



Balalatha's



# CSB IAS ACADEMY

The Road Map to Mussoorie...

Mains iMPACT – 06/10/2024

## FLOOD

### SYLLABUS:

GS 3 > Disaster Management > Floods

### REFERENCE NEWS:

- Recent flooding in north Bihar has severely impacted nearly 1.5 million residents, with significant breaches in river embankments due to heavy rainfall and barrage discharges affecting districts like Purnea, Supaul, Saharsa, Darbhanga, and the Champarans. The release of water from the Kosi and Gandak barrages after rains in Nepal and Bihar has heightened the threat, despite reduced discharges since late September.

### MORE ON NEWS:

- Currently, 1.46 million people in 429 villages across 17 districts are affected, prompting responses from 16 NDRF and 17 SDRF teams, with additional support from air force helicopters delivering rations to isolated areas. Approximately 260,000 people have been evacuated, and 18 relief camps are in operation.
- The state has received Rs 655 crore in central aid to combat the crisis, with health measures in place to prevent waterborne diseases. The Indian Meteorological Department predicts more rain until October 11, adding to the challenges, as the state manages a 20% rainfall deficit.

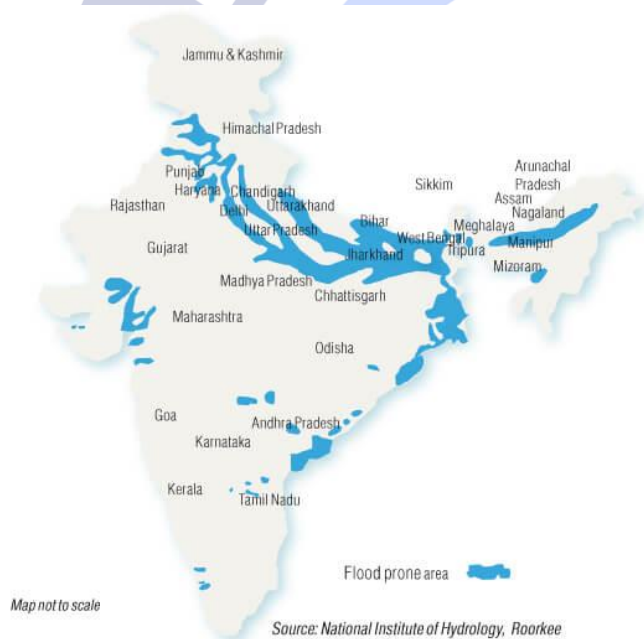
### **Key Factors Contributing to Frequent Flooding in Bihar**

- **Geographical Location:** Bihar is situated at the foothills of the Himalayas, receiving high water discharge from rivers like the Kosi, Gandak, and Mahananda that originate in Nepal.
- **Terrain:** The flat Gangetic plains in Bihar exacerbate water accumulation during the monsoon.
- **Sedimentation:** High sedimentation rates from the Himalayas raise riverbeds, reducing their capacity to channel water effectively and increasing overflow during heavy rains.
- **Climate Change and Rainfall Patterns:** Erratic monsoon patterns and increased rainfall intensity, potentially linked to climate change, exacerbate flooding risks.
- **Infrastructure Challenges:** Embankments and dams intended to control river flows often exacerbate flooding when breached or when they impede natural sediment flow. Poorly maintained embankments and inadequate drainage systems contribute to the problem.
- **Management Practices:** Ineffective flood management and maintenance, along with encroachments on riverbeds and floodplains, increase susceptibility to flooding.
- **Socioeconomic Impact:** Recurrent floods severely impact agriculture, destroy property, and cause loss of livestock, leading to economic distress and forced

migrations. Substantial recovery efforts divert resources from development to relief and rehabilitation.

### **FLOOD PRONE REGIONS IN INDIA:**

- India's unique **geo-climatic conditions and high socio-economic vulnerability** makes it extremely **vulnerable to floods**.
- Out of the total geographical area of 329 million hectares (mha), **more than 40 mha is flood prone**.
- This accounts **for 12% of total land area of the country**.
- Floods are also **occurring in areas which were earlier not considered flood prone**.
- **Flood prone regions in India** can be broadly divided into four regions:
  - **The Brahmaputra River Region:**
    - This region consists of the **rivers Brahmaputra and Barak and their tributaries**, and covers the **Northeastern states** and northern parts of West Bengal. Floods in this region are **severe and quite frequent**.
  - **The Ganga River Region:**
    - This region consists of the **river Ganga and its tributaries**.
  - **The North-west River Region:**
    - The main rivers in this region are the **Indus, Sutlej, Beas, Ravi, Chenab and Jhelum**. Compared to the Ganga and the Brahmaputra river regions, the **flood problem is relatively less in this region**.



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### ○ **The Central India and Deccan Region:**

- Important rivers in this region are the **Narmada, Tapi, Mahanadi, Godavari, Krishna and Cauvery**
- In addition, the **Andaman and Nicobar Islands and Lakshadweep** have peculiar characteristics, which result in drainage congestion, flooding and erosion in coastal areas

### **MITIGATION STRATEGIES:**

- A multitude of measures are adopted to reduce or mitigate the hazards arising from floods.
- They can be broadly categorized into two: **Structural and Non-structural measures**.

### **EXISTING MITIGATION MEASURES IN INDIA:**

- **Constitutional Provisions:** Flood control isn't directly listed in the 7th Schedule of the Indian Constitution, but measures like "Drainage and Embankments" are mentioned in Entry 17 of List II, placing primary flood control responsibility with the states.
- **Ministries Involved:**
  - **Ministry of Home Affairs (MHA):** Acts as the nodal ministry for disaster management.
  - **Ministry of Jal Shakti:** Handles technical aspects of flood management.

	Structural	Non-structural
Concept	<ul style="list-style-type: none"> <li>- Control over hazard</li> <li>- Protection of human settlement</li> </ul>	<ul style="list-style-type: none"> <li>- Hazard mitigation/ avoidance</li> <li>- Adjustment of human activities</li> </ul>
Measures	<ul style="list-style-type: none"> <li>- Sea walls, levees, structure of dams, break water, flood storage reservoirs, dikes, pumps, channel improvements and diversions, and groins</li> <li>- Strengthening buildings through building codes</li> <li>- Building shelters</li> </ul>	<ul style="list-style-type: none"> <li>- Land use management by planning tools (comprehensive plan, zoning, ordinance, incentives)</li> <li>- Infrastructure policy</li> <li>- Insurance</li> <li>- Awareness (education, information dissemination) and partnership</li> <li>- Protect natural areas (dunes, wetland, maritime forests, vegetation etc.)</li> <li>- Risk reduction and preparedness policies</li> </ul>

- **Other Ministries:** Agriculture, Civil Aviation, Environment and Forests, Health, Space, Earth Sciences, Mines, Railways, etc., play significant roles in flood management within their respective areas.
- States also have their own ministries and flood control boards for localized management.
- **National Disaster Management Authority (NDMA):**
  - Responsible for creating policies, plans, and guidelines for disaster management and ensuring their effective implementation.
  - It oversees the National Disaster Response Force, which responds to disasters, and has issued guidelines for managing floods.
  - Released the National Water Policy 2012, recommending reservoir operations that provide flood cushions and reduce sediment trapping during the flood season.
- **Central Water Commission (CWC):**
  - The apex agency for water resources, including flood management.
  - Its Flood Management Organisation appraises flood management projects and multipurpose projects with flood management components, issues flood bulletins, and develops flood forecasting techniques.
- **India Meteorological Department (IMD):**
  - Established in 1875, the IMD is the principal government agency for meteorology and related sciences.
  - It observes weather, provides predictions, and issues warnings for severe weather phenomena.
- **Brahmaputra Board:** Created under the Brahmaputra Board Act, 1980, to manage flood control, erosion, and water resources in the Brahmaputra valley.
- **Ganga Flood Control Commission (GFCC):** A subordinate office under the Ministry of Jal Shakti since 1972, focusing on flood management in the Ganga Basin states.

#### Other major initiatives:

- **Chennai:** In 2019, Chennai implemented CFLOWS-CHENNAI, which stands for Coastal Flood Warning System Chennai. This advanced system provides real-time, area-specific inundation data during monsoons, enhancing the city's ability to respond effectively to flooding.
- **Mumbai:** Launched in June 2020, Mumbai's Integrated Flood Warning System (IFLOWS) is a state-of-the-art webGIS-based decision support tool that enhances the city's resilience by providing early warnings for potential flooding, particularly during high rainfall and cyclones.
- **Guwahati:** The Energy and Resources Institute (TERI) and the National Disaster Management Authority (NDMA) introduced the Flood Early Warning System

(FEWS) in Guwahati. This system is designed to alert local authorities about potential flash floods or heavy rainfall, aiding in proactive disaster management.

### **CHALLENGES IN FLOOD MANAGEMENT:**

- **Unregulated development:**
  - Unabated encroachment of flood plains, reclamation of water bodies, construction of sprawling slums alongside rivers and the shoddy management of storm water drains have led to increased flood risk to lives and properties.
- **Relief-centric approach:**
  - Flood management measures are generally planned on an **ad hoc basis to give immediate relief** on public demand. Hence, flood management strategies continue to be **focused on post disaster relief measures than on pre-disaster planning.**
- **Unscientific dam management:**
  - Operation of reservoirs in India is often carried out in an unscientific and knee jerk manner. **Despite the mandate of the NDMA**, most dams in India do not have any Emergency Action Plans. For instance, high reservoir storage and sudden release of water were the root cause for **the devastating floods in Kerala in 2018.**
- **Interstate water disputes:**
  - Most river basins in India span across various states. However, there is lack of flow of information among the basin-states resulting in gaps in preparedness on their part to face incoming floods.
- **Lack of a central agency:**
  - There is no national or state level institution dealing with all facets of flood management exclusively and in a holistic and comprehensive manner.
- **Delays in completion of projects:**
  - In 2017, the CAG had **highlighted the delays in completion of projects under the Flood Management Programme (FMP)** due to various reasons such as non-release of funds from the Centre, delays in land acquisitions and inadequate planning.
- **Challenges to accurate forecasting:**
  - Climate change has complicated the flood forecasting and warning systems in India. Also, the network of the CWC, though developed on scientific basis, does not cover all the flood prone rivers. Most of the existing flood forecasting stations are poorly maintained.
- **Data deficiency:**
  - A task force was set up by the CWC in 2006, but it did not complete the task of flood risk mapping. There is no proper documentation about floods, their impact and the manner in which these were tackled.

### **NITI AAYOG'S REPORT ON STRATEGY FOR FLOOD MANAGEMENT IN THE COUNTRY**

The recommendations in the report of the committee constituted for **Formulation of Strategy for Flood Management Works in Entire Country and River Management Activities and Works Related to Border Areas (2021-26)** include,

- **Non-Structural Measures:** Emphasizes the adoption of cost-effective, non-structural strategies like flood forecasting, flood plain zoning, and flood proofing to manage water flow effectively across most regions.

- **National Water Model:** Proposes the development of an Indian version of the National Water Model (NWM), inspired by the U.S. model, to enhance flood prediction and management through a comprehensive decision support system.
- **Advanced Technologies:** Recommends utilizing advanced technologies such as artificial intelligence, satellites, remote sensing, and GIS for improving flood forecasting and warning systems.
- **Flood Cushion in Dams:** Suggests implementing a policy to create flood cushions in existing dams to mitigate flood impacts during peak times, aiming to prevent disasters similar to the Kerala floods.
- **Medium and Long-Term Measures:** Advocates for medium-term construction of embankments and levees to protect infrastructure like railways and highways, and stresses the need for long-term structural measures such as dams, reservoirs, and detention basins in critical areas for comprehensive flood defense.

#### WAY FORWARD:

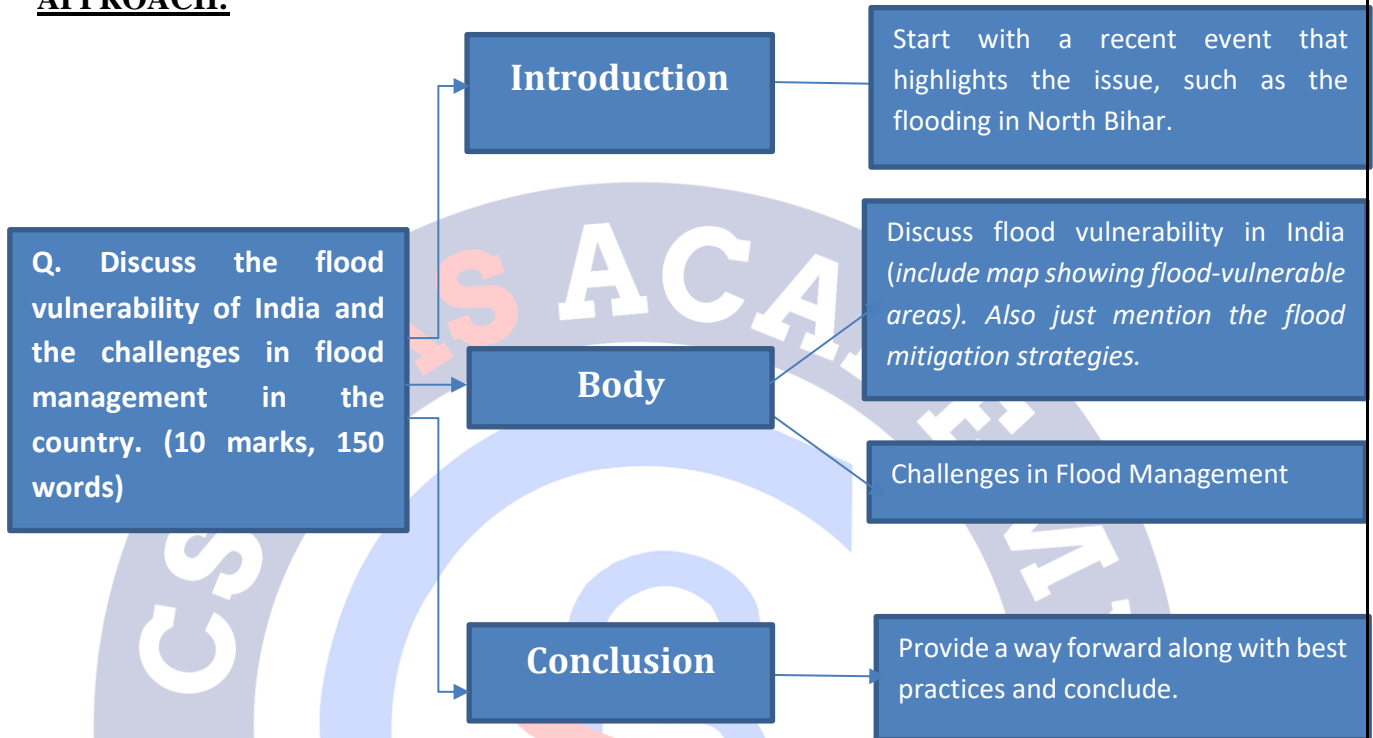
- **Integrated Flood Management:** Emphasize a holistic approach that includes coordinated water management, land use, urban development, transport, agriculture, and nature conservation.
- **Preparedness-Centric Approach:** Recognize flood management as a critical element of good governance and integrate it into national development planning. Establish a national-level flood control authority.
- **Forecasting & Early Warning Systems:** Significantly enhance flood forecasting capabilities through maintenance of current systems and investment in new technologies. Utilize IT-based tools for real-time data sharing and flood warnings.
- **Conservation of Water Bodies:** Acknowledge the role of water bodies in managing urban floods by capturing stormwater runoff. Empower local bodies to protect and conserve these natural resources.
- **Better Cooperation:** Improve coordination with neighboring countries for better information sharing and management of excess water discharge. Develop robust interstate flood management mechanisms within India.
- **Develop Techno-Legal Regime:** Implement regulations to control development in flood-prone areas through specific land use policies and zoning regulations in flood plains.
- **National Flood Management Institute:** Establish an institute dedicated to all aspects of flood management, providing training for engineers and administrators.

#### BEST PRACTICES:

- **Buoyant buildings or “amphibian houses”** — which sit on dry land but can **float vertically during flooding** — have been built in **Maasbommel, the Netherlands**.
- **Yonging River Park in Taizhou, China**, and the **Bishan-Ang Mo Kio Park in Singapore** are the **urban parks designed as wetlands or floodplains** to allow periodic flooding

**PRACTICE QUESTION:**

**Q.** Discuss the flood vulnerability of India and the challenges in flood management in the country. (10 marks, 150 words)

**APPROACH:****MODEL ANSWER:**

Recent severe flooding in North Bihar, impacting nearly 1.5 million residents, has highlighted the ongoing challenges in India's flood management strategies. The floods, exacerbated by breaches in embankments and heavy discharges from the Kosi and Gandak barrages, underline the acute vulnerability of the region and necessitate a comprehensive approach to flood management.

**Flood Vulnerability in India:**

India's unique geo-climatic conditions make it exceptionally prone to floods. More than **40 million hectares, or 12% of the country's land area**, is flood-prone. This includes regions that traditionally were not considered at risk. The vast river systems like the Brahmaputra, Ganga, and their tributaries swell during the monsoon season, frequently inundating surrounding areas and causing widespread damage.

<Include a map showing flood-vulnerable areas in the country>

India employs several flood mitigation strategies, including:

- **Structural Measures:** Embankments, dams, reservoirs, and floodwalls to control water flow.
- **Non-Structural Measures:** Flood forecasting systems, flood insurance, and public awareness campaigns.
- **Integrated Management:** Bodies like the Brahmaputra Board and Ganga Flood Control Commission manage specific river basins.
- **Policies and Guidelines:** Developed by national and state disaster management authorities to guide flood management efforts.

<Can be presented in the form of a spider diagram>

**Challenges in Flood Management:**

- **Unregulated Development:** Uncontrolled encroachments and urbanization of floodplains, along with reclamation of water bodies and poor stormwater management, have significantly heightened flood risks, as seen in sprawling slum developments alongside rivers.
- **Relief-centric Approach:** Flood management often revolves around providing immediate relief rather than proactive risk management. This ad hoc strategy, focused on post-disaster responses, fails to address the underlying risks and enhance preparedness.
- **Unscientific Dam Management:** The management of dams and reservoirs often lacks scientific rigor, as evidenced by the catastrophic floods in Kerala in 2018, triggered by improper reservoir operations. Despite NDMA guidelines, many dams lack comprehensive Emergency Action Plans, leading to mismanagement during critical periods.
- **Interstate Water Disputes:** The sharing of river basin resources across states often leads to conflicts and insufficient collaboration, affecting the timely and effective management of floodwaters.
- **Lack of Central Agency:** There is no dedicated national or state-level agency tasked exclusively with managing all aspects of flood management, leading to fragmented and often inefficient responses.
- **Project Delays:** Delays in the completion of flood management projects, as highlighted by a 2017 CAG report, are common due to funding issues, land acquisition delays, and poor planning, further crippling response efforts.
- **Forecasting Challenges:** Accurate flood forecasting remains a challenge due to climate change impacts and a lack of comprehensive data coverage by the Central Water Commission. Many forecasting stations are poorly maintained, leading to gaps in early warning capabilities.
- **Data Deficiency:** A lack of detailed flood risk mapping and inadequate documentation of past floods and their management hampers effective planning and response strategies.

To enhance flood resilience, India must adopt an integrated management approach that includes:

- **Improved Forecasting and Early Warning Systems:** Leveraging modern technologies such as AI, GIS, and remote sensing to enhance the prediction and management of flood events.
- **Conservation of Water Bodies:** Protecting natural water bodies which play a crucial role in managing stormwater and reducing run-off.
- **Robust Policy Framework:** Establishing a techno-legal regime to regulate development in flood-prone areas and enforcing strict zoning and land use policies.

**Best Practices**

Internationally, several innovative practices have been successful in flood management:

- **Buoyant Buildings:** In the Netherlands, amphibian houses which float during floods have been effective in areas prone to flooding.
- **Urban Wetlands:** Parks like Yonging River Park in China and Bishan-Ang Mo Kio Park in Singapore serve dual purposes for recreation and as flood plains.

India's strategy for flood management must be multi-faceted, incorporating both traditional infrastructural measures and modern technological solutions. Learning from global best practices and fostering interstate and international cooperation are key to developing a resilient flood management system. With these strategies, India can significantly mitigate the impact of floods and enhance the safety and well-being of its vulnerable populations.