



IPM/YLM - 2024 TEST 36

Duration: 3 Hour

Total Marks: 250

- Q1. Invasive alien species threaten biodiversity, disrupting ecosystems and outcompeting native flora and fauna, causing ecological imbalances. Explain. (10M)
- Q2. "India holds huge possibilities for rewilding". What is rewilding? How does it help in ecological restoration? (10M)
- Q3. Highlight the various ways in which Light pollution disrupts ecosystems and human well-being. Also, suggest measures to mitigate it. (10M)
- Q4. Throw light on the key features of the recently announced Carbon Credit Trading Scheme 2023. (10M)
- Q5. "India's Global Biofuel Alliance has the potential to reshape the global energy landscape." Discuss. (10M)
- Q6. Examine various measures that can be implemented to promote responsible consumption and production patterns for a more sustainable future. (10M)
- Q7. Preservation of wetlands is essential for maintaining biodiversity, supporting ecosystems, and ensuring water quality. Illustrate. (10M)
- Q8. India's high-resolution landslide susceptibility mapping is a crucial step in mitigating disasters in the case of landslides. Explain. (10M)
- Q9. Coastal areas face heightened vulnerability due to sea level rise. Recommend effective steps for mitigating and adapting to it. (10M)
- Q10. 'Epidemics of various diseases occur mostly due to ignorance'. Do you agree with this view? What is the government's role in managing and addressing the impact of such health crises? (10M)



- Q11. Analyse the major outcomes of the recently concluded 28th Session of the UN Climate Change Conference (COP 28) with a focus on its impacts on India. (15M)
- Q12. A recent UN report by FAO underscores the substantial hidden costs associated with agri-food systems, particularly the environmental harm and health issues caused by it. Discuss the hidden costs of agri-food systems and suggest measures to mitigate them. (15M)
- Q13. Coal in India should be complemented with Carbon capture, utilisation and storage (CCUS) for decarbonisation without major economic and social disruption. What is CCUS? How can it help deal with climate issues without threatening India's energy security? Discuss (15M)
- Q14. "The 2006 Environment Impact Assessment (EIA) Notification, while showing adaptability to changing times, has been diluted over the years, potentially compromising environmental safeguards". Examine. (15M)
- Q15. What are the primary barriers hindering the financing of energy transition towards renewables in developing and low-income countries? What solutions can address these challenges? (15M)
- Q16. Traditional practices in India play a crucial role in enhancing climate change resilience. Explain. Support your response with relevant examples. (15M)
- Q17. Advancements in green technology can contribute to reducing carbon emissions and combating climate change, though it has limitations. Discuss (15M)
- Q18. How can understanding the factors of hazard, vulnerability, and exposure contribute to more effective disaster risk reduction strategies? Discuss using examples. (15M)
- Q19. What are the key factors contributing to the vulnerability of the Ganges-Brahmaputra Delta in Assam, Bihar, and West Bengal to annual floods? What strategies can be implemented to mitigate the risks associated with these floods? (15M)
- Q20. Why is community-level disaster management important? Outline the disaster management framework for handling disasters at the community level in India. (15M)



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IPM/YLM 1.0 - 2024

TEST - 36

Test Roll No:

Name:

Date:

Total No. of pages uploaded:

INDEX

INSTRUCTIONS

Q.no

Maximum Marks

Marks Obtained

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Total Marks Obtained:

Please read each of the following instructions carefully before attempting the questions:

- » All Questions are compulsory
- » The number of marks carried by a question/part is indicated against it.
- » Keep the word limit indicated in the questions in mind.
- » Any page or portion of the page left blank in Question-cum-Answer Booklet must be clearly struck off.

Remarks:

OUR TEST CENTRES

BENGALURU | DHARWAD | DELHI | HYDERABAD | LUCKNOW | DAVANGERE | SRINAGAR | MYSURU

EVALUATION PARAMETERS

| | VERY GOOD | GOOD | AVERAGE | BAD |
|--|-----------|------|---------|-----|
| 1. Clarity of Thought | | | | |
| 2. Content Relevance | | | | |
| 3. Context | | | | |
| 4. Conceptual Clarity | | | | |
| 5. Dimensionality & Interdisciplinary Linkages | | | | |
| 6. Examples & Illustrations | | | | |
| 7. Language Competence | | | | |
| 8. Presentation | | | | |
| 9. Structure | | | | |
| 10. Objectivity | | | | |

Overall Feedback & Suggestions by the Examiner:

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IPM - 2024

Q1. Invasive alien species threaten biodiversity, disrupting ecosystems and outcompeting native flora and fauna, causing ecological imbalances. Explain. (10M)



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Q2. "India holds huge possibilities for rewilding". What is rewilding? How does it help in ecological restoration? (10M)

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Q3. Highlight the various ways in which Light pollution disrupts ecosystems and human well-being. Also, suggest measures to mitigate it. (10M)

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Q4. Throw light on the key features of the recently announced Carbon Credit Trading Scheme 2023. (10M)

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Q5. "India's Global Biofuel Alliance has the potential to reshape the global energy landscape." Discuss. (10M)

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Q6. Examine various measures that can be implemented to promote responsible consumption and production patterns for a more sustainable future. (10M)



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Q7. Preservation of wetlands is essential for maintaining biodiversity, supporting ecosystems, and ensuring water quality. Illustrate. (10M)

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Q8. India's high-resolution landslide susceptibility mapping is a crucial step in mitigating disasters in the case of landslides. Explain. (10M)

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Q9. Coastal areas face heightened vulnerability due to sea level rise. Recommend effective steps for mitigating and adapting to it. (10M)

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Q10. 'Epidemics of various diseases occur mostly due to ignorance'. Do you agree with this view? What is the government's role in managing and addressing the impact of such health crises? (10M)

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Q11. Analyse the major outcomes of the recently concluded 28th Session of the UN Climate Change Conference (COP 28) with a focus on its impacts on India. (15M)

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Q12. A recent UN report by FAO underscores the substantial hidden costs associated with agri-food systems, particularly the environmental harm and health issues caused by it. Discuss the hidden costs of agri-food systems and suggest measures to mitigate them. (15M)



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Q13. Coal in India should be complemented with Carbon capture, utilisation and storage (CCUS) for decarbonisation without major economic and social disruption. What is CCUS? How can it help deal with climate issues without threatening India's energy security? Discuss (15M)



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Q14. "The 2006 Environment Impact Assessment (EIA) Notification, while showing adaptability to changing times, has been diluted over the years, potentially compromising environmental safeguards". Examine. (15M)



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Q15. What are the primary barriers hindering the financing of energy transition towards renewables in developing and low-income countries? What solutions can address these challenges? (15M)

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Q16. Traditional practices in India play a crucial role in enhancing climate change resilience. Explain. Support your response with relevant examples. (15M)

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Q17. Advancements in green technology can contribute to reducing carbon emissions and combating climate change, though it has limitations. Discuss (15M)

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Q18. How can understanding the factors of hazard, vulnerability, and exposure contribute to more effective disaster risk reduction strategies? Discuss using examples. (15M)

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Q19. What are the key factors contributing to the vulnerability of the Ganges-Brahmaputra Delta in Assam, Bihar, and West Bengal to annual floods? What strategies can be implemented to mitigate the risks associated with these floods? (15M)



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Q20. Why is community-level disaster management important? Outline the disaster management framework for handling disasters at the community level in India. (15M)

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IPM 2024

T36 Environment+ DM Synopsis

NOTE: Please remember that following 'answers' are NOT 'model answers'. What we are providing is content that both meets the demand of the question and at the same time gives you extra points to attempt similar questions. Diagrams/Images have been provided for your understanding.

Q1. Invasive alien species threaten biodiversity, disrupting ecosystems and outcompeting native flora and fauna, causing ecological imbalances. Explain. (10M)

Introduction

Invasive Alien Species, often referred to as invasive species or non-native species, are organisms (plants, animals, microorganisms) that have been introduced to ecosystems outside their native range, either intentionally or unintentionally, and whose introduction or spread causes harm to the environment, economies, food security, and human health.

Body:

Invasive alien species threaten biodiversity, disrupting ecosystems and outcompeting native flora and fauna:

- 1. Outcompete native species:** Invasive aliens are highly aggressive in utilizing resources like food, space, water and even nesting sites.
 - a. They monopolize these resources that native species rely on, leading to sharp decline of native flora and fauna.
 - b. E.g., Siam weed (originally from the Americas), has rapidly spread throughout South Asia, including protected areas of Assam.
- 2. Change ecosystem characteristics:** Some invasive plants and animals can alter the physical environment. For example, invasive vines, shrubs creating thickets that block sunlight and alter conditions for native species.
 - a. Large invasive trees can utilize excessive water and make habitats drier hampering natives e.g. Eucalyptus trees
- 3. Disrupt ecological processes:** Invasives can alter important ecosystem processes like nutrient cycles, habitat disturbance regimes that native biodiversity has evolved around.
 - a. For instance, invasive cheatgrass alters natural fire cycles in American grasslands.
- 4. Lack natural controls:** In their invaded ecosystems, these alien species lack the natural predators, pathogens and environmental pressures that would keep populations under control.
 - a. Hence they thrive uncontrolled exacerbating threats to indigenous species. E.g., Water Hyacinth

Way forward:

- 1. Prevention**
 - a. Strict biosecurity measures by customs and quarantine authorities to block the entry of potentially invasive alien flora and fauna at borders.
 - b. Import prohibitions on globally blacklisted high risk invasives like zebra mussels, water hyacinth etc.
 - c. Stringent screening protocols for exotic pets/aquarium species before allowing import to prevent accidental release.
 - i. E.g. The exotic pet trade booming in India
- 2. Early Detection & Rapid Response**
 - a. Large scale ecological surveys and monitoring to enable early detection of alien species before they become rampant.
 - i. E.g. Satellite tracking systems set up by the Kerala forest department detected invasion by Senna spectabilis
 - b. Quick eradication drives utilizing mechanical removal and specific biocides once detected before irreversible infestation.
- 3. Control & Management**

- a. **Biological control** by introducing co-evolved natural predators of the invasive species from its native range for suppressing its populations.
- b. **Integrated pest management** options combining physical, chemical and biological strategies specific to the invasive species' weaknesses.
 - i. **E.g. In the case of the invasive fruit fly, sterile insect technique (SIT) has been employed to reduce their populations.**

4. **Policy & Governance**

- a. **Legally binding national policies** focused on prevention, control and quarantine against invasive species introduction. E.g. **Biological Diversity Act, 2002**
- b. **Strengthened international cooperation's** and better transboundary regulation given fluid nature of spread.
 - i. **E.g. Inter-agency Liaison Group on Invasive Alien Species under Convention on Biological Diversity (CBD)**

5. **Involving local communities:** Local communities in the Western Ghats have been involved in the removal of invasive plant species like the Mikania micrantha vine, which threatens native biodiversity.
 - o These efforts not only mitigate the invasions but also provide livelihood opportunities.

Conclusion

It is essential to recognize the urgency of managing and mitigating the impact of Invasive alien species to protect our environment and secure a sustainable future for all.

Q2. "India holds huge possibilities for rewilding". What is rewilding? How does it help in ecological restoration? (10M)

Introduction

Rewilding is the **reintroduction of missing, locally extinct plants and animals to a landscape**, which has the potential to restore ecosystems. It also refers to the process of **allowing nature to take its course and restore ecosystems** and biodiversity to a more natural state, by minimizing or removing human interventions like **land development, intensive agriculture, wildlife management** etc.

Body:

Role of rewilding in ecological restoration:

1. **Biodiversity Conservation:** Example - The **Golden Eagle reintroduction project** in Scotland, contributing to the conservation of this species and enhancing local biodiversity.
2. **Allowing forests and wilderness areas to regenerate naturally:** Letting native vegetation, animals and plant species recover on their own by just providing protection and stopping active management.
 - a. **E.g.** Protection provided to tigers under **Project tiger in India.**
3. **Restoring connectivity between protected areas:** Building wildlife corridors between national parks, sanctuaries and reserve forests to enable migration and gene flow across fragmented habitats.
 - a. **E.g.** Elephant corridors between various states.
4. **Reintroducing native species:** Bringing back regionally extinct species that previously occupied the landscapes and have key ecological roles as keystone or umbrella species.
 - a. For example, **In the Sundarbans, rewilding programs by planting native mangrove species have helped revive hundreds of acres of mangroves.**
5. **Providing nature-based solutions:** Using ecosystem restoration approaches like planned rewilding of wetlands, rivers, grasslands etc. to tackle challenges like **climate change, food security in a nature-positive way.**
6. **Promoting co-existence with wildlife:** Adopting models that allow both wildlife revival as well as human uses like **eco-tourism, sustainable harvesting** of forest produce through community-led conservation efforts.
 - a. **E.g.** Community reserve near human habitat in forest.

Way forward:

1. **Expand protected area networks:** Create more national parks, wildlife sanctuaries and community reserves while enlarging existing ones.
 - a. **Provide buffer zones and ensure forest connectivity** between protected areas via green corridors to enable animal migrations.
2. **Voluntarily relocate villages** located deep within forests prone to human-wildlife conflicts to create inviolate spaces for wildlife.

3. **Phase out unsustainable resource use:** Employ local residents in restoration efforts to limit grazing, wood harvesting, unchecked tourism etc. and provide alternative livelihoods. E.g. **PM Ujjawala scheme providing LPG connection.**
4. **Safeguard keystone species:** Enact special programs to stabilize and recover populations of keystone species. For example, **Project Snow Leopard** secures high altitude habitats for the apex predator and prey species.
5. **Employ afforestation drives** using endemic plant varieties, control invasive plants through biocontrol agents, and curb forest fires to enable natural regrowth. E.g. **In Central India, tendu forest regrowth.**

Conclusion

India has the potential to bring back dynamic, wildlife-rich landscapes lost to unsustainable development over time, by stepping back and allowing nature to rebuild itself through progressive rewilding efforts across habitats.

Q3. Highlight the various ways in which Light pollution disrupts ecosystems and human well-being. Also, suggest measures to mitigate it. (10M)

Introduction

Light pollution is **excessive, misdirected or obtrusive artificial (usually outdoor) light** that obstructs starlight in the night sky, interferes with astronomical research, disrupts ecosystems, has adverse health effects and wastes energy.

Body:

Various ways in which Light pollution disrupts ecosystems and human well-being:

Ecosystem Disruption:

1. **Alters predator-prey dynamics:** Artificial lights can create a mismatch between seasonal cues and prey availability for predators like **bats, owls etc.** which rely on darkness for hunting.
2. **Impacts migration and reproduction:** Excess nocturnal light can impact timing and success of critical life stages in **birds, fish, turtles** that use natural light/dark signals for navigation and breeding.
3. **Confuses habitat boundaries:** Illuminated sky glow over cities, road networks can obscure the **ability of moths, insects and baby sea turtles** to orient towards natural habitats.
4. **Enables invasive species:** Non-native weeds, predators can exploit extended daylight conditions due to **artificial lighting** to spread into and dominate native ecosystems.

Human Well-being Risks:

1. **Disrupts circadian cycles:** Too much artificial light at night suppresses the sleep-promoting **hormone melatonin** and can **impair immune functioning**, metabolic processes.
2. **Aggravates light-sensitive diseases:** Glare and blue-rich LED lighting exacerbates conditions like **epilepsy, vertigo, migraine headaches** in humans.
3. **Increases accident risks:** Bright, distracting lights along roadways hamper vision causing more night-time collisions with wildlife and other vehicles.
4. **Wastes energy and resources:** Superfluous, overly bright night lighting across streets, offices lead to higher electricity consumption, light spillage and impacts the climate.

Measures to mitigate

1. **Smart lighting policies** - Governments should enact light pollution regulations on **appropriate lighting zones, intensity, direction**, and wavelength spectrum to minimize ecological consequences and glare.
2. **Energy-efficient fixtures** - Replace conventional outdoor lighting with energy-efficient, fully shielded **LED fixtures** to lower electricity waste and spillage into unintended areas.
3. **Adaptive light controls** - Motion sensors, **dimmers, part-night lighting** can minimize overall illumination when not needed.
4. **Wildlife-friendly lighting** - Deploy specialized amber and green wavelengths near wildlife habitats as they have lower disruptive effects.
5. **Community awareness campaigns** - Educate the public regarding responsible outdoor lighting installations that balance visibility needs while supporting healthy environments.
6. **Development controls** - Enforce stringent guidelines on appropriate lighting standards for new infrastructure through environmental impact assessments and clearances.
7. **Monitoring programs** - Continuously monitor and assess locations prone to light pollution to track progress and ensure mitigation measures are working.

8. **Incentives for responsible lighting** - Governments can provide tax rebates or other incentives to communities, businesses and homes adopting sustainable outdoor lighting practices.

Conclusion

Through collaborative efforts between policymakers, industries and local communities to promote responsible lighting, the impacts of light pollution on ecosystems and human well-being can be significantly reduced.

Q4. Throw light on the key features of the recently announced Carbon Credit Trading Scheme 2023. (10M)

Introduction

Government has launched **Carbon Credit Trading Scheme (CCTS) 2023**, which aims to facilitate the **voluntary adoption of green technologies**, regulate emissions in specific industries, and contribute to India's journey towards **net-zero carbon emissions by 2070**.

Body:

Key features of recently announced Carbon Credit Trading Scheme 2023:

1. **Market based:** The Carbon Credit Trading Scheme is a market-based strategy to control pollution, which allows **corporations to earn credits** by reducing their carbon emissions. These credits can then be traded on a marketplace.
 - a. **Energy Conservation (Amendment) Bill 2022:** The CCTS 2023 is rooted in the Energy Conservation (Amendment) Bill 2022, modifying the **2001 Energy Conservation Act**.
2. **Cap in feature:** The scheme sets a limit or cap on the amount of carbon dioxide and other greenhouse gases that can be emitted by large companies.
 - a. **Companies that emit less than their quota** earn carbon credits, which they can sell to other companies that exceed their limits.
3. **Trading mechanism:** Carbon credit certificates will be traded on power exchanges registered with CERC, which will also regulate carbon credit trading activities.
4. **Inclusion of Non-Obligated Entities:** Non-obligated entities can voluntarily register under the scheme and comply with emission reduction targets.
5. **Focus on Domestic Carbon Credit Trade:** The scheme emphasizes domestic carbon credit trade, with a prohibition on export until India achieves its climate goals.
6. **Administration:** The BEE serves as the Administrator for the Indian carbon market. It identifies sectors and potential for reduction of greenhouse gases emissions in such sectors and recommends to the **Ministry of Power** to include such sectors in the Indian carbon market.
 - a. **The Grid Controller of India Ltd** shall be the registry for the Indian Carbon Market.
 - b. **National Steering Committee (NSCICM):** NSCICM, chaired by the Power Secretary, will oversee and govern the ICM.

Relevance and Significance:

1. **Contributing to Global Climate Goals:** The CCTS plays a crucial role in India's commitment to reducing GHG emissions and contributing to global climate goals.
2. **Incentivizing CCUS Adoption:** The scheme incentivizes the adoption of Carbon Capture Utilization and Storage (CCUS) technologies, aligning with COP26 targets.

Conclusion

The establishment of a domestic carbon market is a progressive step. However, the actual benefit will depend upon the effectiveness of the market. For this, the Government must ensure that proper regulations are established. Moreover, there must be periodic assessment of its functioning and corrective steps its necessary.

Q5. "India's Global Biofuel Alliance has the potential to reshape the global energy landscape." Discuss. (10M)

Introduction:

Under India's G20 presidency, the **Global Biofuel Alliance (GBA)** has been established by world leaders to accelerate the global adoption of biofuels. The alliance **unites prominent biofuel producers and consumers, including the United States, Brazil, and India**, as well as 19 additional countries and 12 international organizations that have committed to joining or supporting the initiative. The Global Biofuel Alliance aims for a **greener and sustainable future**.

Body:

Significance of Global Biofuels Alliance in shaping energy landscape :

1.Sharing of best Practices

1. **Technology Transfer** : GBA will facilitate the transfer of biofuel technologies and aid India in adopting advanced practices.
2. **Climate Funds Mobilization** : The alliance supports the mobilization of international climate funds which will boost India's biofuel initiatives.

2.Ethanol-20 Target

1. **Achieving E20**: Building on the success of E10, India aims to reach E20 by 2025-26.
2. **Learning from Brazil**: GBA will help provide insights from Brazil's achievements in attaining E-85, aiding India in its E20 target.

3.Adoption of Flex Fuel Vehicles

1. **Accelerating Adoption**: GBA may fasten the adoption of Flex Fuel Vehicles in India.
2. **Emission Reduction**: This shift contributes to emission reduction and curtails India's crude oil import bill.

4.Fight Against Climate Change: The establishment of GBA **reinforces global cooperation to reduce fossil fuel usage**, aligning with climate action goals.

5.Promotion of Biofuel Exports

1. **Opportunity for Growth** : GBA opens avenues for India to enhance its biofuel production, fostering **energy independence**.
2. **Export Potential**: India can emerge as a major biofuel exporter alongside **Brazil and the US**, expanding its global influence.

6.Increase in Employment Opportunities

1. **Biofuel Sector Investments**: Investments in the biofuel sector create employment opportunities, benefitting the workforce.
2. **Financial Upliftment**: This contributes to the **improvement of farmers' financial status**, aligning with the goal of doubling farmers' income.

Some challenges that Global Biofuel Alliance may face :

1. **Environmental Challenge** : Water and land requirements may discourage water-scarce countries from joining the alliance.
2. **Geopolitical Challenge** : China and Russia oppose alliances led by western countries. Saudi Arabia and Russia fear biofuels as competition to oil. India and China, major coal users, may not abandon coal despite environmental concerns.
3. **Funding challenge** : Global institutions like WB and IMF lack sufficient resources for significant investments in such groups.
4. **Secrecy around technology** sharing may hinder the alliance's goals.

Conclusion :

India's Global Biofuel Alliance **could reshape the global energy landscape by promoting sustainable alternatives, reducing reliance on fossil fuels, and fostering international collaboration** in the pursuit of cleaner energy solutions. **The alliance's success hinges on overcoming these challenges** and fostering international cooperation for sustainable energy solutions.

Additional Points:

Biofuels are a type of fuel that is derived from organic matter, typically living or once-living materials, and is produced in a relatively short period of time. These fuels can be used to power vehicles, heat homes, and generate electricity, and are **considered renewable because they can be made from plants that can be grown and replenished repeatedly**

Biofuels offer several advantages, including:

- 1. Renewability:** Biofuels can be produced from renewable sources such as biomass, ensuring a sustainable energy supply.
- 2. Energy Security:** By reducing dependence on foreign oil, biofuels can help reduce import costs and improve energy security.
- 3. Cleaner Energy:** Compared to fossil fuels, biofuels emit fewer greenhouse gases, making them a cleaner alternative for energy production.
- 4. Increased Farmer Income:** Biofuels provide an additional income stream for farmers, contributing to the goal of doubling their income.
- 5. Abundant Availability:** Biofuels can be produced from a variety of sources, including crops, waste, and algae, ensuring a reliable supply.

Additional Points:

The **first generation of biofuels** is derived from **food sources such as rice, wheat, sugarcane, and vegetable oils**. These fuels are produced through fermentation or trans-esterification processes.

The **second generation of biofuels**, is obtained from **non-food feedstocks like agricultural waste, industrial waste, and used vegetable oils**. These feedstocks are considered more sustainable than the first generation as they do not compete with food production for land and resources.

The **third generation, or "algae fuel," is derived from algae** and can be used to produce both biodiesel and bio-alcohols. This generation of biofuels is considered more sustainable and efficient than the previous two as it does not require the destruction of biomass or the use of arable land.

The **fourth generation of biofuels (4G)** is similar to the third in that it **does not require arable land for production**. However, unlike the third generation, 4G biofuels do not require the destruction of biomass during the production process. This **makes them an even more sustainable option for the future of biofuel production**.

Q6. Examine various measures that can be implemented to promote responsible consumption and production patterns for a more sustainable future. (10M)

Introduction

The imperative of promoting responsible consumption and production patterns has become paramount in the pursuit of a sustainable future. As global challenges such as climate change and resource depletion escalate, it is imperative to examine a spectrum of measures that can be implemented to foster responsible consumption and production.

Body:

Various measures that can be implemented to promote responsible consumption patterns:

- 1. Awareness campaigns:** Launch widespread media and educational campaigns to inform consumers about the environmental and social impacts of their purchasing choices and the benefits of sustainable goods.
 - a. E.g. Eat right awareness campaign, LiFE initiative
- 2. Eco-labelling schemes:** Implement reliable eco-labelling and certification systems like Fairtrade, Rainforest Alliance, etc. to help consumers easily identify and opt for sustainably produced goods.
 - a. E.g. energy rating of electronics by BEE.
- 3. Taxes and incentives:** Impose higher taxes on unsustainably manufactured goods while providing tax rebates or subsidies to producers of sustainable alternatives to drive consumer behaviour. E.g. FAME India scheme for promotion of EVs.
- 4. Public procurement policies:** Government agencies should mandate ecologically responsible procurement like buying renewable energy, efficient appliances, recycled paper etc. to create demand and set an example.

5. **Responsible advertising:** Enforce responsible advertising standards to curb **greenwashing**, ensure truthful environmental and social impact disclosure and prevent misleading sustainability claims.
 - a. **E.g. GreenCo rating system**, recognizing environmentally responsible companies.
6. **Circular economy models:** Promote business and community-centric sharing, renting, reusing, upcycling platforms for everything from clothing to consumer durables to reduce new purchases.
 - a. **E.g. Extended producer responsibility for e-waste.**

Measures that can be implemented to promote responsible production patterns:

1. **Adopt sustainable sourcing practices:** Companies should source raw materials and inputs in a sustainable way that does not negatively impact the environment, such as avoiding deforestation for materials or overfishing. This promotes responsible resource use.
 - a. **E.g. Coffee brand** sourcing beans from **Rainforest Alliance certified farms**
2. **Improve production efficiency:** Upgrading equipment, optimizing processes, recycling byproducts/waste, and minimizing energy and water use in manufacturing can significantly reduce resource consumption and waste generation per unit of output.
 - a. **E.g. E-commerce company** minimizing product packaging volume to reduce cardboard and plastic waste
3. **Implement eco-design principles:** Considering the full product lifecycle during design stages allows companies to choose less impactful materials, make products more durable and reusable, and plan for easier end-of-life recycling or disposal.
 - a. **E.g. Appliance maker** **reducing the variety of plastic resins** used and avoiding glue or welding to **increase ease of disassembly** and closed-loop recycling.
4. **Adopt cleaner production technologies:** Utilizing **renewable energy, cleaner chemistry principles** to substitute toxic inputs, and technologies like **carbon capture and storage** can mitigate environmental impacts of production itself.
5. **Create sustainability standards and reporting:** Voluntary company standards, industry-wide codes of conduct, and sustainability reporting increases transparency and accountability around responsible production indicators.
6. **Comply with regulations:** Adhering to environmental regulations around waste discharge, emissions, resource extraction permits, chemical use reporting requirements, and labour codes supports responsible practices.
7. **Train employees:** Educating staff about sustainability issues relevant to production, like waste minimization and energy conservation, fosters a culture of responsibility.

Conclusion

The collective adoption of these measures can pave the way for a more equitable and environmentally conscious society, aligning economic activities with ecological well-being and social equity.

Q7. Preservation of wetlands is essential for maintaining biodiversity, supporting ecosystems, and ensuring water quality. Illustrate. (10M)

Introduction :

Wetlands are areas where **water is the primary factor controlling the environment and the associated plant and animal life**. They occur where the water table is at or near the surface of the land, or where the land is covered by water.

Body :

Preservation of wetland is important because it performs various functions :

1.Maintaining biodiversity :

- a) Almost all of the world's **waterbirds** use wetlands as **feeding and breeding grounds**.
- b) Migratory waterbirds use wetlands throughout their range which can sometimes literally be from **pole to pole**.
- c) Compared to other ecosystems, wetlands are **one of the most productive habitats** in the world with great species diversity .
- d) Wetlands' microbes, plants and wildlife are part of global cycles for water, nitrogen and sulphur.
- e) **National Biodiversity Authority** : Conservation of wetlands is vital for saving the earth as they support **40% of the planet's flora and fauna despite covering only 6% of the surface**,

2.Supporting ecosystems :

- a) Wetlands can be thought of as "**biological supermarkets**." They provide great volumes of food that attract many animal species.
- b) These animals use wetlands for part of or all of their life-cycle. **Dead plant leaves and stems** break down in the water to form small particles of organic material called "**detritus**."
- c) **This enriched material feeds many small aquatic insects, shellfish and small fish that are food for larger predatory fish, reptiles, amphibians, birds and mammals.**
- d) They serve as nurseries for fish, offer breeding grounds for amphibians, and support a variety of insects and microorganisms .

3. Water Quality Improvement:

- a) Wetlands act as **natural filters**, trapping sediments and pollutants from runoff water.
- b) They play a vital role in **purifying water by absorbing excess nutrients and contaminants**, contributing to improved water quality downstream.
- c) They regulate water quantity, groundwater recharge, and can contribute to **regulating floods** and the impacts of storms.
- d) Wetlands also help in **erosion control and sediment transport**, thereby contributing to land formation and increasing resilience to storms.
- e) All these ecosystem services improve **water security**, including security from natural hazards and climate change adaptation.

4. Carbon Sequestration: Wetlands store large amounts of carbon in their soils **i.e. they are blue carbon sinks** . Preserving wetlands **contributes to global efforts to combat climate change** and promote carbon sequestration.

5. Cultural Importance: Many cultures have deep connections to wetlands, considering them **sacred or integral to their traditions**. Preserving wetlands helps maintain these cultural ties.

Conclusion :

India's annual budget recently announced a **strategy for 'Green Growth'** that includes a special scheme called '**Amrit Dharohar**' for **protecting vital wetlands, which sustain aquatic biodiversity** .

Recently , Union government has embarked on a mission to promote tourism at ecologically sensitive wetland by **shifting these fragile wetlands from high value tourism to nature tourism** by **directly supporting conservation action and letting local communities and economies take the lead**.

Additional Definition of Wetlands:

The **Ramsar Convention takes a broad approach** in determining the wetlands which come under its aegis. —“areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres”

Q8. India's high-resolution landslide susceptibility mapping is a crucial step in mitigating disasters in the case of landslides. Explain. (10M)

Introduction

Landslide Susceptibility Mapping involves creating maps that **depict areas prone to landslides** based on certain factors. For example, using data on past landslide events and factors like slope steepness, soil type, and vegetation cover, a computer model can analyse these variables to predict areas at high risk.

Recognizing the importance of proactive measures, **IIT Delhi's HydroSense Lab** has created India's **first high-resolution landslide susceptibility map**.

Body:

Significance of India's high-resolution landslide susceptibility mapping in mitigating landslides:

1. **Data Sources:** The map incorporates **1.5 lakh known landslide events** from sources like the Geological Survey of India (GSI). It also considers **16 landslide conditioning** factors, including soil cover, tree density, proximity to roads or mountains, etc.
2. **Machine Learning Analysis:** Ensemble machine learning methods were employed to analyse the data. This involves using multiple machine learning models together to mitigate the impact of any single model's limitations.
3. **High-Resolution Mapping:** The map provides a high-resolution overview with a detailed resolution of **100 sqm.**, offering insights into landslide susceptibility across India.
4. **Identification of New Risk Zones:** Familiar areas with high susceptibility, such as the **Himalayan foothills, Assam-Meghalaya region, and Western Ghats**, were identified.
 - a. **New risk zones, previously unrecognized**, were also revealed, including parts of the **Eastern Ghats north of Andhra Pradesh and Odisha**.
5. **Online Accessibility:** The map is available online and accessible to the public. It allows anyone to interact with the data without requiring technical expertise.
6. **Future Use:** The map aims to assist policymakers and organizations in landslide investigation and mitigation, and the team plans to develop a **Landslide Early Warning System for India**.

Way forward:

1. **NHAI's Landslip Detection System:** The National Highways Authority of India (NHAI) plans to install a landslip detection system on the **Kochi-Dhanushkodi National Highway** in Munnar.
 - a. The system, developed by IIT-Mandi, the Indian Army, and DRDO, aims to provide early warnings about landslips.
2. **Landslide Hazard Maps:** Generation of reliable landslide hazard maps using advanced tools like UAVs, Terrestrial Laser Scanners, and high-resolution Earth Observation (EO) data.
3. **International Best Practices:** Learning from **Brazil's SNAKE System**, a Landslide Early Warning System (LEWS), to incorporate digital monitoring, forecasting, and alert mechanisms.
4. **Special Purpose Vehicle (SPV) for Landslide Management:** Formation of an expert professional group at the national level to study and decide on risk mitigation strategies to recommend permanent fixes for identified landslide hotspots.
5. **Awareness Programmes:** Initiatives aimed at creating a culture of awareness, alertness and preparedness among the public.
6. **Monitoring Construction and Development Implementing:** strict monitoring of construction and developmental activities, such as roads and dams, in landslide-prone areas.
7. **Limiting Agriculture and Settlements:** Restricting agriculture to valleys and areas with moderate slopes, controlling large settlements in high vulnerability zones.
8. **Afforestation and Water Flow Control:** Promoting large-scale afforestation programs and constructing bunds to reduce water flow.
9. **Encouraging Terrace Farming:** Encouraging terrace farming, especially in northeastern hill states where **Jhumming (Slash and Burn/Shifting Cultivation)** is prevalent.

Conclusion

Understanding the causes and effects of landslides is essential for disaster preparedness and mitigation efforts. Moreover, international cooperation and sharing of knowledge and best practices are crucial in addressing the challenges posed.

Q9. Coastal areas face heightened vulnerability due to sea level rise. Recommend effective steps for mitigating and adapting to it. (10M)

Introduction

Coastal regions, bearing witness to the **confluence of land and sea**, are experiencing an unprecedented threat – the **rise in sea levels**. This peril, driven by **climate change**-induced factors such as melting ice caps and glaciers, presents an imminent danger to the **sustainability and resilience of coastal communities**.

Body:

Heightened vulnerability due to sea level rise:

1. **Increased flooding:** Several areas along India's **7,500 km** coastline already witness seasonal flooding. With sea levels projected to rise **1 foot by 2050**, extreme flooding events will become more intense and frequent, especially in coastal cities like **Mumbai, Chennai etc.**

2. **Greater erosion:** Significant beach and shoreline erosion is expected with rising seas and intensified storm surges. This will severely impact coastal communities as well as tourism infrastructure along sandy beach fronts.
 - a. For example, important heritage **sites like Mahabalipuram face erosion risks.**
3. **Saltwater intrusion:** Rising seas will lead to more saltwater flowing into coastal aquifers, creeks and rivers. This salinization will contaminate drinking water sources and agricultural soil posing risks to crops, livestock and human health.
 - a. **E.g. Kerala, Karnataka coasts already witnessing such salinization.**
4. **Loss of biodiversity** - Important coastal and marine ecosystems like mangrove forests, coral reefs, sea-grass beds etc. which support rich biodiversity face decline.
 - a. For instance, **backwater biodiversity hotspots in southern India** are under threat.
5. **Infrastructural damage** - Critical coastal infrastructure like ports, roads, buildings face higher risks of structural damage from tidal flooding and saltwater corrosion over the long term with just 3 feet of sea rise.

Effective steps for mitigating and adapting to it:

Mitigation

1. **Restore natural buffers:** Protect and expand coastal mangroves, wetlands, sand dunes that act as natural barriers to dissipate wave energy and tide action.
 - a. E.g. **Projects like Mangrove reforestation** along Maharashtra coast, portion of the Bhitarkanika mangrove ecosystem
2. **Renewable energy:** Mitigate climate risks exacerbating sea-level rise by shifting aggressively to renewable energy rather than emission intensive coal that causes further ocean warming.
 - a. E.g. target of installing 175 GW of renewable energy
3. **Climate-proof infrastructure:** Design and modify roads, bridges, ports, buildings to handle marine flooding through elevated surfaces, adjustable barriers, stormproof materials.
4. **Blue Carbon Solutions:** Implement Blue Carbon initiatives, which involve the conservation and restoration of coastal ecosystems like seagrasses and salt marshes.

Adaptation measures:

1. **Storm warning communication:** Upgrade early warning systems, emergency contacts with coastal communities to alert and safely evacuated during episodic flooding events.
 - a. E.g. Damini lightning alert app to coastal communities
2. **Resilient agriculture:** Promote salt-tolerant crop varieties, hydroponics, innovative irrigation to protect food security and farmer livelihoods in affected regions.
 - a. E.g. promotion of **salt-tolerant pokkali rice cultivation** in Kerala backwaters
3. **Managed retreat:** Relocate people, assets away from highest risk zones through voluntary buyouts, and policies that restrict further development in vulnerable areas.
4. **Adaptation funding:** Commit consistent financing both from domestic and international sources expressly towards climate adaptation efforts for coastal protection.
 - a. E.g. National Adaptation Fund for Climate Change

Conclusion

With long-term outlook and by combining ecologically sensitive defences along with community-focused resilience initiatives, India can build up coastal areas that are safer and better buffered against rising sea levels.

Q10. 'Epidemics of various diseases occur mostly due to ignorance'. Do you agree with this view? What is the government's role in managing and addressing the impact of such health crises? (10M)

Introduction:

US Centre for Disease Control defines **Epidemics** as the occurrence of more cases of disease than expected in a given area or among a specific group of people over a particular period of time. Eg: 2021 India black fungus epidemic.

Body:

Epidemics of various diseases occur mostly due to ignorance?

Yes:

1. **Lack of Hygiene and Sanitation:** Inadequate awareness about hygiene practices like handwashing and proper sanitation disposal can create breeding grounds for pathogens, facilitating disease transmission.
 - **Eg:** Cholera outbreaks are often linked to poor sanitation infrastructure and lack of access to clean water.
2. **Misinformation and Disinformation:** Spread of unreliable information about disease prevention or treatment can hinder effective control measures and encourage risky behaviors.
 - **Eg:** Anti-vaccination campaigns against measles vaccine causing outbreaks.
3. **Lack of Awareness:** Unfamiliarity with early symptoms of an infectious disease can delay diagnosis and intervention, allowing the pathogen to spread unchecked.
 - **Eg:** Delaying medical help due to misinterpreting COVID-19 symptoms as common cold initially contributed to its rapid spread.
4. **Cultural Practices:** Certain cultural practices or traditional beliefs might conflict with public health recommendations, hindering control efforts.
 - **Eg:** Hesitation against contraception causing HIV/AIDS epidemic.

No:

5. **Socioeconomic Disparities:** Poverty, overcrowding, and lack of access to healthcare create vulnerable populations susceptible to outbreaks.
 - **Eg:** HIV/AIDS disproportionately affects marginalized communities lacking proper healthcare and education.
6. **Microbial Mutation:** Viruses and bacteria constantly evolve, developing resistance to existing treatments and vaccines, outsmarting existing control measures.
 - **Eg:** The emergence of new flu strains each season.
7. **Climate Change and Environmental Disruptions:** Changes in weather patterns and ecosystems can influence the emergence and spread of vector-borne diseases.
 - **Eg:** Invasiveness of mosquito species leading to Dengue epidemics.
8. **Global Travel and Interconnectedness:** Rapid movement of people and goods across borders facilitates the rapid spread of disease outbreaks beyond their origin.
 - **Eg:** The COVID-19 pandemic spread from travel.

What is the government's role in managing and addressing the impact of such health crises?

1. **Surveillance and Early Detection:** The government plays a crucial role in establishing robust surveillance systems to detect potential health threats early.
 - **Eg:** India has the Integrated Disease Surveillance Programme (**IDSP**).
2. **Healthcare Infrastructure Strengthening:** Governments need to invest in and strengthen healthcare infrastructure to effectively manage health crises.
 - **Eg:** India's Ayushman Bharat Health Infrastructure Mission (**PM-ABHIM**).
3. **Public Health Awareness:** Governments are responsible for disseminating accurate information to the public.
 - **Eg:** "Do Boond Zindagi ki" Polio vaccination campaign.
4. **International Collaboration and Coordination:** Health crises often require international collaboration.
 - **Eg:** India actively participates in global initiatives like the Coalition for Epidemic Preparedness Innovations (**CEPI**) and the World Health Organization (**WHO**).
5. **Research and Development:** Governments should invest in research and development to enhance preparedness.
 - **Eg:** Indian Council of Medical Research (ICMR) partnered with Bharat Biotech to create indigenous COVID-19 "Covaxin" vaccine.

Conclusion:

While ignorance can contribute to the occurrence and spread of epidemics, it is crucial to recognize the broader factors at play. Governments play a pivotal role in addressing the impact of health crises by focusing on education, infrastructure, preparedness, and community engagement. We must recognize and realize the "**One Health Approach**" in preventing and mitigating disease outbreaks.

Q11. Analyse the major outcomes of the recently concluded 28th Session of the UN Climate Change Conference (COP 28) with a focus on its impacts on India. (15M)

Introduction

The **Cop28 UN Climate Change Conference** is one of the most important annual climate change events. It is held in a **different**

country each year and its goal is to find solutions to the problems caused by climate change. Recently COP28 organised in Dubai has concluded.

Body:

Significant outcomes of the recently concluded 28th Session of the UN Climate Change Conference (COP 28):

1. **Loss and Damage (L&D) Fund:** COP28 countries agreed to launch the Loss and Damage (L&D) fund, hosted by the World Bank for four years, aligning with UNFCCC and the Paris Agreement.
 - a. All developing countries are eligible, and contributions are voluntary, with a specific percentage earmarked for Least Developed Countries and Small Island Developing States.
2. **Global Stocktake:** COP28 released the fifth iteration of the Global Stocktake (GST), adopting eight steps to limit global temperature rise to 1.5 degrees C. These steps include:
 - a. **Tripling renewable energy capacity by 2030** (to at least 11,000 GW by 2030) and collectively double the global energy efficiency improvements from around 2% to over 4% every year until 2030.
 - b. **Phase-down of unabated coal power**
 - c. Accelerating efforts globally towards net zero by around mid-century
 - d. **Accelerating zero and low emissions technologies** e.g., Nuclear, CCUS, Hydrogen
 - e. **Transitioning away from fossil fuels** in energy systems, in a just, orderly and equitable manner, so as to achieve net zero by 2050
 - f. **Reducing non-CO2 emissions** e.g., methane emissions globally by 2030
 - g. **Emissions reductions from road transport**
 - h. **Phasing out of inefficient fossil fuel subsidies**
 - i. The text maintains continuity with COP26, balancing global aspirations while recognizing diverse energy needs.
3. **Global Cooling Pledge:** 66 national signatories committed to a 68% reduction in cooling-related emissions by 2050
4. **Climate Finance:** UNCTAD estimates that developed nations owe developing countries \$500 billion in 2025 under the **New Collective Quantified Goal (NCQG)** for climate finance, confirmed in the Paris Agreement.
 - a. The goal, starting at **\$100 billion annually**, allocates \$250 billion for mitigation, \$100 billion for adaptation, and \$150 billion for loss and damage.
5. **Global Goal on Adaptation (GGA) framework:** Draft text introduced to enhance climate change adaptation like Climate-Induced Water Scarcity Reduction, Climate-resilient food and Agriculture Production and Strengthening Resilience Against Climate-Related Health Impacts
6. **Triple Nuclear Energy** : The text calls to **triple global nuclear energy capacity by 2050**
7. **Powering Past Coal Alliance (PPCA):** PPCA, a coalition involving governments, businesses, and organizations, focuses on transitioning from unabated coal power to clean energy. At COP28, PPCA welcomed new national and subnational governments, advocating for cleaner energy alternatives. India is not part of PPCA as it has not committed to phasing out of coal.
8. **Coalition for High Ambition Multilevel Partnership (CHAMP):** 65 national governments signed commitments for enhanced cooperation with subnational governments in climate strategies.
9. **Buildings Breakthrough Initiative:** The goal of the Buildings Breakthrough Initiative is to make near-zero emissions and resilient buildings the new normal by 2030. The initiative is co-led by France and the Kingdom of Morocco, coordinated under the umbrella of UNEP, and hosted by the Global Alliance for Buildings and Construction (Global ABC)

Limitations of the cop28 agreements:

1. **Lacked clear timelines for fossil fuel phase-out**
2. **Ambiguity in the tripling of renewable energy capacity**, raising uncertainty
3. **Absence of specific measurement criteria** for the phase-down of coal
4. **The global adaptation framework** adopted **lacks financial provisions** and requires further development
 - a. With the current \$100 billion goal of Climate Finance unmet, developing countries **face debt distress**
5. **Loopholes Criticized:** Some stakeholders, including the Alliance of Small Island States, criticize the agreement for containing "a litany of loopholes," challenging its transformative potential.
6. **Compromise on Absolute Phase-Out:** The absence of language mandating an absolute phase-out of hydrocarbons underscores the challenging negotiations and compromises made to secure the agreement.
7. **Call for Greater Ambition:** Climate leaders like Manuel Pulgar-Vidal stress the need for enhanced ambition and implementation to limit global warming effectively.

Impact of COP28 summit outcome on India:

1. **Global Stocktake (GST):** The GST's emphasis on tripling renewable energy capacity and phasing down unabated coal power aligns with India's ambitious renewable energy goals.
 - a. However, challenges may arise in **balancing these objectives with the developmental needs.**
2. **India's active participation and initiation** of climate action initiatives, such as the **Global River Cities Alliance (GRCA) and the Green Credit Initiative**, demonstrate a commitment to sustainable development within the context of national circumstances.
3. **Challenge:** India's opposition to certain international initiatives, including **methane emission mandates** and coal phase-out, reflects the ongoing challenges of balancing climate objectives with national development priorities.

Global perspective:

1. **Coal phase out:** Despite commitments to expand non-fossil fuel and renewable energy, India and other countries stood firm on **not phasing out coal-generated electricity** in the near term.
2. **Opposition from countries hindering progress** on methane emission cuts including India. India is not a part of the Global Methane Pledge

Conclusion

India's active role at COP28 reflects a dedication to global environmental leadership, combining domestic achievements with international collaborations to address the urgent challenges of climate change.

Q12. A recent UN report by FAO underscores the substantial hidden costs associated with agri-food systems, particularly the environmental harm and health issues caused by it. Discuss the hidden costs of agri-food systems and suggest measures to mitigate them. (15M)

Introduction

A recent **United Nations Food and Agriculture Organization (FAO) report** highlights the enormous hidden costs of global agri-food systems, totalling **over \$10 trillion**. In countries like **India**, these costs, amounting to nearly **11% of GDP**, manifest in various forms such as increased poverty, environmental damage, and health issues.

Body:

Hidden costs of agri-food systems:

Environmental Costs

1. **Greenhouse gas emissions:** Agriculture generates over **20% of global greenhouse gas** emissions through activities like **deforestation, fertilizer production** and use, livestock rearing, rice cultivation, and more. These emissions contribute to climate change but are not reflected in food prices.
2. **Water pollution:** Fertilizer and pesticide runoff **pollutes rivers, lakes, and oceans**, causing algal blooms and dead zones. Farm animals also produce large amounts of waste that pollutes waterways. The costs of cleaning up this pollution are not factored into food.
3. **Soil degradation:** Intensive farming without proper crop rotation and use of chemicals depletes soils. This **reduces fertility and productivity over time**, incurring restoration costs not built into food pricing.
4. **Biodiversity loss:** Conversion of forests and grasslands to farmland reduces biodiversity of plants and animals. This affects ecosystem functioning and services but goes unaccounted.
 - a. E.g. The **quantified environmental hidden costs** from agriculture, accounting for more than **20% of quantified hidden costs**, are equivalent to almost **one-third of agricultural value added**.

Health Costs

1. **Pesticide hazards:** Pesticide residue on foods and seepage into groundwater causes health issues like **cancers, birth defects, infertility** and more. Treatment costs are substantial but overlooked.
2. **Antimicrobial resistance:** Rampant antibiotic use in livestock leads to drug resistance in bacteria which gets transferred to humans. This spurs higher healthcare costs down the line which are not priced into meat.
3. **Diet-related diseases:** Resource-intensive production of processed foods high in sugar, salt and fat contributes to **obesity, diabetes, heart disease** and other diet-related illnesses. This burdens public health systems.
 - a. E.g. In India, the burden of disease (productivity losses from dietary patterns) had the largest share (60%) among hidden costs.

Measures to mitigate hidden costs of agri-food systems:

1. **Promote climate-smart agriculture:** Adopt practices like **low/no-till farming, crop diversification, organic fertilizers, and methane capture** from livestock to reduce greenhouse gas emissions and boost resilience to climate change.
 - a. E.g. **Promotion of millets by India.**
2. **Incentivize sustainable production:** Governments can provide financial incentives and subsidies to farmers who adopt regenerative agricultural practices that conserve resources and minimize externalities.
 - a. E.g. **introducing water pricing so as to reduce excessive groundwater extraction.**
3. **Tax environmental "bads":** Levy taxes on use of chemical pesticides and fertilizers or livestock waste pollution to account for resulting clean-up/treatment costs.
4. **Advance precision agriculture:** Leverage technologies like **AI, robotics, and IoT** to optimize water and **nutrient application, automate tasks, and boost efficiency** in the food system.
5. **Tighten regulations around safety:** Enforce stringent regulations and quality standards regarding use of **antimicrobials, pesticides, water usage** to minimize health and ecology impacts.
6. **Mainstream crop insurance:** Expand crop insurance coverage and premium subsidies to help farmers cope with weather uncertainties and stabilize incomes in case of crop failures. **E.g. PM Fasal Bima Yojana.**
7. **Invest in agri R&D:** Develop and promote adoption of novel drought/pest-resistant, bio fortified, and high-yielding crop varieties suited local environments. **E.g. Providing more funds to ICAR.**
8. **True cost accounting of food:** Adopt full cost assessment protocols and reporting requirements for agribusinesses to account for current externalities in their pricing and operations.

Conclusion

Incentivizing farmers and aligning food prices to sustainability parameters through such steps can help minimize the overlooked damages of agri-food systems over time.

Q13. Coal in India should be complemented with Carbon capture, utilisation and storage (CCUS) for decarbonisation without major economic and social disruption. What is CCUS? How can it help deal with climate issues without threatening India's energy security? Discuss (15M)

Introduction

Carbon capture, utilization, and storage (CCUS) is a set of technologies designed to **capture carbon dioxide (CO₂)** emissions produced from the use of fossil fuels in electricity generation and industrial processes, prevent it from entering the atmosphere, and either **store it** underground or utilize it in various ways. Implementing CCUS can play a crucial role in **decarbonizing industries, mitigating climate change, and ensuring energy security.**

- **Capture:** Involves capturing **CO₂ emissions from industrial processes or directly from the atmosphere.**
- **Utilization:** Involves finding **productive uses for the captured CO₂**, such as in enhanced oil recovery, carbon-based products, or chemicals.
- **Storage:** Involves **securely storing the captured CO₂** underground to prevent its release into the atmosphere.

Body:

Its role in dealing climate issues in India

1. **Reducing Greenhouse Gas Emissions:** By capturing CO₂ from coal-fired power plants and other industries
 - a. E.g. **ONGC** initiated pilot projects like the **Talcher Fertilizer CO₂ capture project** to test the feasibility of CCUS technology in India.
2. **Maintaining Energy Security:** India heavily relies on coal for its energy needs, CCUS allows India to continue using coal for energy while simultaneously mitigating the environmental impact.
 - a. E.g. **National Mission on Enhanced Oil Recovery (EOR)** initiative aims to enhance oil production while simultaneously sequestering CO₂ underground.
3. **Economic and Social Stability:** Abruptly phasing out coal could lead to **economic and social disruptions due to job losses** in the coal industry and related sectors. CCUS provides a gradual transition.
4. **Technological Advancements:** For instance, India has established **research and development centres** focused on CCUS technologies.
 - a. India has also **collaborated with the United Kingdom** in the area of clean energy research and development, including CCUS.

5. **Policy Support:** These policies align with broader strategies to **diversify the energy portfolio** while reducing carbon emissions.
 - a. **E.g.** India has a **National Policy on Biofuels** that encourages production and use of biofuels, which can be part of a low-carbon energy mix.
6. **Incorporation of CCUS in Climate Action Plans:** India has incorporated CCUS as part of its **climate action plans** to achieve the goals outlined in the Paris Agreement.
7. **International Cooperation:** can provide India with access to **funding, technology, and knowledge exchange**.
 - a. **E.g.** Participation in **Global Carbon Markets** so that, India can **leverage financial mechanisms to support CCUS projects**.

India is not in a position to do away with coal, **without substantial cost to the need of energy security for its poor**. CCUS presents a **pragmatic approach for India to decarbonize its energy sector** while addressing climate concerns **and ensuring energy security**. It serves as a **transitional solution**, allowing for the continued use of coal and other fossil fuels while actively working towards a sustainable and low-carbon future.

Conclusion

The deployment of CCUS technologies in conjunction with coal use can help India address climate issues without compromising energy security, fostering a **balanced and sustainable approach to energy production**.

Q14. "The 2006 Environment Impact Assessment (EIA) Notification, while showing adaptability to changing times, has been diluted over the years, potentially compromising environmental safeguards". Examine. (15M)

Introduction

The Environment Impact Assessment (EIA) Notification of 2006 is a crucial regulatory framework in India designed to assess the **potential environmental impact** of various developmental projects before they are undertaken. However, over the years, there have been concerns about the dilution of the EIA Notification, suggesting that it may compromise environmental safeguards.

Body:

Dilution of the 2006 EIA Notification

1. **Post-facto Clearance Provision:** Introduction of this in the **draft EIA notification in 2020**, which allow projects to **seek clearance after initiating construction** undermines the **preventive nature of the EIA process** and **weakens the accountability** of project proponents.
2. **Reduced Public Participation:** Amendments have been made to the public consultation process, potentially **limiting public participation**.
 - a. **For instance**, the draft EIA Notification 2020 proposed **reducing the notice period for public hearings from 30 to 20 days** and the **hearing duration from 45 to 40 days**.
3. **Exemptions and Streamlining Clearance Process:** Automatic clearance for certain categories may streamline the process but could compromise the thoroughness of the environmental assessment.
 - a. **E.g.** infrastructure projects **like highways and roads, power transmission lines**.
 - b. **Recent tragedy in Char Dham Yatra** (collapse of tunnel) has been attributed to having not carried out EIA of the project
4. **Relaxation in Terms of Violations:** There have been instances where violations of environmental norms were regularized or condoned, signalling a **lenient approach towards non-compliance**.
5. **Strategic Projects and Security Clearance:** The inclusion of the **"strategic projects" category** in the amendments can lead to **potential misuse or lack of transparency**.
 - a. **E.g.** The **inclusion of national security as a criterion for approval without clear definitions** raises questions.
6. **Expert Committees and Their Independence:** Changes in the constitution of **expert appraisal committees** and their roles have been criticized for potentially compromising their independence.
7. **Limited Scope for Rejection:** The amendments have limited the scope for regulatory authorities to reject projects based on environmental concerns. This could potentially **prioritize economic interests over environmental protection**.
8. **Weak Monitoring and Compliance Mechanisms:** The efficacy of monitoring and compliance mechanisms has been questioned, with concerns about **inadequate follow-up** on conditions stipulated during project clearances.

Points Indicating Adaptability to Changing Times

1. **Introduction of New Categories:** The EIA Notification has been amended to include **new categories of projects**, reflecting an **acknowledgment of emerging environmental challenges** and the need for regulation in diverse sectors.
 - a. E.g. Inclusion of **EV Battery manufacturing** under EIA.
2. **Use of Technology in Assessments:** The incorporation of technology, in environmental assessments can enhance the accuracy and comprehensiveness of impact assessments.
 - a. E.g. use of **remote sensing and GIS**.
3. **Public Access to Information:** Efforts have been made to **improve transparency** by making information related to EIA processes accessible to the public online. This can empower communities and environmental activists to **monitor projects more effectively**.
4. **Climate Change Considerations:** Amendments have been proposed to include climate change considerations in the EIA process
 - a. E.g. 2020 EIA notification emphasises **Climate Change Impact Assessment (CCIA)**.

Conclusion:

Balancing development needs with environmental protection requires a holistic approach that addresses these concerns by:

- Strengthening **public participation and transparency** in the EIA process.
- **Revisiting exemption categories** and ensuring stringent environmental assessments for all projects.
- Enhancing **regulatory capacity and enforcement mechanisms**.
- **Investing in research and development** for robust environmental impact assessment methodologies.
- Promoting **alternative and sustainable development models** that minimize environmental impact.

This examination highlights the need for **continuous evaluation and improvement of the EIA system**. By addressing the potential loopholes and strengthening its implementation, India can ensure that **environmental considerations remain a key factor** in development decisions, protecting its rich ecological heritage for future generations.

Q15. What are the primary barriers hindering the financing of energy transition towards renewables in developing and low-income countries? What solutions can address these challenges? (15M)

Introduction:

Energy transition refers to the **shift from traditional, often fossil fuel-based energy sources to cleaner, more sustainable alternatives renewable energy**.

Body:

There are **several barriers to financing of energy transition** towards renewables in developing and low-income countries like:

1. **Lack of capital and investment:** Many developing countries face challenges in mobilizing sufficient capital for renewable energy projects due to limited financial resources, especially in low-income economies.
 - a. E.g. The climate finance commitment set in 2009, which aimed to **mobilize \$100 billion per year** for developing countries has not fulfilled itself.
2. **High initial cost and risks:** The upfront costs of renewable energy technologies can be high, and investors may perceive these projects as risky due to uncertainties in policy frameworks and project outcomes.
3. **Policy and regulatory challenges:** Inconsistent or inadequate policies and regulations can create uncertainty for investors.
 - a. **Just Energy Transition Partnership (JET-P)** is a key mechanism for multilateral financing by developed countries to support an energy transition in developing countries. However **India didn't participate in it** due to inclusion of criteria for phase down of Coal.
4. **Infrastructure and technical barriers:** Inadequate infrastructure, including transmission and distribution networks, can pose challenges to integrating renewable energy sources into existing power systems.
 - a. Example: **India adopted Open access rules 2022** for small consumers also to purchase renewable power through open access, but lack of connectivity hinders their participation
5. **Dependency on fossils:** Subsidies for fossil fuels can distort the market and make renewable energy projects less competitive.

- a. **Example: India rejected complete phasing out of coal** based energy as energy transition talks need to take place on equal terms

Solutions to address the challenge:

- Global Partnerships:** Global partnerships can open new channels of support through technology or financial resources being shared. Example **Global Climate Action Partnership (GCAP)**
- RE as a Responsible Energy:** RE shouldn't stand merely for renewable energy but also for responsible energy. To avoid negative impacts, the RE industry must act on four principles:
 - Actively promoting universal labour, land, and human rights;
 - Protecting restoring and nurturing resilient, thriving ecological systems;
 - Committing to participatory governance principles;
 - Recognising that resilient communities and an inclusive workforce are critical to their success
- Climate Financing:** Calling for **climate finance of \$1 trillion**, the Prime Minister of India highlighted in his COP26 address that developing nations cannot achieve ambitious targets of net-zero with older, unfulfilled climate finance targets.
- Debt restructuring and relief:** Calls were made for a significant reduction in debt levels in developing countries, particularly debt cancellations for least developed countries. For instance, **Zambia reached a \$6.3 billion debt restructuring** deal in debt owed to other governments including China.
- Opening robust financing pathways:** To meet the **INR 1.5-2 trillion annual** investment requirement in renewable energy, the Indian government has authorized **100% annual Foreign Direct Investment (FDI)** for renewable power generation and distribution projects.
- Stronger action plan and targets among the global south :** India, as a developing nation with growing energy demands, has set a goal of achieving **net-zero emissions by 2070**
- Fostering policy consistency:** Policy inconsistency can deter investors and slow down progress. Therefore, there should be consistency and predictability in India's energy and climate policies.
- Promoting public awareness and engagement:** Raising public awareness about the importance of green transition and creating a societal demand for sustainable products can help incentivize businesses to invest in green technologies and practices.

India's Clean Energy Steps:

| Steps | |
|---|---|
| 1. Ambitious Targets | 500GW non-fossil energy by 2030. |
| | 450GW from renewables. |
| | 43% RE purchase obligation by 2030. |
| 2. Supportive Policies | Energy Conservation (Amendment) Act. |
| | National Green Hydrogen Mission. |
| | Fiscal incentives (production-linked). |
| | Upcoming national carbon market. |
| 3. Net Zero Commitment | Aim for net-zero emissions by 2070. |
| | Updated INDC with 50% non-fossil capacity by 2030. |
| 4. Energy Conservation Amendment Bill, 2022 | Mandates use of non-fossil fuels. |
| | Includes green hydrogen, ammonia, biomass, ethanol. |
| | Empowers Central Government for carbon markets. |

Conclusion

Addressing these barriers requires a **comprehensive and collaborative approach** involving governments, international organizations, private sector entities, and local communities. The combination of financial support, effective policies, and capacity-building initiatives can contribute to the successful financing of energy transition towards renewables in developing and low-income countries.

Q16. Traditional practices in India play a crucial role in enhancing climate change resilience. Explain. Support your response with relevant examples. (15M)

Introduction:

Climate change being one of the most **pressing challenges of the 21st century** poses significant risks not only to the **environment, human health and food security**, but also **economic development**. The **Global Climate Risk Index 2021** had ranked **India 7th in the list of most affected countries** in terms of exposure and **vulnerability to climate risk events**.

Body:

Additional Points:

Impact of climate change on India:

1. **Reduced Agricultural Output:** Climate change can severely **disrupt crop cycles and cause low agricultural yield due to changes in temperature, precipitation patterns, pest infestation, soil erosion**. Eg. **Agriculture contributes 15% of Indian GVA**
2. **Increased Health Costs:** Climate change can increase the **incidence and severity of diseases such as malaria, dengue, cholera, heat stroke, respiratory infections**, and mental stress. Eg. According to the **WHO**, **between 2030 and 2050**, climate change is expected to **cause approximately 2.5 lakh additional deaths per year, from malnutrition, malaria, diarrhoea and heat stress**.
3. **Damaged Infrastructure:** Climate change can damage physical infrastructure such as **roads, bridges, railways, ports, airports, power plants, water supply systems**, and buildings due to **sea level rise, coastal erosion, landslides, storms, floods, and heat waves**. For instance, India spent **USD 3 bn of economic damage caused by floods in the last decade** which is 10% of the global economic loss.
4. **Reduced Industrial Output:** Climate change can **increase operational costs** and reduce profits in the industrial sector. Eg. India could contribute to **34 million out of 80 million global job losses due to heat stress-associated productivity decline by 2030**.
5. **Energy Crisis:** According to the traditional knowledge about rotational grazing, ensuring that grasslands remain healthy and resilient to climate variability **International Energy Agency (IEA)**, India's primary energy demand will double by 2030.

Traditional practices in India play a crucial role in enhancing climate change resilience due to their sustainable and time-tested nature. These practices are deeply rooted in local knowledge, community-based approaches, and an understanding of the environment.

Traditional practices and climate resilience:

1. **Agroecological farming techniques** : It can safeguard farming productivity against climate disruptions and enhancing soil fertility .
 - a. Example : **Bhoochetna in Karnataka**-- Farmers in Karnataka have revived traditional farming techniques through the Bhoochetana program, which promotes organic farming, mixed cropping, and water conservation.
2. **Water harvesting and management practices** can help tackle the increasing water crisis as India is the largest exploiter of ground water resources .
 - a. **Example: Johads (small earthen dams)** in Rajasthan helps in harvesting rainwater, helps recharge groundwater levels, ensures water availability during dry periods.
3. **Community based forestry contribute to carbon sequestration**, biodiversity conservation, and the overall resilience of ecosystems against climate change impacts.
 - a. Example **Bishnoi community** has a long-standing tradition of protecting trees and wildlife.
4. **Traditional weather forecasting** using observations of natural indicators like animal behavior, cloud patterns, and wind directions. This knowledge helps farmers make informed decisions about planting and harvesting.
5. **Traditional knowledge about rotational grazing**, ensuring that grasslands remain healthy and resilient to climate variability.
 - a. Example: **Gujrati maldhari** community practices sustainable livestock management
6. **Cultural practices like sacred groves** that are protected due to religious beliefs. These groves **act as biodiversity hotspots and** contribute to ecosystem resilience by maintaining a balance.
7. **Surangas or Thurangams** are an indigenous **hydraulic engineering marvel** to tap into the ground water resources in another wise difficult topographical environment of Western Ghats.
8. **Community resilience building by using traditional knowledge**, integrating into community-based disaster management. This includes practices like raised plinths for houses and knowledge about flood-resistant crops, enhancing the community's resilience to flood.
 - a. Eg. Kerala's kuttanad model

While traditional practices in India **may hold cultural and historical significance**, relying solely on them to enhance climate change resilience **may not be sufficient** in the face of rapidly changing environmental conditions. Climate change is a complex and global issue that **requires innovative and adaptive solutions**. Traditional practices, though valuable, **may not always align with the scale and urgency** needed to address contemporary climate challenges. Incorporating **modern technologies, scientific advancements, and global cooperation** is essential to complement traditional practices and develop comprehensive strategies for climate change adaptation and mitigation..

Conclusion

UNESCO, through its LINKS programme, has been influential in **ensuring that local and indigenous knowledge holders** and their knowledge are included in contemporary science-policy-society. Using traditional knowledge through a mass movement will help LiFE mission (lifestyle for environment).

Q17. Advancements in green technology can contribute to reducing carbon emissions and combating climate change, though it has limitations. Discuss (15M)

Introduction

The **pressing global challenge of climate change** has spurred the development and adoption of green technologies as a critical means to reduce carbon emissions and mitigate environmental impacts. These innovations encompass a **spectrum of solutions**, ranging from **renewable energy sources and energy storage** to electric vehicles and **carbon capture technologies**.

Body:

Advancements in green technology can contribute to reducing carbon emissions and combating climate change:

1. **Renewable energy:** Innovations in solar, wind, hydro, geothermal and biomass-based power generation technologies are making renewable electricity increasingly affordable and efficient.
 - a. **Greater adoption of renewables directly offsets fossil fuel usage** across power, industry and transport sectors.
2. **Energy storage solutions:** Advances in battery technologies, from **lithium-ion to flow batteries**, are enabling larger scale grid integration of intermittent renewable electricity and expansion of **emissions-free electric mobility**.
 - a. **E.g. advancement in battery technology exemplified by Tesla's Gigafactories.**
3. **Hydrogen fuel cells:** Refinements in production, infrastructure and costs of hydrogen fuel cells can accelerate **decarbonisation of long-haul transport** including shipping, aviation besides providing cleaner industrial heat.
 - a. Green hydrogen production from **water electrolysis** powered by renewables has enormous potential.
4. **Carbon capture & storage:** Though still expensive, innovations in materials, processes for capturing CO2 emissions from factories/power plants and securely storing it underground or putting it to industrial use can tackle hard-to-abate emissions.
5. **Smart grids & meters:** Wider deployment of **IT-enabled, self-balancing smart grids** matched with smart meters in homes enables greater monitoring of renewables integration, **predictive demand management** and reduces transmission losses leading to lower emissions.

Limitations of green technology in reducing carbon emissions and combating climate change:

1. **High upfront costs** - Many green technologies like **EV vehicles, hydrogen electrolyzers, and large-scale batteries** still come at higher purchasing costs compared to fossil fuel alternatives creating budgetary limitations for widespread adoption.
2. **Infrastructure limitations** - Renewable energy expansion as well as emerging solutions like **hydrogen and carbon capture** require massive new supportive infrastructure from **transmission lines, pipelines to storage facilities** which will take decades to setup.
3. **Intermittency and storage issues** - The variable nature of renewables like solar, wind poses grid integration challenges. **Affordable grid-scale storage technologies** are still in developmental stages and constrained by geographical potential.
 - a. **E.g. The production of lithium-ion batteries for EVs relies on rare earth elements.**

4. **Technological maturity** - While costs are declining fast, many green technology options like **ocean energy, 3rd generation biofuels, direct air capture of CO₂** have not reached technical maturity and commercial scalability limiting their near-term emissions reduction potential.
5. **Policy and transition barriers** - Phasing out fossil fuels requires overcoming political opposition, addressing displaced **workforce through re-skilling**, and coordinating multi-sectoral policy priorities across government, industry and civil society long-term roadmaps.

Way forward:

1. **Prioritize research and innovation** to enhance efficiency and cost-competitiveness of emerging Genentech solutions through adequate public R&D grants and private investments.
2. **Implement transitional subsidy support**, tax incentives and access to finance for enterprises and consumers adopting greentech to accelerate widespread deployment and drive economies of scale.
 - a. E.g. **FAME initiative by India.**
3. **Invest heavily into modernizing energy transmission**, storage and distribution infrastructure along with common standards to seamlessly integrate and leverage variable renewable solutions.
4. **Price carbon emissions** appropriately starting with higher fuel/energy taxes while lowering taxes on income to facilitate societal shift away from fossil fuels.
5. **Develop local manufacturing supply chains** and skilled workforce around exported greentech to boost international technology transfer and customized adoption suited to regional needs.
6. **Foster international collaborative platforms** for technology assessments, knowledge exchange and joint innovation mechanisms to avoid duplicative efforts.
 - a. E.g. **International solar alliance, Global biofuel initiative.**
7. **Continually review energy mixes**, infrastructure plans and policy priorities through formal iterative processes allowing flexibility to mainstream Genentech.

Conclusion

A shared long-term vision among policymakers and industries prioritizing emissions reductions through sustained investments into greentech refinement can maximize its climate mitigation potential.

Q18. How can understanding the factors of hazard, vulnerability, and exposure contribute to more effective disaster risk reduction strategies? Discuss using examples. (15M)

Introduction:

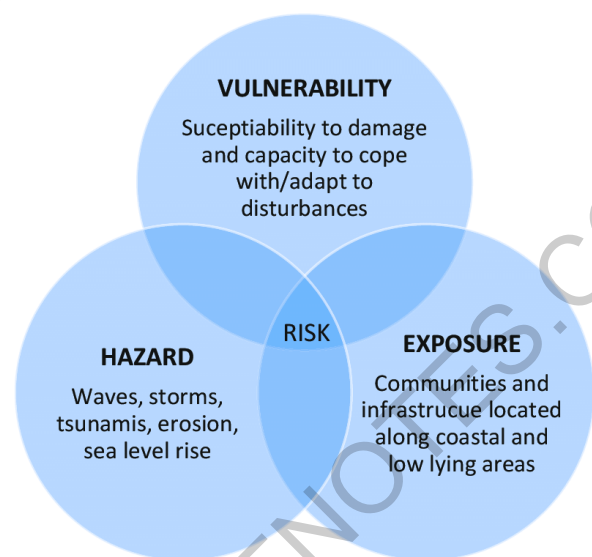
Hazards are defined as physical phenomena that pose a threat to the people, structures or economic assets and which may cause a disaster. They can be natural or human-made. **Vulnerability** is the extent to which a community, structure, service or geographic area is likely to be damaged or disrupted by the impact of a particular hazard. Lastly, **Exposure** is defined as the situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas.

Body:

Understanding the factors of hazard, vulnerability, and exposure contribute to more effective disaster risk reduction strategies:

Hazard:

1. **Early Warning Systems:** Understanding hazards allows for the development and implementation of early warning systems.
 - **Eg:** Japan's sophisticated seismic monitoring systems and Indian Ocean Tsunami Early Warning System provide advanced alerts of the hazards.
2. **Infrastructure Planning:** Recognition of specific hazards informs infrastructure planning.
 - **Eg:** In regions prone to cyclones, cyclone-shelters are designed and constructed to withstand high winds and storm surges.
3. **Community Preparedness:** Knowledge of hazards facilitates community training and preparedness programs.



- **Eg:** Areas prone to wildfires may conduct regular drills to educate residents on evacuation procedures and fire prevention measures.
- 4. **Adaptive Strategies:** Understanding changing hazard patterns, such as those influenced by climate change, enables the development of adaptive strategies.
 - **Eg:** the Netherlands invests in innovative solutions like sea defenses and sustainable water management against sea-level rise.

Vulnerability:

- 5. **Targeted Interventions:** Identifying vulnerabilities allows for targeted interventions to reduce underlying risk factors.
 - **Eg:** NDMA Guidelines on Seismic Retrofitting of Deficient Buildings and Structures.
- 6. **Social Safety Nets:** Addressing socio-economic vulnerabilities involves the establishment of social safety nets.
 - **Eg:** India's national food security program and MGREGA for employment.
- 7. **Community Empowerment:** Recognizing community-specific vulnerabilities empowers local populations.
 - **Eg:** National Disaster Management Guidelines for Community Based Disaster Risk Reduction and Red cross' Community-based disaster risk reduction program.
- 8. **Education Programs:** Vulnerability reduction often involves education programs. In regions susceptible to infectious diseases, public health campaigns educate communities about preventive measures, reducing the vulnerability of the population to outbreaks.
 - **Eg:** Public health campaigns in malaria-prone areas.

Exposure:

- 9. **Land-Use Planning:** Understanding exposure helps in land-use planning to minimize the concentration of assets in high-risk areas.
 - **Eg:** Coastal Zone Regulations (CRZ) rules.
- 10. **Insurance Mechanisms:** Managing exposure involves the development of insurance mechanisms.
 - **Eg:** Pradhan Mantri Fasal Bima Yojana reduces exposure to weather hazards.
- 11. **Spatial Planning:** Recognition of exposure informs spatial planning.
 - **Eg:** Seismic map zonation, Landslide atlas et al help spatial visualization and planning to reduce exposure.
- 12. **Migration Policies:** Countries prone to climate-related hazards may develop migration policies to manage exposure.
 - **Eg:** Disaster-Induced Internal Displacement is currently presumably covered under the DMA of 2005.

Conclusion:

In conclusion, a holistic understanding of hazards, vulnerabilities, and exposures is fundamental for designing effective disaster risk reduction strategies. By addressing each factor systematically, communities and nations including India can enhance their resilience and minimize the impact of disasters.

Q19. What are the key factors contributing to the vulnerability of the Ganges-Brahmaputra Delta in Assam, Bihar, and West Bengal to annual floods? What strategies can be implemented to mitigate the risks associated with these floods? (15M)

Introduction:

The **Ganges-Brahmaputra Delta**, encompassing the states of Assam, Bihar, and West Bengal and covers more than 105,000 km². It stands as a geographical marvel with its intricate river networks. However, this deltaic region is not just a testament to natural beauty but also bears the brunt of annual floods

Body:

Key factors contributing to the vulnerability of the Ganges-Brahmaputra Delta to annual floods:

Natural Factors:

- 1. **Heavy Rainfall and Monsoon Intensity:** The region experiences intense monsoon rains, often exceeding 2,500 mm annually, leading to rapid riverine rises and flash floods.
 - **Eg:** These rivers drain 75% of the total basin runoff in only 3 months of the monsoon.

2. **Riverine Morphology:** The Brahmaputra River has a highly dynamic and shifting course, prone to erosion and channel avulsion (sudden change in course), increasing flood risks.
 - **Eg:** The course of the Brahmaputra River has changed dramatically over the past 250 years, of 80 km from east of the Madhupur tract (Bangladesh) to the west of it.
3. **Tectonic Activity:** The region lies in a seismically active zone, and earthquakes can trigger landslides and disrupt river courses, exacerbating flood events.
 - **Eg:** Earthquakes of 1897 and 1950 in Assam increased flood frequency in the delta due to subsidence.
4. **Tidal influence:** The Ganges Delta experiences high tides, creating backwater effects that impede drainage and worsen flood inundation.
5. **Cyclonic impact:** The delta region is prone to cyclones, with an average of 4-5 cyclones making landfall every year.
 - **Eg:** 2021 Cyclone Yaas caused massive floods.

Anthropogenic Factors:

6. **Deforestation and Land Use Changes:** Unsustainable deforestation in the upper catchments increases soil erosion and sediment load in rivers, reducing their carrying capacity and causing overflows.
 - **Eg:** Sundarbans flooding attributed to these.
7. **Encroachment on Floodplains:** Building settlements and infrastructure on floodplains obstructs natural drainage and reduces buffer zones, amplifying flood impacts.
 - **Eg:** Bihar floods from are particularly severe due to encroachment of floodplains.
8. **Inadequate Drainage and Infrastructure:** Insufficient drainage systems, choked rivers, and dilapidated embankments cannot handle excessive water, leading to widespread inundation.
 - **Eg:** Inadequate and weak embankments are annually breached in Bihar-West Bengal floods.
9. **Poor Urban Planning:** Urbanization without proper water management and flood zoning increases runoff and exposes more people to risks.

Strategies can be implemented to mitigate the risks associated with these floods:

1. **Early Warning Systems:** Implement advanced early warning systems to provide timely alerts to communities, enabling them to evacuate and take preventive measures.
 - **Eg:** Flood Early Warning System (**FLEWS**) in Assam by its state disaster management authority.
2. **Eco-Restoration:** Undertake comprehensive eco-restoration initiatives, including reforestation and wetland conservation, to enhance natural drainage systems and reduce vulnerability.
 - **Eg:** Red River Delta Rehabilitation Project restored over 100,000 hectares of mangroves and wetlands which can be replicated here.
3. **Infrastructure Development:** Invest in resilient infrastructure, such as embankments, flood shelters, and drainage systems, to protect communities and vital assets.
 - **Eg:** Coastal Embankment Improvement Project (**CEIP**) in Bangladesh part of the delta.
4. **Community Engagement:** Foster community-based initiatives for flood preparedness, including training in disaster response, and involve local communities in planning and decision-making processes.
 - **Eg:** Community Preparedness and Adaptation of "Living with Floods" under Flood Risk Mitigation and Management.
5. **Climate-Resilient Agriculture:** Promote climate-resilient agricultural practices and crop varieties to minimize the impact of floods on the agrarian economy.
 - **Eg:** Integrated Rice-Fish Farming System (**IRFFS**) promoted by the World Food Programme.

Conclusion:

As seen above, many factors are natural and inevitable to certain extent, thus, mitigating the risks associated with annual floods in the Ganges-Brahmaputra Delta requires a holistic and integrated approach that combines physical infrastructure, sustainable land-use practices, community engagement, and international cooperation.

Q20. Why is community-level disaster management important? Outline the disaster management framework for handling disasters at the community level in India. (15M)

Introduction:

In context of **Disaster Risk Reduction** (DRR), a community is a set of people who are exposed to the same hazard. Hence, Community based disaster management, by its very definition, involves communities in identifying, assessing and acting jointly

to reduce disaster risks.

Body:

Community-level disaster management is important:

1. **Addressing Unique Vulnerabilities:** India's varied regions face diverse threats, like floods in Assam, earthquakes in the Himalayas, and cyclones in coastal areas. Community-level management allows for tailored solutions like mangrove restoration in Sundarbans to mitigate storm surges and floods.
2. **Faster Response and Action:** Communities can react quicker due to proximity, local knowledge and familiarity with the area, saving lives and minimizing damage during **crucial first “golden” hours**.
3. **Enhanced Resilience and Empowerment:** Engaging communities builds capacity to cope with and recover from disasters, leading to long-term resilience and reduced dependence on external assistance.
4. **Social Cohesion and Trust:** Working together strengthens social bonds, promotes cooperation, and creates a solid foundation for collective action and resilience.
5. **Effective Resource Mobilization:** Communities can efficiently utilize local resources, skills, and networks, reducing the burden on formal organizations.

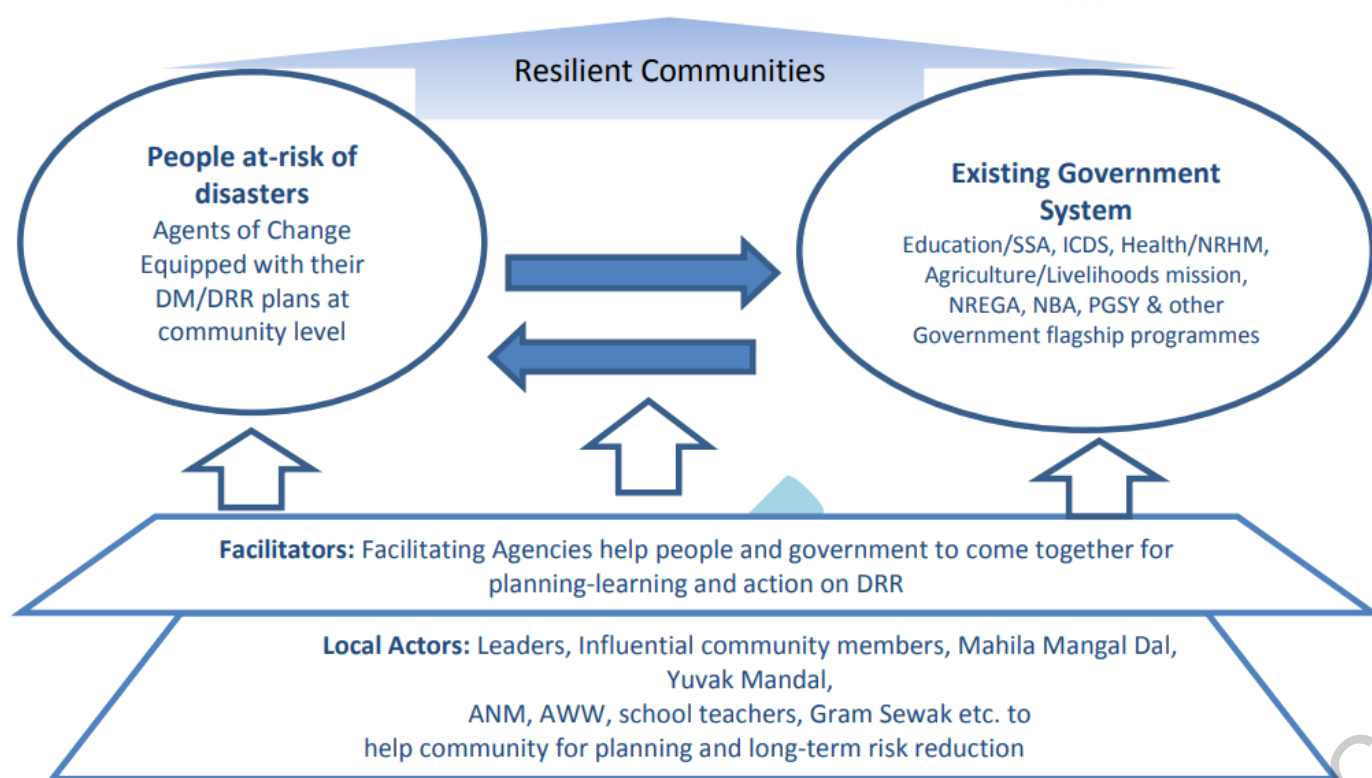


Figure 2.1 Frameworks for Implementation of CBDM

Disaster management framework for handling disasters at the community level in India:

1. The framework is provided under **NDMA Guidelines of 2014** on Community based Disaster Management (**CBDM**).
2. **CBDM Process:** CBDM involves sequential stages such as community mobilization, organization, and capacity building; hazard, vulnerability, and risk assessment; risk reduction planning and mainstreaming; early warning systems; post-disaster relief and recovery; and participatory monitoring and evaluation.
3. **Institutional involvement:** CBDM requires the formation and functioning of community-based disaster management institutions, such as Village Disaster Management Committees (**VDMCs**), City Disaster Management Committees (**CDMCs**), and Community Facilitation Centers (**CFCs**), that represent the interests and needs of all the community groups and coordinate with various stakeholders, such as government, NGOs, civil society, and private sector.
4. **Capacity Development:** CBDM entails the development of functional and technical capacities of various stakeholders, such as state and district officials, municipal administration, community groups, NGOs, academic institutions, and other actors, to undertake CBDM activities, such as assessment, planning, and implementation.

5. **CBDM case studies:**

- Chipko movement helped in disaster awareness at community level. Later, Uttarakhand integrated technology into CBDM such as satellite early warning systems.
- Gujarat State Disaster Management Authority's Sustainable Community Initiative for Disaster Recovery and Preparedness in District Porbandar was implemented in partnership with UNCRD and SEEDS which earned global recognition.
- Natural Disaster Mitigation Partnership, Vietnam is also a globally recognized model of CBDM.

Needful innovative measures:

- **Technology Integration for Early Warning:** Integrate technology, like mobile apps, for real-time alerts.
 - **Eg:** "Satark" landslide prediction system in the Western Ghats.
- **Community-Driven Communication Platforms:** Develop localized communication tools.
 - **Eg:** Platforms like 'Gram Vaani' are utilized for community-driven information sharing.
- **Use of Drones for Disaster Assessment:** Deploy drones for rapid response, package delivery and damage assessment.
- **Traditional Knowledge Integration:** Combine traditional wisdom with modern approaches, recognizing traditional knowledge systems.
 - **Eg:** In regions prone to forest fires, integrating indigenous knowledge of controlled burning practices with modern fire management.

Conclusion:

India has correctly recognized the need of integrating community participation in disaster management since the **Hyogo Framework** for Action 2005-2015 and continued under current **Sendai Framework**. As we move forward, it is crucial to continue aligning policies and practices with these frameworks, ensuring a resilient and inclusive future for India in the face of growing disaster risks.



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