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Bihar urban flood 2019 and disaster management: A case study

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Abstract

The state of Bihar in India witnessed severe urban flooding in 2019, causing extensive damage to infrastructure, loss of life, and disruption to normal life. This work provides a

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summary of the urban flood event and explores disaster management strategies implemented to mitigate the impact of such disasters in the future.

In terms of long-term disaster management, efforts were made to improve urban planning and infrastructure resilience. This involved the development of early warning systems, improved drainage systems, construction of flood-resistant structures, and mapping of flood-prone areas.

Therefore, there is a need for sustained efforts in strengthening disaster response mechanisms, improving coordination among stakeholders, and implementing proactive measures to mitigate the impact of future urban flood events.

Subject Classification: *Q5.*

Keywords: *Disaster management, Flood management.*

Introduction

Flood is one of the most severe disasters across the globe which primarily arises due to heavy to extremely heavy rainfall, cyclone and high tides etc. Some of the human lead factors such as channel blocking miss use of land and deforestation etc. Flood causes huge loss to human life and infrastructure and some solid preventive measures are required to minimize the damage. Some of the preventive and mitigation steps involve dam construction, river dike which are structural flood control measures. Non-structural preventive measures include flood estimation, early warnings about river discharge, flood hazard and risk reduction management, public involvement and institutional framework. Floods often affected India compared to the other disasters and the damaged caused by the flood are extremely severe. Monsoon contributes for 75 to 80 % of the gross rainfall in India in between the months of June to September. Heavy discharge of the river has been observed during the monsoon especially in the following states viz. Uttar Pradesh, Odisha, Bihar, Assam, Andhra Pradesh and West Bengal. According to National Flood Commission, 40 million hectares' land in the country is prone to flood and cumulative 7.2 million hectares is severely affected yearly.

Methodology

The present study is qualitatively based on primary and secondary source of information inputs. The primary data is based on the data obtained through rigorous field work and interaction with the affected people from the city. The interviews available on the various public platforms for different news channels and newspapers. Tables and charts

are used for the better understanding purpose. The effect of flood has been assessed through estimating the loss of infrastructure and causalities in the capital city. Various measures taken after the disasters such as water and sanitation facilities for women, relief centres situation has been discussed in this study. For the secondary source of information, various techniques are used such as telephonic interview were conducted with other key informants involved in flood relief who have experienced the problem during the flood. Photographs of flood available on open platforms are also used to study and analyse the flood affected community issues.

Causes

The Ganges and its Himalayan tributaries naturally flood almost 75% of Bihar's landmass, making up 73.06% of all of India's flood-prone region. These rivers' combined catchment area is located 65 percent outside of Chinese territory, in Nepal and Tibet. As a result, Bihar's northern portion is more susceptible to flooding than its southern region (Sinha et al.). The morphological behaviour of river streams has been deteriorated as a result of human involvement in the river plains of bordering nations, which has resulted in a significant migration of sediments into the state. Due to this, the rivers' ability to discharge water was reduced, which raised the possibility of flooding on the plains. Another reason for seasonal fluctuations in river flow is the variance in discharge in Himalayan rivers from minimum flow to maximum flow. Additionally, the erratic topography in northern Bihar is a factor in the increased frequency of floods. The elevation at the Indo-Nepal border is between 90 and 95 metres, whereas the elevation at the confluence of these rivers in the Ganga is between 40 and 45 metres.

Impact analysis

The impact of flood can be divided into two categories; primary impact and secondary impact. Primary impact is the one which resulted due to direct contact with flood water such as casualty, loss of property, damage to the government as well private infrastructures like road, railways, electricity, bridges, telephone communications etc. Secondary impacts are the one which are not due to direct contact of flood water such as stoppage of services, prolonged health impact etc. These effects are the consequence of the failure of fundamental services such as water distribution, sewage disposal, food supply, etc. The framework of flood impacts is as shown in figure. Infrastructure framework of any state or country serves as a

backbone for different activities, services and industries and failure of the same during flooding affect severely from economics point of view. Complete or partial shutdown of industries shorten the production and the supply chain may also get disturbed not only the impacted region but also in the region rely on it. The impact of flood on the farmer community is also significant. Apart from the crop loss during the flood, there may be decayed quality of land for cultivation due to the sediment deposited over the land. This makes the land infertile and adversely affects the community who rely on it completely for their survival.

The total number of villages affected by these districts with a population of 119 lakhs was 1846. A total of 1.25 lakh people were evacuated by the disaster response teams, various government organizations and NGOs and 116 people lost their lives in this tragedy. Some people from the flood affected area shared their stories about the disaster with various media platforms, some of them are given below:

1) We were sleeping around 2 am. The flood in our house came slowly and increased within a few minutes... The water level was up to two feet, and after a few minutes it was more than four feet. We were able to get out of our house without any delay. Ran for it and came out. [Middle National Highway] to a safe place When I saw my house in the morning, it was broken and full of water...the whole village was under water. It was terrible, scary... All our crops and everything that was left was gone. My four buffaloes and two goats died. I have lost all my valuables, and I don't know what to do next.
2) I am 60 years old. After 2008 flood, some NGO taught us how to save ourselves in case of flood. … We learned from those NGOs that we should run to the roof of any pucca house. When the flood came, everyone ran on the roof of the pucca house. However, since I could not climb stairs, I was left alone in the flood. I clung to the bamboo tree for three hours. I could feel the water flowing below my waist. I couldn't hold on much longer, and I almost gave up when some villagers who made a small boat using a banana tree went looking for me. They found me and saved my life.

"People in our area are suffering from malaria and high-grade fever due to mosquitoes. Kindly guide us what we do as a precautionary measure. Currently, our houses have been destroyed and there is no pure water to drink".

"Many people do not even have medicines for their treatment. We don't have drinking water now. It was through your program that we heard an interview of a doctor on home water purification methods. … There are 20 more people with me who are listening to your program in this critical situation.

Suggestion

In general, there are two types of flood control measures: (i) structural measures, which comprise land and comparable non-structural features such building embankments, flood retention walls, flood embankments, channel upgrades, and detention basins; and (ii) non-structural measures, which include these. Make use of planning, disaster prevention and mitigation measures, flood insurance, watershed management, flood forecasting, and development of flood-prone areas. Both measures should be used together for the best and most effective results as they are not mutually exclusive but rather complementary.

Structural Measures:

The majority of the flood management activities in Bihar involve building and maintaining embankments. It falls under the heading of temporary structural modifications.

Land-use planning:

Government regulations or master plans should take into account land use in flood-prone areas. Along with ecological reserves, the land near streams should be used for parks and recreational activities. Simple amenities like picnic areas and restrooms should be made flood-proof. You could mention a private development like a golf course. The main goal is to incorporate the subsequent land-use for flood-prone land into extensive plans for the urban area and its surroundings.

Zoning of flood-prone lands:

Preventing development in flood-prone areas is a smart method to mitigate future flood damage. The best course of action is to zone such land; however, as mentioned previously, a land use plan should be adopted to assign a specific purpose to the land. Flood-prone areas

have low water velocities and are susceptible to severe erosion; therefore, zoning can be used to reduce flood damage, but it must be flexible enough to accommodate various types of land use. No, agricultural use of the territory is permissible. In Bihar, where there is a paucity of agricultural land, flood-prone land can be utilised judiciously as agricultural land to ensure food self-sufficiency.

Redevelopment of flood-prone areas:

A significant flood calamity presents an opportunity to make amends for poor planning in the past. Consideration should be given to the elimination of flood-prone structures and the transformation of the land into a restricted use. In the long term, physically relocating flood-prone developments as part of a calamity mitigation programme should be more cost-effective.

Compensation and incentives:

The victims are given compensation after the disaster. They are able to somewhat rebuild their life with its help. However, compensation should work to minimise future flooding damage as part of disaster relief. Instead, then only fixing the damage, money should be invested on floodproofing, purchase, and rehabilitation in order to stop similar disasters from happening again. Incentives must be created to promote floodproofing and removal from flood-prone locations. This needs to be backed up by a cost-sharing arrangement where the government and business owners both own a piece.

Flood Insurance:

The foundation of flood insurance is the idea of dispersing the loss over a bigger population. Access to flood insurance should be available to anyone who live in floodplains. The authority is required to inform the populace about the advantages and value of flood insurance. The accumulated premiums of policyholders will be used to cover affected parties' losses in the case of catastrophic events. It is feasible to use flood insurance to lessen the impact of floods and the losses they create. The "Pradhan Mantri Fasal Bima Yojana" is an initiative in this direction, but

it needs to be carried out more efficiently for all the assets, including livestock and livelihoods in the impacted areas.

Silt management:

Floods have a serious impact on the lower reaches of the Kosi River and its tributaries every year. The flow velocity of the Kosi and its tributaries, including the Adhwara group, the Bagmati, and the Kamla Balan, is significantly reduced as they travel from their source in the hills to the Nepal Terai and the Bihar plains. As a result, the depth of the flow increases, resulting in a reduction in the capacity to carry silt. Reduced water carrying capacity causes silt to be deposited on the riverbed (Figure 13), which causes the riverbed to rise and subsequently cause bank erosion. Because canal mouths are frequently blocked, the river's course is changed, putting new areas at risk of flooding. This development is also attributed to the rise in water levels, which ultimately causes floods in the basin and causes embankments to overflow and breach. To address this issue, watershed management with a successful siltation management policy is necessary.

Conclusion

The ability of individuals in the state of Bihar to support themselves is severely impacted by ongoing flooding. Flooding has long been a major cause of severe property damage and fatalities. The industry sector is also severely impacted by infrastructure degradation. Despite government efforts to handle disasters, families continue to suffer severe losses in terms of their lives and possessions. Floods cannot be stopped, but their effects can be lessened with advance planning. It is possible to stop individuals from moving in search of work and to stop the state's pattern of erratic development with careful planning and management. To lessen the detrimental consequences of flood impacts, structures including the building and upkeep of embankments, buffers along riverbank sections, land spurs and other essential flood protection works have previously been completed. But structural solutions to the problem are insufficient. Therefore, non-structural measures must also be put into practise. It is essential to implement non-structural flood management strategies, such

as zoning limitations, flood forecasting and warning, floodproofing, and systems for disaster prevention, readiness, and response. Raising and maintaining community knowledge of flooding risks is crucial, as is making sure everyone knows what to do in an emergency. They must be built in a way that allows them to adapt to the possibility of floods, live alongside them in flood plains, and be drained for river usage as required.

Reference

[1] Kansal, M. L., Article detail, *International Journal of Advanced Research*, (2020). https://www.journalijar.com/article/16355/impacts-of-flood-and-its-management.

[2] Senapati, S., Vulnerability and risk in the context of flood-related disasters: A district-level study of Bihar, India, Redirecting, (2022). https://doi.org/10.1016/j.ijdrr.2022.103368.

[3] Gupta, A., Geospatial analysis of September, 2019 floods in the lower gangetic plains of Bihar using multi-temporal satellites and river gauge data, (2020). https://doi.org/10.1080/19475705.2020.1861113.

[4] Das, Anik. A Comprehensive Analysis of Floods in North Bihar, *India and Some Amicable Solutions.* 12. 44-55, (2021). https://www.researchgate.net/publication/354788195.

[5] Bhatt, C M & Gupta, Amitesh & Dalal, Prohelika & Roy, Arijit & Chauhan, Prakash. Geospatial Analysis of September, 2019 Floods in the Lower Gangetic Plains of Bihar Using Multi-Temporal Satellites and River Gauge Data. Geomatics, *Natural Hazards and Risk.* 12. 84-102, (2020). 10.1080/19475705.2020.1861113. https://www.researchgate.net/publication/347945523.