awareness and Financial Incentives:** Most consumers have little or **no knowledge of the consequences** of reckless e-waste disposal. They also **lack market information** about prices for various e-waste components, and they have **few financial incentives** for responsibly disposing of their e-waste.

Various measures can be adopted for timely and safe recycling of e-wastes, such as:

- **Separate department in urban local bodies:** Since a large chunk of **e-waste is generated in urban areas**, a separate department can be created in urban local bodies to deal with the waste management.
- **Market Information about E-waste Prices:** The prices for e-waste and its components should be widely publicized among urban consumers **to create a powerful market signal** for customers who sell the e-waste to local vendors.
- **Strengthen unorganized sector:** State governments can develop **grant schemes** for incentivizing small-scale, informal e-waste recycling centers to upgrade the facilities so that they comply with **environmental and health safety** regulations.
- **Lessons from developed countries:** In EU countries, e-waste management systems were put in place in the 1990s, and yet recycling is just 45% of total waste generated. Therefore, India should focus that the targets under EPR are set in such a way that the producers feel **incentivised to design** more sustainable, less toxic, and more easily recyclable electronics.

Considering the strategic importance of critical elements found in e-wastes, the government of India has brought the new E-Waste Management Rules 2022, National Policy on Electronics (2019) and Scheme for Promotion of Manufacturing of Electronic Components and Semiconductors (SPECS).

8. *India is vulnerable to a large number of natural disasters on account of its unique geo-climatic conditions. Elaborate with examples.*

Approach:

- Define natural disasters and geo-climatic conditions of India in introduction.
- Elaborate with the examples of how India is vulnerable to various types of natural disasters.
- Conclude appropriately.

Answer:

As per **NIDM (National Institute of Disaster Management),** out of 36 states and union territories in India, 27 are disaster prone. Almost 58.6 per cent of the landmass is prone to **earthquakes** of moderate to very high intensity; over 40 million hectares (12 per cent of land) are prone to **floods** and river erosion; of the 7,516 km long coastline, close to 5,700 km is prone to **cyclones** and **tsunamis**; 68 per cent of the cultivable area is vulnerable to **drought** and hilly areas are at risk from **landslides and avalanches**.

India is amongst the 10 most disaster-prone countries of the world and is vulnerable, in varying degrees, to a large number of natural, as well as, human-made disasters on account of its unique geo-climatic and socio-economic conditions. For instance:

- **Cyclones:** India has a coastline of about 7516 kms, which (especially the eastern coast) is exposed to nearly 10 percent of the world's tropical cyclones. About 71 percent of this area is in ten states (Gujarat, Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu, Puducherry, Andhra Pradesh, Orissa and West Bengal).
- **Floods:** India receives an **annual rainfall of 1200 mm, over 75% of which is concentrated in 3-4 months** i.e., June to September. Due to this, most of the rivers are fed with huge quantities of water and around 12 per cent (40 million hectare) of land in India is prone to floods. For instance, the **floods in Kerala in 2018** resulted in widespread devastation, with loss of lives, homes, and infrastructure.

- **Earthquakes:** India falls prominently on the **'Alpine - Himalayan Belt'** along which the Indian plate meets the Eurasian plate. This makes the entire region covering **fourteen states** highly prone to earthquakes. The other seismically active regions of the country include the Gulf of Khambhat and Rann of Kutch in **Western Gujarat** and **Andaman and Nicobar Islands**. The **2001 Gujarat earthquake** resulted in significant loss of life and property.
- **Landslides:** High vulnerability zones in India include **Himalayas, Andaman and Nicobar Islands, Western Ghats** etc., which experiences landslides due to high rainfall, and seismic activity. For example, **2013 Uttarakhand floods** and landslides resulted in massive devastation.
- **Droughts:** Around **68% of the country** is prone to drought in varying degrees. Almost **33% of the areas receive rainfall less than 750 mm** thus being chronically drought prone. Major drought-affected areas include most parts of **Rajasthan, Kachchh region of Gujarat**, interior parts of Madhya Pradesh, Maharashtra, Telangana, Karnataka, Tamil Nadu, Jharkhand and Odisha.
- **Wildfires:** India's forested regions are vulnerable to wildfires, particularly during the dry season. **54.40% of forests in India are exposed to occasional fires, 7.49% to moderately frequent**
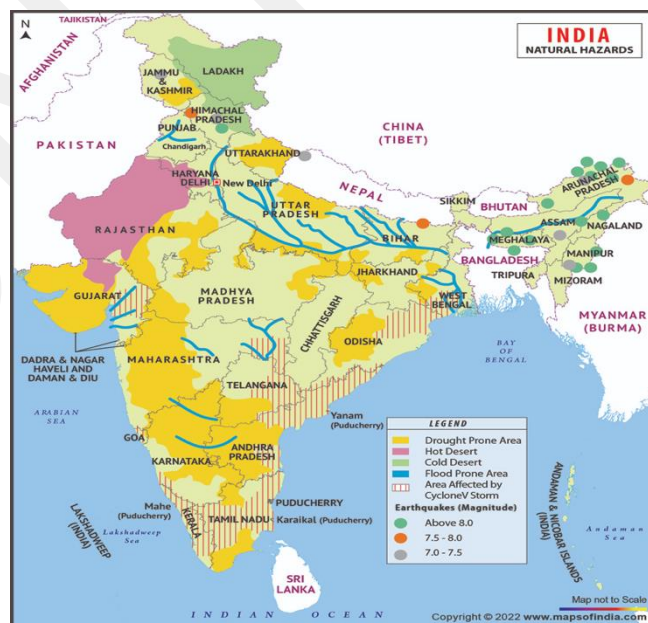
fires and 2.4% to high incidence levels. The devastating forest fires occurred in **Uttarakhand in 2016** and in the **Bandipur National Park in Karnataka in 2019**.

- **Heatwaves:** India experiences extreme heat waves, particularly during the summer months. Most of the states across **northwest India, Gangetic Plains, Central India and east coast India** are affected during the heatwave season.

In response to India's vulnerability to a wide range of natural disasters, the Government of India has established the **National Disaster Management Authority** under the Disaster Management Act, 2005. A **National Disaster Management Plan** covering all phases of disaster management based on the 4 priority areas of **Sendai framework** has also been prepared.

9. *Discuss the major challenges faced by the National Disaster Response Force (NDRF) in performing its functions and propose measures to enhance its effectiveness.*

Approach:

- Give a brief introduction about how the National Disaster Response Force (NDRF) is a vital component of India's disaster management and relief operations.
- Discuss the major challenges faced by the NDRF in executing its role.
- Suggest measures to enhance its effectiveness.
- Give a brief conclusion.

Answer:

National Disaster Response Force (NDRF) is a specialist disaster response force under the Disaster Management Act 2005. NDRF has saved over 1.48 lakh human lives and evacuated over 7 lakh stranded individuals from its inception till 2021. It has played a major role not only in domestic disaster relief but also in international situations like the recent '**Operation Dost'** in Turkey and Syria for earthquake relief.

Major challenges faced by the NDRF in executing its role include:

- **Inadequate capital expenditure**: Over the years the actual expenditure in the capital sector in Budget has largely been showing a declining trend, which would also hamper the plan of building infrastructure and capacity augmentation of NDRF Battalions.
- **Low budget for training**: Budget Estimates and Actual Expenditures analysis since 2016-17 reveals that the provision for training NDRF personnel has remained low at Rs. 1 to 2 crore, with utilization between 50% to 80%. Moreover, there is a lack of modern training facilities at par with the international technical and equipment standards.
- **Increased activities**: From helping a child in a pit, to rescue work in a flood or cyclone, NDRF personnel are engaged in a varied range of situations which is increasing by the day.
- **Lack of continuity:** NDRF is a 100% deputationist force and thus personnel from various CAPFs & Police Organizations are posted in NDRF on deputation for a period of seven years.
- **Insufficient equipment:** There has been a huge shortage of almost all the items authorised to NDRF. The non-availability of critical equipment affects effective and quick response.
- **Dual control:** There is great ambiguity in the control and command structure. While the MHA controls funds and execution, the NDMA has administrative control over the force. This results in a tussle between the two. Further, the force has to deal with two bosses for everything, thereby complicating and delaying processes.

Measures to enhance its effectiveness:

- Although the concept of 100% deputationist force is apt for the purpose, it may be **reviewed to include participation of suitably fit and trained youth from other organizations** too, for instance, senior NCC cadets, trainees from Nehru Yuva Kendra Sangathan, for operational and administrative purposes in NDRF.
- For **addressing financial constraints**, cooperation of local administration with NDRF and Permanent Disaster Management Funds and regular contributions from the States and Central Budget can be worked out.

- Budget should be specifically allocated for **establishing and upgrading appropriate training infrastructure**, hiring well trained personnel and procuring state of art technical equipment for **training of the force as per international standards**.
- **Shortage of equipment** under different categories should be **reviewed in a time bound manner and procured** without further delay.
- **Capacity at state as well as community level needs to be enhanced** as in coming times with increasing frequency of disasters, the NDRF would not be able to reach everywhere. Plus, **the range of activities for NDRF should also be limited** in order to obtain specialist response.

Experience in major disasters has clearly shown the need for pre-positioning of some response forces to augment the resources at the State level at crucial locations. Thus, it is imperative to build NDRF's capability to ensure effective response and recovery.

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10. *Local bodies are the key to disaster risk mitigation in India. Discuss with examples.*

Approach:

- Introduce by briefly mentioning why local bodies play an important role in disaster risk reduction.
- Discuss the role of local bodies in disaster risk mitigation.
- Conclude accordingly.

Answer:

Local bodies such as municipalities and panchayats play a critical role in disaster risk mitigation in India. This is because they are closest to the people and communities affected by disasters and are best placed to coordinate and implement disaster risk reduction measures at the local level. They have **first-hand knowledge** of their community's social, economic, infrastructure, and environmental needs, helping them to provide support in a disaster.

The **Sendai framework for Disaster Risk Reduction** (2015-2030) calls for empowering local authorities through appropriate regulatory and financial means to work and coordinate with civil society, communities and indigenous peoples and migrants in disaster risk management at the local level.

The key role of local bodies in disaster risk mitigation can be illustrated as follows:

- **Pre-Disaster Phase**
  - **Resource Mapping**: Initiating a 'Mapping of Resources and Facilities' in and around its functional area with special emphasis on their suitability for disaster management. For example, identifying temporary locations for keeping evacuated persons, storage of food, drinking water, medicines, etc., availability of necessary equipment, etc can be arranged by the local governments.
  - **Vulnerability Mapping**: Carrying out 'Vulnerability Mapping' of the locality and updating the vulnerability profile of the area at regular intervals.
  - **Early Warning Systems**: The can devise an 'Early Warning and Reporting System' with the list of 'nodal persons' across the functional area. For example, the Brihanmumbai Municipal Corporation has installed flood sensors in various parts of Mumbai to monitor water levels and issue warnings in case of heavy rainfalls.
- **During Disaster**
  - **Disaster response:** The local bodies can play a vital role in disaster response as 'first responders'. For instance, during the 2018 floods in Kerala, the local bodies were at the forefront of the rescue and relief efforts by setting up temporary shelters.
  - **Arranging necessities**: Starting a 'community kitchen' at an appropriate place for ensuring food to all those affected and ensuring medical services are available to the needy at all times.
- **Post disaster**
  - **Medical Camps**: The services of private medical practitioners, nursing staff and para-medical staff can be ensured by the local government to organise medical camps.
  - **Recovery**: Coordinate the activities of government departments, non-governmental agencies and community based organisations for providing livelihood support for the affected families.

They also can aid in restoring livelihood assets like roads and infrastructure in the locality on priority.

Considering this importance, the Disaster Management Plan of the Ministry of Panchayati Raj (DMP–MoPR) has been recently released. Further, it is imperative to promote a culture of planning and implementation of disaster risk reduction initiatives that builds on local and national government and civil society partnerships and cooperation in support of local initiatives to dramatically reduce the costs of risk reduction, ensure local acceptance and build social capital.

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11. ***Bring out the impact of noise pollution on human health and the environment.***

Approach:

- Introduce by highlighting the meaning of noise pollution.
- Briefly explain its impact on human health and environment.
- Conclude by mentioning the measures taken to tackle it.

Answer:

Noise pollution is considered as **any unwanted or disturbing sound** that affects the health and well-being of humans and their environment. **Air (Prevention and Control of Pollution) Act, 1981** includes noise in the definition of **'air pollutant'.** The effects of noise pollution were seen as a nuisance rather than an environmental problem for decades. However, according to recent estimates of the WHO, the number of people with hearing loss could **rise to over 2.5 billion by 2030** from the current 1.5 billion (nearly 20% of the global population).

Impact of noise pollution on human health:

- **Noise induced hearing loss**: Constant exposure to loud noise, which is beyond the range of normal sound intensity can damage the eardrums, thus resulting in hearing disability.
- **Cardiovascular issues:** Prolonged noise pollution has led to chronic increases in hormones, such as cortisol, adrenaline, and noradrenaline. These increased hormone levels can lead to hypertension, stroke, congestive heart failure etc.
- **Sleeping disorders:** Noise pollution can also affect the sleep cycle of an individual which may lead to sleeping disorders, low energy levels, and fatigue.
- **Stress and cognitive impacts:** People especially children who live near noisy airports or streets have been found to suffer from stress and other problems, such as impairments in memory, attention level, and reading skill.
- **Emotional troubles:** Constant sharp noise can cause a severe headache and disturb emotional balance.

Impact of noise pollution on the environment:

- **Impacts communication of animals:** When biological species attempt to communicate with their partners or detect prey or predators, man-made sounds can imitate or mask the sound of the biological group. It also hampers their ability to navigate.
- **Impact on health of organisms:** Noise pollution has also been known to raise cortisol levels in multiple species including seahorses, dogs, and fish.
  - Studies have also indicated that excessive environmental noise at 85 dB can cause premature birth or adverse pregnancy complications.
  - It also leads to cardiovascular impacts causing spikes in heart rate and blood pressure.
  - Noise stressors can lead to altered chemical production or gene expression.
- **Unusual animal behaviour:** Some studies indicate that prolonged exposure to noise causes unusual animal behaviour. For instance, certain species of whales beached themselves after exposure to sonar.

Faced with the above challenges, international bodies like the WHO have agreed that awareness of noise pollution is essential to beat this invisible enemy. In this direction, several steps like avoiding very noisy leisure activities, insulating homes, educating the younger generation about essential aspects of environmental education, creating more greenspaces etc. can be taken.

12. *Evaluating India's preparedness in handling disasters caused by cyclones, discuss the measures taken to improve cyclone disaster management capabilities in India.*

Approach:
- Introduce by giving facts about the status of occurrence of cyclones in India.
- Briefly explain the preparedness done by India in this regard.
- Mention the short and long term measures needed in this regard.
- Conclude accordingly.

Answer:

India with a **long coastline of 7516.6 kilometres** is exposed to nearly **10 percent of the world's tropical cyclones**. On an average, **five to six tropical cyclones form every year, of which two or three could be severe.**

Given this situation, India has improved its cyclone disaster management capabilities a lot over the years, as evident from the following instances:

- **Swift action** was taken during some of the major cyclones such as Cyclone Phailin (2013), Fani (2019) etc. The United Nations Office for Disaster Risk Reduction hailed efforts of evacuating more than a million people to safety during the Fani cyclone.
- **India Meteorological Department** state of the art cyclone warning services **forecasted cyclones with significant accuracy** as witnessed during cyclones Phailin (2013), Hudhud (2014), Vardah (2016), Titli (2018), Fani (2019) and Amphan, Nisarga (2020).
- **NDRF has also been commended for its role in providing timely rescue and relief work.**
- There has **been increased coordination with ISRO** for weather conditions, coastal information through its remote sensing satellites - NAVIC and RESOURCESAT-2.

This improvement in the cyclone disaster management capabilities of India can be attributed to the following measures, which have been taken over the years:

- **The Natural Disaster Management Authority,** created in 2005 has formulated the comprehensive **National Guidelines for Management of Cyclones.**
- **The National Cyclone Risk Mitigation Project, 2011** was launched to upgrade the forecasting, tracking and warning about cyclones in states.
- **National Disaster Response Force (NDRF)** performs disaster response and relief operations, and maintains a National Disaster Response Reserve, a fund of Rs. 250 crores for emergency supplies.
- **A blueprint of the National Disaster Management Plan** was unveiled in 2016 to tackle disaster following the **Sendai Framework For Disaster Risk Reduction 2015-2030.**
- **Colour Coding of Cyclones** is issued by the IMD to awareness generation among people ahead of natural hazards.
- **Seven Cyclone Warning Centers** covering the east & west coasts have been established for Cyclone Warning Services.
- Further, the efforts have been undertaken towards **building disaster resilient infrastructure (DRI)** and **zone mapping.**

While these efforts have drastically reduced cyclone-related deaths to double-digit figures in recent years, certain areas still need improvement, such as:

- Currently, the **focus is mainly on evacuation** and little attention is given to other key disaster response functions.
- The **current strategy would prove to be abysmally inadequate** if there is a repeat of a super cyclone, where the **tidal inundation was up to 20 km**.
- There is **very little discussion on the quality and quantity of the relief** distributed.
- The pace at which **financial assistance** is distributed to eligible people post-disaster for house reconstruction etc. is very **slow.**
- The **media focus on the situation often is limited** to the emergency period.
- The **funds available for reconstruction are inadequate** because state governments underestimate the budgets required for mitigation and reconstruction. Moreover, central assistance is available only for disaster relief and not for mitigation or restoration.

Thus, efforts such as better coordination between centre and state, performing Disaster Risk Audit in risk-prone areas, making disaster management regime more inclusive etc. would go a long way in making cyclone disaster management more effective.

13. *Highlighting the reasons behind widespread soil degradation in India, discuss the various steps undertaken to address the problem of soil pollution.*

Approach:

- Introduce with the status of soil degradation in the country.
- Highlight the various reasons responsible for soil degradation and contamination.
- Discuss the various steps undertaken to resolve this.
- Conclude accordingly.

Answer:

Soil degradation is the physical, chemical and biological decline in soil quality due to its improper or poor management for agriculture, industrial or urban purposes. **A third of the world's soils** are degraded and in India, around **29.7 per cent of land is degraded,** according to the ISRO Atlas published in 2021. Nearly **3.7 million hectares suffer from nutrient loss** in soil (depletion of soil organic matter) in India.

The **reasons for widespread soil degradation** in the country are as follows:

- **Heavy metal pollution:** Industrial activities like mining, manufacturing, mineral extraction, dumping industrial wastes, chemical spills and e-waste all result in soil contamination.
- **Climate change and disasters:** Excessive rainfall and floods owing to changing weather patterns have depleted the top fertile soil. Other natural disasters like earthquakes, tsunamis, droughts, landslides are also contributors to soil degradation.
- **Unsustainable agriculture practices:** Water erosion in the form of sheet and gully erosion, excessive tillage and use of heavy machinery, crop residue burning and inadequate organic matter inputs, poor crop rotation practices etc. have all contributed to soil pollution and degradation.
  o Overusing agrochemicals causes soil acidification, reduces soil organic matter, stunts plant growth, and releases greenhouse gases.
  o Excessive irrigation causes waterlogging and soil salinity as it prevents leaching of salts.
- **Deforestation:** Deforestation removes trees and crop cover, exposing soil minerals, reducing the availability of humus and litter layers and affecting aeration, water holding capacity, and biological activity.
- **Urbanisation:** Urbanization impacts soil degradation by removing vegetation cover, compacting soil during construction, and altering drainage patterns. Impermeable concrete covering increases surface runoff and topsoil erosion.

The Government has undertaken several steps to address the problem of soil pollution such as:

- **Soil Health Card** provides every farmer with soil nutrient status of his land and dosage of fertilizers to be maintained for good soil health.
- Schemes like **Parampragat Krishi Vikas Yojana (PKVY) and Mission Organic Value Chain Development for North Eastern Region** promote low-cost organic farming.
- **PM Krishi Sinchayi Yojana** and '**Per drop more Crop' campaign** seek to educate farmers on ways to maintain soil moisture and ensure irrigation efficiency.
- **National Afforestation Programme (NAP) and Green India Mission (GIM)** are aimed at extensive afforestation measures to control continuous erosion of soil due to the reduction of forests.
- **Rashtriya Krishi Vigyan Yojana** protects the loss of topsoil, improving soil fertility, enhancing crop production, land and water productivity of soils and the ecosystem as a whole.
- **Other schemes** such as **Neem Coating of Urea, Nutrient Based Subsidy (NBS) Scheme** also help in maintaining nutrient profile of soil.

Soil is the second largest carbon sink after the ocean, thereby playing a crucial role in mitigating climate change. In this regard, India's efforts towards restoring 26 million hectares of degraded land by 2030 are crucial to healthy soils and achieving the target of additional carbon sink of 2.5 to 3 billion tonnes of carbon dioxide equivalent.

14. *State the reasons for the increasing instances of urban floods in India. Also, discuss the steps taken by the government to mitigate the urban flood risk in the country.*

Approach:

- Introduce with data about the recent rise in urban floods.
- Analyse the reasons responsible for rising urban flood risk in India with examples.
- Discuss the measures taken and conclude accordingly.

Answer:

There has been an increasing trend of urban flood disasters in India over the past several years most notably amongst them include floods in Chennai (2004), Mumbai (2005), Delhi (2009), Guwahati and Delhi (2010) and the recent **Bangalore floods (2022).**

The reasons for the increasing urban floods in the country are discussed below:

- **Changing weather patterns:** Global climate change has resulted in changed weather patterns and increased episodes of high intensity rainfall and cloudburst events occurring in shorter periods of time. Increased average rainfall during monsoons has resulted in storm surges that inundate the coastal cities.
- **Concretization:** The increased urbanization and concretization of urban spaces results in reduced infiltration into the soil. This leads to the overflowing runoff, which inundates urban spaces and storm drains.
- **Storm water and waste mismanagement:** Narrow drainage capacities accentuated by improper disposal of solid waste and dumping of construction debris into the drains also contributes significantly to reducing their capacities thus overflowing every time there is overwhelming rainfall.
- **Encroachments:** Large scale encroachments owing to unrestricted and haphazard urban sprawl onto the natural drains, lake beds and the river floodplains has led to decrease in their capacity to absorb rainwater thus resulting in flooding.
- **Inadequate infrastructure:** Reduced capacity of installed pipelines, flood storage, drawbacks in the operation of pumping stations and a general lack of maintenance adds to the flooding risks.

Following are the steps taken to mitigate the urban flood risk of the country:

- Post the Mumbai floods of July 2005, National Disaster Management Authority (NDMA) prepared the **National Guidelines on Management of Urban Flooding** for the first time to address urban flooding as a separate disaster, delinking it from floods.
- Initiatives like the **Sponge Cities Mission and Atal Mission for Rejuvenation and Urban Transformation (AMRUT)** have helped civic authorities in city planning by keeping flood risks in mind.
  - Further, residential and commercial stakeholders have incorporated green infrastructure options like rain gardens, green roofs, and rainwater harvesting systems to upgrade capacity.
- Efforts towards **rejuvenation and restoration of lakes, wetlands** in cities like Bangalore, Mumbai and creation of an 'Urban Jungle' for the cities to enhance its biodiversity are undergoing.
- **Nature Based Solutions** have been undertaken to combat urban drainage issues and environmental impacts such as the **Bhopal's green-blue master plan, Delhi's Master Plan 2041, Chennai's water as leverage initiative and Pune's urban agricultural plan**.

India's urban population is expected to reach 814 million by 2050, with the addition of four new megacities by 2030. Alongwith the above steps, management of urban flooding must include community interactions building awareness, coming together of both public and private stakeholders for improved local governance, waste management and climate governance as top priority.

15. *Identify the reasons for increasing human-wildlife conflict in India. What are the major steps taken by the government to mitigate this conflict?*

Approach:

- Introduce by mentioning the rising instances of human-wildlife conflict in India.
- Discuss the causes and consequences of this conflict.
- List the major initiatives taken by the government to mitigate this conflict.
- Conclude appropriately.

Answer:

As per the report by UNEP and WWF, the human-animal conflict is one of the main threats to the long-term survival of the world's most iconic species. India would be one of the most affected countries as it has the world's largest human population as well as large populations of tigers, Asian elephants, one-horned rhinos, Asiatic lions, and other species.

MoEFCC data shows that over 500 elephants were killed between 2014-2015 and 2018-2019, mostly due to human-elephant conflict while 2361 people were killed during the same period.

Reasons for Human-Wildlife Conflict:

- **Habitat depletion and fragmentation**: Changes in land use, cropping patterns, and development activities have led to habitat depletion and fragmentation, forcing animals to search for food and water in human settlements, resulting in conflict.
- **Movement of livestock and humans in wildlife habitats:** Poverty and other constraints force disadvantaged humans to enter protected areas and exploit natural resources bringing them into conflict with wild species.
- **Invasive alien species**: The introduction of invasive species can reduce the availability of food and water for wildlife, leading to competition for resources and conflict with humans.
- **Climatic factors:** Changing climate has also altered vegetation of an area and the predation and foraging activities of many species including lions and leopards which come into conflict with humans.
- **Increase in wildlife population due to conservation efforts**: Wild animal populations may grow beyond the carrying capacity of a protected area causing individuals and groups to "spill over" into human settlements and cultivations.
- **Stochastic events:** Unforeseen events like forest fires, floods, etc. can push animals out of their habitats, destroy their feedstock and bring them to populated areas in search of food and shelter.

Measures taken by the Government to mitigate the Human-Wildlife conflict (HWC)

- **National Human-Wildlife Conflict Mitigation Strategy and Action Plan:** It is designed to address the underlying causes and factors contributing to conflict, focusing on the "Drivers-Pressures-State-Impact-Response" framework.
- **Standing Committee of National Board of Wildlife Guidelines**: The advisory seeks expedited inter-departmental coordinated and effective actions like promoting **community participation, providing insurance for crop loss, ex gratia relief, adoption of early warning systems, dedicated hotline numbers, identification of hotspots etc.**
- **Legislative framework:** Legislations such as Wildlife Protection Act-1972, National Biodiversity Act-2002, have provisions for protection of the wildlife and their habitat by creating protected areas.
- **State level initiatives:** Several initiatives such as creation of State Level Committees in States like Kerala, Uttarakhand, Maharashtra, etc. have been taken to reduce HWC and mitigate their effects on humans and animals alike.
- **Creation of wildlife corridors:** Several states, including Kerala, Madhya Pradesh, and Karnataka, have established corridors to enable animals to move freely between habitats and access food and water.
- **Funding to States:** The Central government provides financial support to the States/UTs conservation of wildlife and their habitat though Development of Wildlife Habitat Scheme.

- **International cooperation:** Initiatives like Indo-German Human-Wildlife Conflict Mitigation Project are undertaken to frame guidelines and standard operating procedures so that humans and wildlife could coexist.

Eradicating human-wildlife conflict is a challenging task but well-planned integrated approaches can reduce HWCs and lead to a form of coexistence between people and animals.

16. *Assess the environmental impact of agricultural subsidies in India. Additionally, suggest measures to reduce this impact.*

Approach:

- Give a brief introduction about agricultural subsidies in India.
- Assess the environmental impact of agricultural subsidies in India.
- Highlight measures to reduce this impact.
- Conclude appropriately.

Answer:

Agricultural subsidies have evolved as an important component of the Indian agriculture system over the years. Various types of agricultural subsidies in India include **input subsidies (fertilizer, power, irrigation, seed, etc.),** Minimum Support Prices (MSPs), export subsidies, etc. However, these subsidies have led to major environmental impacts.

The negative environmental impacts of various agricultural subsidies are as follows:

- **Soil degradation:** Agricultural subsidies incentivize intensive farming practices that prioritize monocropping over crop rotation and sustainable agricultural practices, thus leading to soil degradation. Further, they promote excessive use of chemical fertilizers that impact soil productivity.
- **Air pollution:** India's fertilizer industry is classified under the "red category" of polluting sectors by the Central Pollution Control Board of India (CPCB).
  - Pollutants like **sulphur dioxide, fluoride, particulate matter, etc.** are released from the fertilizers in plants.
  - Agriculture contributes **around 10-12% of total greenhouse gas (GHG) emissions**. Low nitrogen use efficiency in India prompts the release of nitrogen as nitrous oxide into the environment.
- **Water pollution**: Production as well as use of fertilizers leads to groundwater and surface water pollution in the following ways:
  - Discharge from urea plants contains nitrogen, and cyanides, which can lead to groundwater and surface water pollution, if not treated properly.
  - Excess fertilizers are washed away to freshwater bodies and lead to harmful algal blooms.
- **Overexploitation of groundwater:** Power subsidy for irrigation resulting in overexploitation of groundwater has **led to a decrease in water-table.** For example, in Punjab **79% of groundwater reservoirs are over exploited,** followed by Delhi (65%), Rajasthan (63%), Haryana (61%).

Measures to reduce the impact of agricultural subsidies include:

- **Support efficient use of fertilizer** in high fertilizer-use areas, and take a more balanced approach to boosting fertilization everywhere. For example, the government has mandated **100% Neem Coating on all subsidized agricultural grade urea.**
- **Promote drip irrigation system** in which water is applied near the plant root through emitters or drippers thus limiting the water wastage.
- **Conditional funding based on environmental practices**, and use systems of "graduated" payments that reward farmers for better and better performance. For example, the government can condition low-cost agricultural loans to farms and municipalities that curbed deforestation.
- **Promote organic farming** that minimizes chemical inputs and emphasizes natural processes.
- **Implement precision agriculture** and use of technologies like GPS and remote sensing to optimize farming inputs, reduce waste, and minimize environmental impact.

- **New incentives and policies for ensuring the sustainability of agriculture** and ecosystem services will be crucial to meet the demands of improving yields without compromising environmental integrity.
- Direct conservation support toward integrated projects that bring groups of farmers together with scientists to try out **innovative systems that reduce fertilizer or pesticide use**.
- Management practices, such as **soil conservation systems**, including no-tillage and extended crop rotations can mitigate the negative effects on soil health/functions.

The government of India has taken various measures to promote sustainable agriculture such as Pradhan Mantri Krishi Sinchayee Yojana, National Mission for Sustainable Agriculture (NMSA), nutrient-based subsidy scheme, etc. There is a further need to bring more innovation and modern techniques in the agricultural sector, which are sustainable in the long-term.

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17. *Explain the process involved in the formation of cloudbursts and state their impact. Also, suggest measures to reduce the impact of cloudbursts.*

Approach:
- Briefly define cloudbursts in the introduction.
- Explain the step-by-step process of formation of cloudbursts.
- Highlight the impact of cloudbursts.
- Mention the various measures that can be taken to reduce the impact.
- Conclude appropriately.

Answer:

A cloudburst is a **localized but intense rainfall activity that can cause widespread destruction, especially in hilly regions**. According to the IMD, 100mm of rain in an hour is called a cloudburst. They usually occur over a small geographical region of about 20 to 30 sq. km. **Most cloudbursts occur in the Himalayan states**, where local topography, wind systems, and temperature gradients between the lower and upper atmosphere facilitate the formation of such events.

Process involved in the formation of cloudbursts:

- The **moisture carrying air moves up a hilly terrain**, forming a vertical column of clouds known **as 'cumulonimbus' clouds**. This upward motion of the clouds is also known as an **'orographic lift'.**
- Raindrops, instead of dropping down, are **carried upwards by the air current.** Thus, new drops are formed and existing raindrops gain in size.
- **Lightning** within these clouds helps in delaying rainfall.
- When they are unable to hold the **large volume of moisture**, these dense clouds **eventually burst resulting in torrential downpours** in the geographical region right below. It leads to overflowing of water bodies in a very short duration of time.
- **Hilly terrains aid in heated air currents rising vertically upwards,** thereby, increasing the probability of a cloudburst situation.
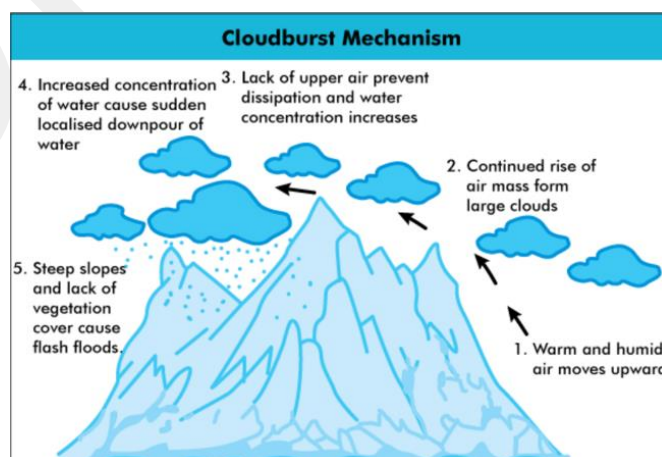
Impact of cloudbursts:

- **Flash floods:** It usually happens downstream from the storm as heavy rains produce more water than an area can handle.
- **Landslides**: Mountainous terrain adds momentum to large amounts of water gushing down, leading to landslides, mudslides and flooding.
- **Loss of life and property:** The economic impact due to cloudbursts is tremendous in the forms of affected households, loss of human and animal life, damage to infrastructure, crops, etc.

- **Environmental degradation:** Cloudburst triggered debris flow and flash flood lead to dislocation of forest trees and degradation of land.

Measures to reduce the impact:

- **Constructing the settlements in safer places,** generally away from the violent streams with special consideration to water level during heavy rainfall. Also, in the disaster risk zones, scenario analysis can be carried out under which identifying driving forces of disaster risks is the first step.
- **Better forecasting by the IMD** and incorporation of advanced technology to monitor and predict extreme weather events can enable early warning, evacuation and preparedness. For example, a dense radar network over cloudburst prone areas to monitor the cloud burst.
- **Participation of the local community** can strengthen the entire framework of disaster management. For example, **imparting training to the rural people** for minimizing damage.
- **Nature-based eco-disaster risk reduction** can be adopted to prevent further disaster risks. For instance, a large-scale plantation drive on degraded land will restore the fragile landscape.

Cloudbursts occur naturally and cannot be stopped, however, their severity can be minimized. A comprehensive approach will help reduce the devastating effects of cloudbursts on affected areas.

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18. *What are the key causes of marine pollution? Discuss its overall impact on the environment.*

Approach:

- Define marine pollution in the introduction.
- Mention the causes of marine pollution.
- Discuss the overall impact of marine pollution on the environment.
- Conclude accordingly.

Answer:

As per the United Nations, "marine pollution is the introduction by man, directly, or indirectly, of substances or energy to the marine environment resulting in deleterious effects such as harm to living resources, hazards to human health, hindrance to marine activities, impairment of the quality for use of seawater for various uses and reduction of amenities."

Causes of marine pollution are the following:

- **Oil pollution:** Anthropogenic activities such as petroleum extraction from oceans, transportation by ships, run-off from highways and discharge from recreational vehicles lead to marine oil pollution. However, naturally occurring oil seeps from the seafloor are also a major source of oil entering the oceans.
- **Ocean mining:** Ocean mining sites drilling for silver, gold, copper, cobalt, and zinc create sulfide deposits deep down into the ocean.
- **Nutrient pollution:** Excess nutrients enter the oceans due to runoff of dissolved nitrogen and phosphorus from fertilizers, discharge from sewage treatment plants and industries, etc. Nitrogen released by fossil fuel combustion also enters the oceans.
- **Toxic chemicals:** These contaminants enter the oceans through direct discharge from industries, agriculture, household cleaning, etc. as well as from indirect sources through atmospheric emissions and subsequently enter the oceans through rainfall.
- **Marine debris:** While some marine debris comes from ocean-based sources such as cargo or fishing boats, a staggering 80% is estimated to come from land-based sources which include plastic products and other man-made substances washed into storm drains, and funneled directly into coastal waters.
- **Thermal pollution:** Increase in GHG emissions leads to global warming, which eventually increases the temperature of oceans.
- **Noise pollution:** Growing number of ships, oil exploration activities, and military and civilian sonar use.

Marine pollution negatively impacts the overall marine environment in the following ways:

- Nutrient pollution results in 'eutrophication', which may cause algal blooms. These blooms can **discolour the water**, clog fish gills, and can even be **toxic, e.g., red tides**. Microbial breakdown of dead algae can also cause **oxygen deficiencies and dead zones**.
- Pesticides, such as DDT, and other persistent chemicals like *polychlorinated biphenyls* (PCBs) **accumulate in the fatty tissue** of animals. These chemicals can cause **reproductive failure** in marine mammals and birds. Consuming such organisms also leads to **biomagnification**.
- Plastics kill marine animals such as turtles, as they often **swallow floating plastic bags** mistaking them for jellyfish. Marine animals often get entangled with plastic. Floating plastics also tend to collect in large **"patches" in ocean gyres.**
- **Oil Spills** on the water surface damage marine life to a large extent.
  - Oil interferes with photosynthetic processes and decreases total primary production in phytoplankton.
  - It affects the insulating ability of fur-bearing mammals, impairs the water repellency of a bird and causes reproduction impairment in adult fish.
  - It leads to 'tainting', which imparts an unpleasant flavor to the seafood, reducing its market value.
- **Toxic sulphides** from deep-sea mining impact the benthic fauna.
- Noise pollution **disorients marine animals,** such as whales, for whom migration is an important part of the reproductive cycle.

Globally, multiple agreements such as the **Oslo Convention, MARPOL Convention, Paris Convention and OSPAR Convention** have been signed to reduce marine pollution. However, there is a need to devote resources to research, improve monitoring, and continue development of pollution source-reduction strategies and technologies.

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19. *There is a lack of significant improvement in the quality of river water in India despite multiple efforts by different stakeholders. Elaborate with examples.*

Approach:

- In the introduction, discuss the deteriorating quality of river water in India.
- Mention the steps taken to improve the quality of river water in India.
- State the reasons for poor quality of the river despite the efforts taken in this regard.
- Conclude accordingly.

Answer:

As per a study conducted by the **Central Pollution Control Board (CPCB)**, 603 rivers across India were assessed for Biochemical oxygen demand, and 311 polluted stretches were noted from 279 rivers. **In order to arrest this deteriorating quality of river water in India, the following are some of the measures taken by different stakeholders:**

- **The Water (Prevention and Control of Pollution) Act, 1974**: The basic objective of this Act is to maintain and restore the wholesomeness of national aquatic resources by prevention and control of water pollution.
- **Namami Gange Programme (2014):** It is a Central sector scheme, which aims to accomplish the objectives of effective abatement of pollution, conservation and rejuvenation of River Ganga.
- **National River Conservation Plan (1995):** It is a centrally sponsored scheme, which aims to reduce the pollution load in rivers through implementation of various pollution abatement works, thereby improving their water quality.
- **National Water Quality Monitoring Programme (NWMP)**: It assesses the status of water quality and facilitates prevention and control of pollution in water bodies. Under this programme, the monitoring network consists of 4484 locations spread in 28 states and 7 Union Territories across the country.
- **Institutional mechanisms:** The CPCB assesses the water quality of aquatic resources in the country in association with the State Pollution Control Boards and Pollution Control Committees.

Despite these measures, there is a lack of significant improvement in the quality of river water in India due to the following reasons:

- **Low capacity**: There is a lack of proper sewage treatment plants in the states.
  - For example, while the five major states through which the Ganga flows generated around 10,000 million liters per day (MLD) of sewage, they had a combined sewage treatment capacity of around 4000 MLD or just 40 per cent.
- **Lax monitoring**: Data collection about the quality of river water and its dissemination remain challenging in India.
  - For example, under the National Mission for Clean Ganga, manual monitoring should be carried out at 134 stations, but monitoring is currently carried out at 97 stations.
- **Waste discharge**: Untreated sewage continues to be discharged into rivers, which pollutes the water resources. According to the NGT, untreated waste gets discharged in 60 percent of Ganga.
  - Untreated waste discharge of textile manufacturing and processing units, chemical manufacturing units, etc. into the Sabarmati makes it one of the most polluted rivers in India.
- **Unplanned tourism activities**: Using water bodies to attract tourists has become a threat to several water bodies in India due to lack of responsible tourism.
  - For example, heightened plastic pollution alongside the Indus River that flows through Ladakh.
- **Agricultural run-off**: Excessive use of fertilizers and pesticides by farmers along river floodplains contributes to poisoning of the river water, its floodplains and groundwater.
  - For example, the CPCB has reported the presence of metals such as manganese, copper, lead, etc. in the Yamuna River.

Concerted efforts of the Central and state governments aimed at ensuring proper monitoring, proper infrastructure for waste treatment, proper implementation of laws and effective public participation are required for further improvement in river water quality in India.

20. *How do you differentiate natural disasters from natural hazards? Discuss the stages involved in disaster mitigation and management.*

Approach:

- Briefly define natural disasters and natural hazards and explain how they are different from each other.
- Discuss the stages involved in disaster mitigation and management.
- Conclude accordingly.

Answer:

N**atural disasters and natural hazards** are used interchangeably at times. Both are related phenomena, yet, they are quite distinct from each other. **Natural hazards** are elements of circumstances in the natural environment that have the potential to cause harm to people or property or both. These may be swift or permanent aspects of the respective environmental settings like currents in the oceans, steep slopes and unstable structural features in the Himalayas or extreme climatic conditions in deserts or glaciated areas.

As compared to natural hazards, **natural disasters** are relatively sudden and cause large-scale, widespread death, loss of property and disturbance to social systems and life over which people have a little or no control. Thus, **any event can be classed as a disaster when the magnitude of destruction and damage caused by it is very high**. Every disaster is unique in terms of the local socio-environmental factors that control it, the social response it generates, and the way each social group negotiates with it.

There are **three stages** involved in disaster mitigation and management, which include:

- **Pre-disaster management:** It involves generating data and information about the disasters, preparing vulnerability zoning maps and spreading awareness among the people. It involves two important stages:

- o **Prevention**: The prevention stage involves identifying potential hazards and taking steps to prevent or minimize the impact of disasters. This can involve measures such as building codes, land-use planning, and early warning systems.
  - o **Preparedness:** The preparedness stage involves developing plans and procedures to respond to disasters. This includes developing evacuation plans, stockpiling emergency supplies, and training emergency responders.
- **Response during the occurrence of a disaster**: During disasters, rescue and relief operations such as evacuation, construction of shelters and relief camps, supplying of water, food, clothing and medical aids, etc. should be done on an emergency basis.
- **Post-disaster operations**: These involve rehabilitation and recovery of victims. They should also concentrate on capacity- building in order to cope up with future disasters, if any. Post-disaster operations can be further divided into two stages:
  - o **Recovery:** The recovery stage involves helping the affected communities to rebuild and recover from the disaster. This can involve providing financial assistance, rebuilding damaged infrastructure, and providing counseling and support services.
  - o **Mitigation**: The mitigation stage involves taking steps to reduce the risk and impact of future disasters. This can involve measures such as improving infrastructure, strengthening building codes, implementing land-use planning strategies and capacity building of the communities.

Effective disaster management requires a coordinated effort between the government agencies, emergency responders, and the local community. In India, **the National Disaster Management Authority headed by the Prime Minister** is tasked with the responsibility of spearheading and implementing a holistic and integrated approach to disaster management.