

Fighting Flood and Drought: The Dual Challenges of Bihar

Assignment-1

CH211-ENVIRONMENTAL SCIENCE AND ENGINEERING

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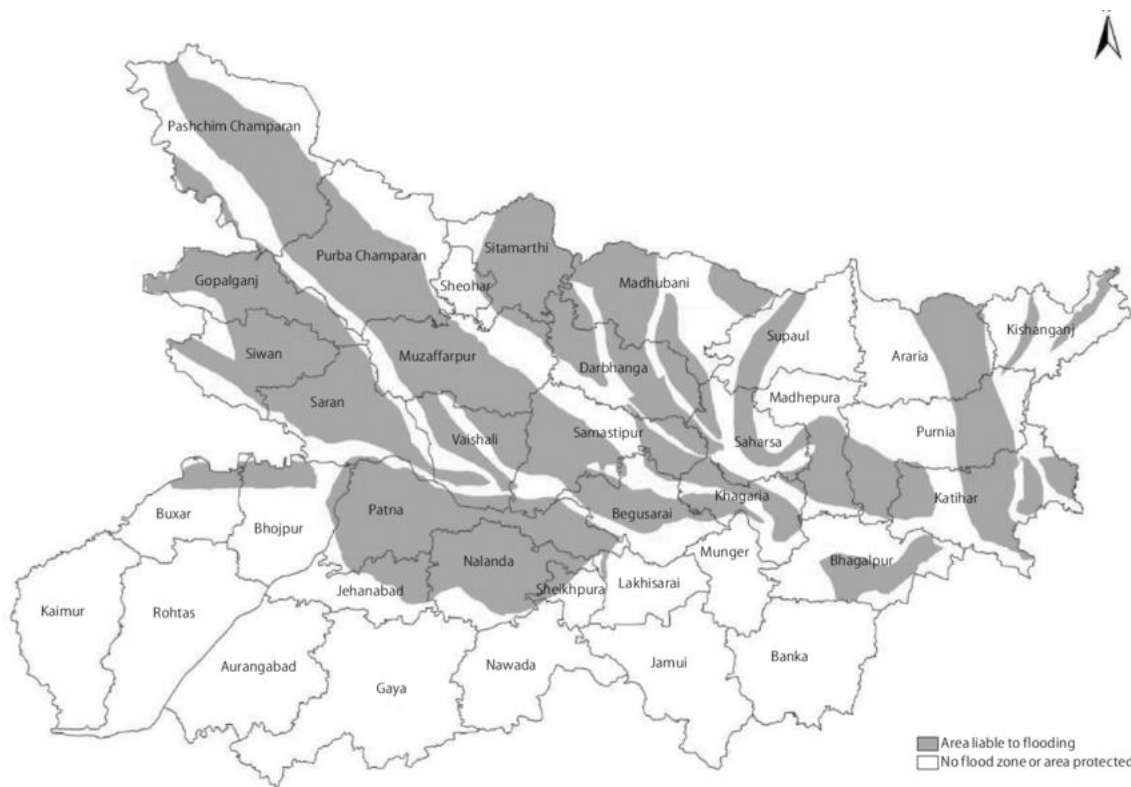
Introduction

- Bihar is the 12th largest state in India with an area of 94,162 sq. km.
- It boasts a topography characterized by a vast expanse of fertile alluvial plains within the Gangetic Valley.
- Despite its agricultural richness, Bihar is inherently disaster-prone, facing recurring challenges, notably floods and droughts.
- 16.5% of India's flood-affected area and 22.1% of its flood-affected population are in Bihar.

Floods and Droughts in Bihar:

- Bihar experiences the dual impact of floods and droughts, with distinct geographic patterns.
- The northern region, situated above the Ganga River, is predominantly flood-prone, while the southern region, below the Ganga, faces the recurring spectre of drought.
- Recent years have witnessed an alarming increase in the frequency of these disasters.
- Bihar has been grappling with the challenge of floods for generations, and it's become a part of our story. A significant chunk of India's annual flood losses can be traced back to Bihar.
- Floods have always been a concern, but off late, they seem to be showing up more frequently. Since 1979, Bihar has faced numerous floods, causing considerable havoc and damaging property in a big way.
- Recent data from the Indian Meteorological Department (IMD) reveals that ten districts in Bihar—Gaya, Jehanabad, Nalanda, Rohtas, Aurangabad, Patna, Begusarai, Sheikhpura, Saharsa, and Banka—have encountered rainfall deficits between 26% and 55%. Situated in the drought prone Magadh region, these districts have a history of water scarcity, facing recurring challenges for years.
- In a concerning development, the scarcity of water has now extended to North Bihar districts, including Muzaffarpur, Samastipur, Darbhanga, and Madhubani. The situation in these regions has escalated, underlining the expanding reach of the water crisis across the state.

The Flood Issue



The flood prone areas of Bihar

Current Scenario

- In July 2023, continuous rainfall in the watershed regions of Nepal has led to rising water levels in multiple rivers, surpassing the danger levels.
- About 100 villages in six districts, namely Araria, Katihar, Purnea, Bhagalpur, Munger, and Supaul, have experienced flooding, impacting over 50,000 inhabitants.
- Most of these districts share a border with Nepal and the flood was a result of heavy rainfall in upstream areas of the neighbouring country.
- As per the Bihar State Disaster Management Authority (BSDMA), a substantial 73.63% of the geographical area in North Bihar is identified as prone to floods. The catchment areas of major rivers like Kosi, Bagmati, Kamala Balan, Gandak, Budhi Gandak, and Adhwara have witnessed swelling rivers, causing overflow into villages, damaging houses, schools, government buildings and primary health centres.
- Particularly alarming is the situation in Muzaffarpur district, where a staggering 2,500 villages have been inundated.

- Agriculture operations, especially paddy sowing, are in a halt due to floods in Bihar as it has resulted in waterlogged fields, leading to the destruction of paddy crops and other pulses.

What causes floods?

- **Nepal's Monsoon Rainfall:** The primary cause of flooding in Bihar stems from rivers originating in Nepal. During the monsoon season, Nepal experiences intense rainfall, leading to a surge in the water levels of these rivers. As a result, the rivers become overloaded, causing flooding in the basin, particularly in North Bihar. The intricate interplay between heavy rainfall in Nepal and the downstream impact on Bihar's river systems underscores the transboundary nature of the flooding challenge.
- **Impact of Koshi Barrage:** A significant contributor to flooding in Bihar is the Koshi Barrage on the Koshi River in Nepal. When there is an overload of water in the river, the barrage must be opened. This release of water, in turn, leads to floods in districts like Supaul and others within its basin. The Koshi Barrage, while serving vital functions, becomes a crucial factor in the cyclical challenge of flooding, highlighting the interconnectedness of water management across borders.



Kosi Barrage

- **Major Rivers Contributing to Flood Damages:** The rivers responsible for significant damages in Bihar include Koshi, Bagmati, Gandak, Budhi Gandak, Kamla, Balan, and Adhwara. These waterways play a pivotal role in the flood dynamics of the region, inflicting considerable harm during periods of heightened water flow and overflow. Managing the impact of these rivers is critical for effective flood mitigation strategies in Bihar.

Other minor causes are:

- **Vulnerability of Weak Embankments:** The susceptibility of weak embankments, vulnerable to breaking down under the force of water, stands as a significant factor contributing to dangerous floods in the region. The compromised integrity of these embankments amplifies the impact of flooding, posing a serious threat to communities and infrastructure. Strengthening and maintaining robust embankments become crucial components of effective flood resilience measures.
- **Impact of Overloaded Ganga River:** The Ganga River, already burdened with excess water, experiences additional loading during heavy rainfall. This surplus water further slows down the speed of rivers in North Bihar. Consequently, the slowed river flow contributes to the spread of water within the basin region, exacerbating the overall flooding scenario. The cumulative effect underscores the intricate relationship between the Ganga River's load and the dynamics of flooding in the northern basin of Bihar.
- **Alluvium Accumulation and Reduced River Depth:** An additional contributing factor to flooding is the alluvium brought by these rivers. Due to embankments, the alluvium does not disperse as intended. This accumulation results in a decrease in the depth of the river, leading to a reduction in the water-carrying capacity of the rivers. The compromised capacity, in turn, contributes to flooding as the rivers struggle to manage increased water flow during periods of heavy rainfall. Addressing this sedimentation challenge is vital for enhancing the resilience of river systems against floods.

Consequences of Flood

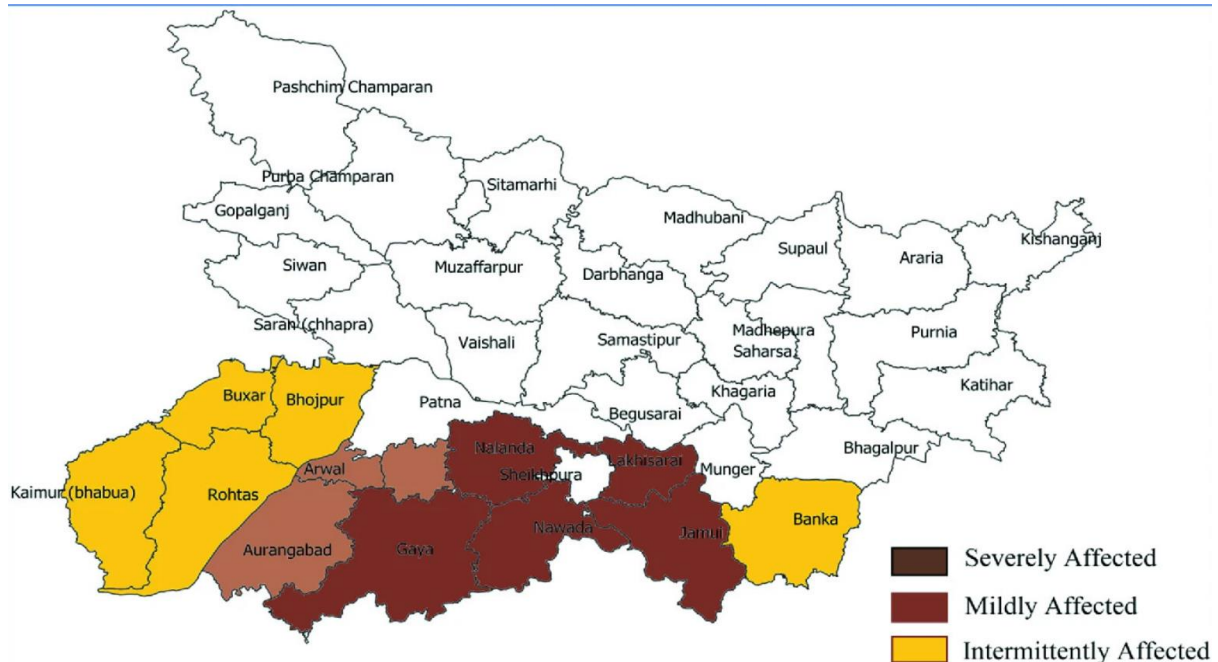
Indirect Damages:

- **Loss of Life:** Endangers human and animal lives due to inundation.
- **Agricultural and Arboreal Loss:** Damages crops and trees, impacting livelihoods and ecosystems.
- **Infrastructure Destruction:** Harms houses, Primary Health Centres, and transportation facilities, disrupting normal life.
- **Impact on Utilities:** Damages electricity lines, affecting power supply and adding to the challenges faced by communities.

Indirect Damages:

- **Economic Impact:** Loss of employment for daily wage workers, artisans, and small shop owners.
- **Water Quality:** Damage to clean drinking water sources, posing a threat to public health.
- **Health Consequences:** Increased risk of epidemics, including communicable and non-communicable diseases like Malaria, Typhoid, Dengue, etc., following floods.
- **Soil Degradation:** Erosion of fertile soil, transforming it into lateritic and infertile land, affecting agricultural productivity.

The Drought Issue



The drought affected districts of Bihar

Current Scenario

- Bihar experienced a significant rainfall deficit from June 1-29, 2023. The state received only 47.5 mm of rainfall compared to the normal 151.1 mm, indicating a deficiency of 69 percent, as per India Meteorological Department (IMD) data. This shortfall raises concerns for sectors like agriculture and necessitates proactive measures to address potential impacts on water resources and overall well-being.
- Of the 38 districts in the state, two have received normal rainfall, six have been categorised as 'Deficient' and 30 as large-deficient by the IMD.
- The most critical situation is observed in Muzaffarpur, Vaishali, and Saran districts. Muzaffarpur faced an alarming 99 percent less rainfall than the normal levels. Similarly, Vaishali received 93 percent less rainfall, and Saran experienced a deficiency of 97 percent compared to the usual precipitation. These extreme deficits accentuate the severity of the rainfall shortage in these areas, posing substantial challenges for agricultural activities and water resources in these districts.

- Apart from this, Aurangabad has received 86 per cent less rainfall than normal, Begusarai 87 per cent, Samastipur 91 per cent and Siwan 91 per cent less.
- Despite the overall deficiency, Bihar received a notable surge in rainfall, recording 9.6 mm between 8 am on June 27 and 8 am on June 28. Notably, districts including Araria, Banka, Bhagalpur, Khagaria, Munger, and Supaul experienced significantly above-normal rainfall, surpassing 60 percent in the span of these 24 hours. This localized increase provides a brief respite but prompts a continued need for vigilance and responsive measures in the ongoing monsoon season.

What causes droughts?

- **Dependence on Monsoon Rainfall:** Bihar relies significantly on rainfall, especially during the monsoon, for agricultural cultivation. The state receives an average of 108 cm of rainfall annually, with approximately 85% occurring during the monsoon season. However, the consistency of monsoon rainfall in Bihar, particularly in South Bihar, is highly variable. Some years witness rainfall significantly higher than the average, while others experience much lower than the average. This inconsistency contributes to periodic drought-like situations arising every 2–3 years, posing challenges to agricultural practices and highlighting the vulnerability of the state's dependence on monsoon patterns.
- **Challenges in Irrigation Facilities:**
 - **Limited Irrigated Farmlands:** Less than 50% of farmlands in Bihar are irrigated, with 63% relying on tube wells, 31% on irrigation projects like canals, and the remaining 4% from other sources.
 - **Dependency on Rainfall:** More than 50% of farmlands are dependent on rainfall, making agriculture vulnerable to inconsistent weather patterns.
 - **Groundwater Depletion:** The reliance on tube wells has led to large-scale groundwater depletion, contributing to the overall water scarcity and drought-related concerns in Bihar.

- Limited Canal Irrigation: Only a few districts in South Bihar, including Kaimur, Banka, and Lakhisarai, have proper irrigation systems through canals. The rest of South Bihar remains heavily dependent on rainfall, exacerbating the impact of drought-like situations.
- **Decline in Ponds and Outdated Irrigation Practices:**
 - Reduced Water Storage: The considerable decrease in the number of tanks and ponds diminishes the water storage capacity crucial for sustaining the region throughout the year.
 - Groundwater Impact: Ponds play a vital role in increasing the groundwater level, and their decline contributes to water scarcity.
 - Outdated Irrigation Practices: The persistence of outdated irrigation systems, characterized by excessive water wastage, exacerbates the impact of drought in Bihar.
- **Decline in Forest Area:**
 - Low Forest Cover: Bihar has only 7.76% forest area, which is considerably less than the recommended level of 33% for India, according to the India State of Forest Report (ISFR) 2019.
 - Impact on Climate: The decrease in forest cover is concerning as trees play a crucial role in reducing wind speed and promoting rainfall. The low forest cover could contribute to unfavourable climatic conditions in the state.

Consequences of Drought

- **Crop Failures and Farmer Distress:**
 - Financial Strain: Crop damages due to drought impose heavy financial burdens on farmers, leading to economic distress.
 - Food Insecurity: Crop failures contribute to a heightened risk of hunger and malnutrition among affected communities, with farmers facing challenges in providing for their families.
 - Destitution Threat: Some farmers may plunge into destitution as they grapple with the aftermath of failed crops, further exacerbating social and economic challenges.

- **Unemployment:**

- **Agricultural Dominance:** With over 80% of the population engaged in agriculture and allied sectors, drought results in the loss of employment not only for farmers but also for numerous individuals directly or indirectly associated with these activities.
- **Economic Impact:** The decline in agricultural productivity due to drought leads to a broader economic downturn, affecting employment across various linked industries.

- **Migration Due to Unemployment:**

- **Large-Scale Migration:** The lack of employment opportunities and destitution drive a significant number of people to migrate from Bihar. This migration is not only towards mega cities but also to farmlands in states like Punjab and Haryana in search of livelihoods.
- **Impact on Urban and Rural Areas:** The migration pattern affects both urban and rural areas, creating challenges for both the regions people are leaving and those they are moving to.

- **Decline in State's Economy:**

- **Agricultural Dependency:** While agriculture contributes around 19.3% to the state's total GDP, a decline in agricultural productivity due to drought has a significant ripple effect on the economy.
- **Secondary Effects:** The economic contraction in the agricultural sector can lead to a decline in the contributions of other sectors to the GDP, creating a broader economic downturn.
- **Shrinking Economy:** The cumulative effect of drought-related challenges contributes to the shrinkage of the state's economy.

- **Environmental Degradation:** Groundwater Depletion: Drought-induced decline in groundwater levels leads to drying trees, reducing the overall forest cover, which is already limited (7.76% of the total geographical area).

- Impact on Environment: Decreased forest cover results in environmental hazards such as an increase in average temperature and elevated carbon dioxide levels.
- Environmental and Health Hazards: The environmental changes triggered by reduced forest cover contribute to various hazards affecting both the environment and human health.

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