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**From Policy to Practice:
Charting a Path for Floodplain
Zoning in India**

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From Policy to Practice: Charting a Path for Floodplain Zoning in India

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ABSTRACT

Floods are a recurrent phenomenon in many parts of India, and human and economic losses are consistently rising with increased exposure to the hazard. These losses can be significantly reduced by eliminating the encroachment on floodplains and regulating the land use within it through floodplain zoning, a widely accepted and effective non-structural policy measure. Despite its benefits, floodplain zoning has not been widely adopted in India, mainly due to the incoherency of policy documents and the reluctance of flood-affected states to enact legislation. This paper discusses the challenges of existing policy and practice. It suggests a basin-wide approach that builds on the strength of integrated flood management to achieve the desired governance objectives of floodplain zoning.

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INTRODUCTION

Floods regularly plague several parts of India, and the damage caused by inland flooding cost the country nearly 0.84 percent of its GDP annually (as per 2010 GDP data). Additionally, more Indians are exposed to flood risk than any other population in the world.¹ Flooding is also a natural event vital for geomorphological and ecosystem processes in the ‘active floodplain’^a of rivers. Rivers spill into their floodplains when the flow exceeds the bank-full discharge of the channels. The risk of adverse consequences to human health and life, the environment, cultural heritage, economic activity and infrastructure through the exposure to floods^b can be reduced by devising appropriate flood-risk management plans at the basin level.² India is slowly beginning to realise that floodplains are an integral part of a river area; a river with a complete floodplain is not just in equilibrium but also in good health.³

Over the years, floodplains have become sites of development due to their economic potential. The increasing human presence in the floodplains has changed the definition of floods from the submergence of land that does not “normally get submerged” to that “not expected by humans to get submerged.”⁴

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- a According to the draft River Conservation Zone (Regulation of Harmful Activities) Rules, 2012, an active floodplain is defined by high flood line (HFL), which in entrenched /embanked stretches of a river is the available space (including the river channel/s) in the valley of entrenched stretch, or between two embankments, or between existing roads on either side along a river acting as an embankment. In other stretches of the river HFL, active floodplain shall be the 100-year flood line.
- b For all practical purposes, only the floods caused due to monsoonal precipitation is being considered as a hazard. Coastal and estuarine flooding, flooding due to snow and ice-melt during spring and early summer, glacial lake outburst flooding, and flooding due to cloudburst are not being considered.

This paper analyses the situation in Bihar to establish links between the encroachment^c of floodplains (and high population density in the flood-affected districts), the scale of alterations in the floodplains through land-use change, and the mounting losses caused by floods.

The paper further explores floodplain zoning as a policy measure, and critically analyses the Model Bill for Flood Plain Zoning (MBFPZ) and the National Disaster Management Guidelines for floods (NDMG). It identifies the gaps in achieving the governance objectives—restricting losses caused by floods by tackling the encroachment of floodplains and regulating the land use within it—to make floodplain zoning operational and functional.

It also advocates for going beyond the centre-state jurisdictional limitations and instead adopting a river basin approach to implement floodplain zoning pegged on integrated flood management.

IMPACT OF HUMAN ENCROACHMENT ON FLOODPLAINS

Flooding is a natural process, and an active floodplain signifies the replenishment of soil and nutrients. The fertile floodplains have always been ideal agricultural sites since the periodic flooding has ensured

c In this study, the term ‘encroachment’ is being used to highlight any human intervention, legal or illegal, that takes place in the ‘active floodplain’ without conforming to the zonal requirements as mentioned in the National Disaster Management Guideline. The authors would like to emphasise that encroachment is being viewed as ‘*encroaching into the river’s space*’.

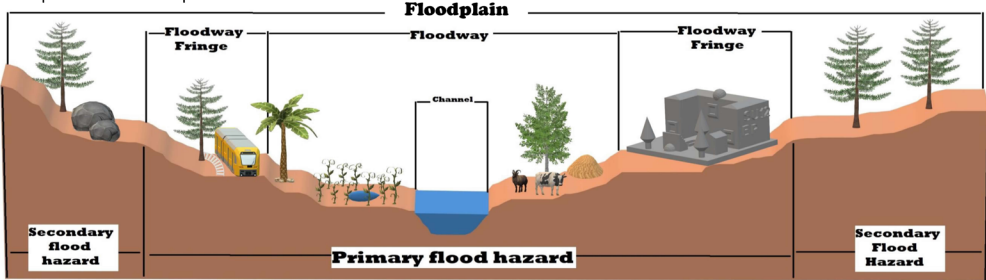
a fresh supply of nutrient-rich fine-grained sediment. Moreover, floodplains are either flat or gently undulating, and water is readily and adequately accessible. The floodplains of the world's major rivers—the Tigris and the Euphrates in Western Asia, the Nile in Africa, and the Indus and the Huang He in Asia—have been the sites of major civilisations with concerted agricultural activities.

At the same time, floodplains are crucial for regulating the flow of water in a river. An under-developed and well-vegetated floodplain allows the water to spread horizontally across its length and breadth, and be soaked up by the wetland soils and streamside forest leaf litter. The excess water is released slowly back to the main channel, reducing the volume of the floodwater in it. Healthy riparian areas are thus crucial to stop the overland flow from turning into a flood discharge and causing damage and destruction to the downstream areas.⁵

Gradually, floodplains became densely populated, and it became necessary to protect the economic interests in these areas. The Yangtze and Huang He were embanked in the 1st and 7th century BC respectively, and the Nile and the Kosi river in North Bihar in the 12th century.⁶ The construction of embankments intensified with the arrival of the British in South Asia, who introduced colonial engineering to further utilise the floodplains for the development of agriculture. This coincided with the extension of roads, railway lines and canals without any reasonable provision for drainage.^{7,8} This human-induced land-use change significantly alters the landscape heterogeneity, productivity and biodiversity of the upland watersheds and the floodplains,⁹ leading

Figure 1: Components of a floodplain and zones proposed under the National Disaster Management Guidelines.

Components of a floodplain.



Zones proposed under NDMG

<p>PRIORITY 1</p> <p>Flood Frequency : Once in 100 years Rainfall Frequency : Once in 50 years</p> <p>Safest zone for construction of residential building, public utilities etc.</p>	<p>PRIORITY 2</p> <p>Flood Frequency : Once in 25 years Rainfall Frequency : Once in 10 years</p> <p>Allowed : Residential buildings could be allowed but with certain design elements being incorporated in the construction</p>	<p>PRIORITY 3</p> <p>Flood Frequency : 10 years or so</p> <p>Allowed : Open spaces like gardens, parks and playgrounds</p> <p>Not allowed : Commercial buildings and public utilities.</p>	<p>PRIORITY 2</p> <p>Flood Frequency : 25 years or so Rainfall Frequency : Once in 10 years</p> <p>Design elements : All buildings in vulnerable zone should be should be constructed on columns or stilts.</p>	<p>PRIORITY 1</p> <p>Flood Frequency : Once in 100 years Rainfall Frequency : Once in 50 years</p> <p>Preference : Defence installations, industries, public utilities like hospitals, electricity installations, railway stations etc.</p> <p style="text-align: center;">1</p>
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Source: Author's own.

to increased flood velocities in the encroached space and a significant rise in the peak flow that reaches the downstream regions.¹⁰

In recent years, floodplains have also been sites for urban development, further increasing the probability of damage as the geographical and demographic growth of a city means an increased exposure to floods. As settlements develop in floodplain areas, the flood hydrology is altered, which in turn aggravates flooding in the immediate downstream, thereby requiring more protection in the form of embankments.¹¹ Floodplain development and the construction of embankments also impact the riparian ecosystem (See Table 1).

Table 1: Types of alterations done to the flood plains and their impact^d.

Alterations	Impact
Increase in impervious surfaces	<ul style="list-style-type: none"> ➤ Decreases infiltration and increases runoff, leading to: <ul style="list-style-type: none"> ● Decreases in lag time ● Increases in peak discharge ● Production of runoff from small storms ➤ Reduction in water seepage and subsequent recharge of floodplain water table
Development in-filling on and near floodplains	<ul style="list-style-type: none"> ➤ Constricts channel flow and capacity ➤ Unplanned development leads to prolonged waterlogging ➤ Disrupts migration and spawning cues for fish
Construction of stormwater drainage systems	<ul style="list-style-type: none"> ➤ Increases velocity and amount of runoff entering river, leading to: <ul style="list-style-type: none"> ● Decreases in lag time ● Increases in peak discharge
Filling of water bodies	<ul style="list-style-type: none"> ➤ Disables fish to spawn on floodplain as the nurseries for juvenile fish is lost ➤ Reduced storage of flood waters, leading to: <ul style="list-style-type: none"> ● Decreases in lag time ● Increases in peak discharge ➤ Disrupts migration and spawning cues for fish.

^d The alterations to the floodplains and the resultant impact are not foolproof. Some alterations could have overlapping impacts. For simplicity, the authors have identified the most important causal-effect relation to categorise the information.

Alterations	Impact
Construction of embankments and expansion of agriculture	<ul style="list-style-type: none"> ➤ Change in soil-moisture regime of floodplains <ul style="list-style-type: none"> ● Reduced availability of soil moisture made available due to inundation during flood events ● DecrWaterlogging in the floodplains due to reduced capacity of water to get flushed out ➤ Reduction in lateral movement of river channel <ul style="list-style-type: none"> ● Prohibiting the formation of new habitats such as in secondary channels and oxbow lakes ➤ Reduced deposition of nutrients on floodplains

Source: Adapted from Montz (2000)¹², Postel and Richter (2003)¹³, and modified by the authors.

Embankments further create a false sense of security because it is assumed that they are unbreachable, propagating the idea that they are synonymous with ‘flood protection’. Therefore, to be protected from floods, more embankments are constructed. This ‘levee effect’ results in greater investment into the hazard-prone area since, in the short-run, the veil of ‘flood protection’ ensures that ‘benefits’ are greater as any ‘loss’ due to floods is successfully averted. The value of the embanked areas is also greater, making them more desirable, and contributing to further floodplain development. Since flood-protection works are generally cost-intensive and require funding from multiple sources with little or no cost-sharing mechanism, the beneficiaries are not those who pay for it. This, coupled with the short-term effectiveness of flood-control structures, make embankments immensely lucrative for the local community.¹⁴

The construction of embankments have only aggravated the situation in India, and this is most acutely seen in Bihar. The short-sighted flood-protection plan of constructing dams and embankments has backfired. Such structural measures fail to live up to expectations

and have worsened the situation,¹⁵ and the building of such structures could have dangerous consequences, as seen during the breach of the Kosi embankment in Nepal in 2008 that affected about 50,000 Nepalis and 3.5 million Indians in North Bihar.¹⁶

Case Study: Bihar

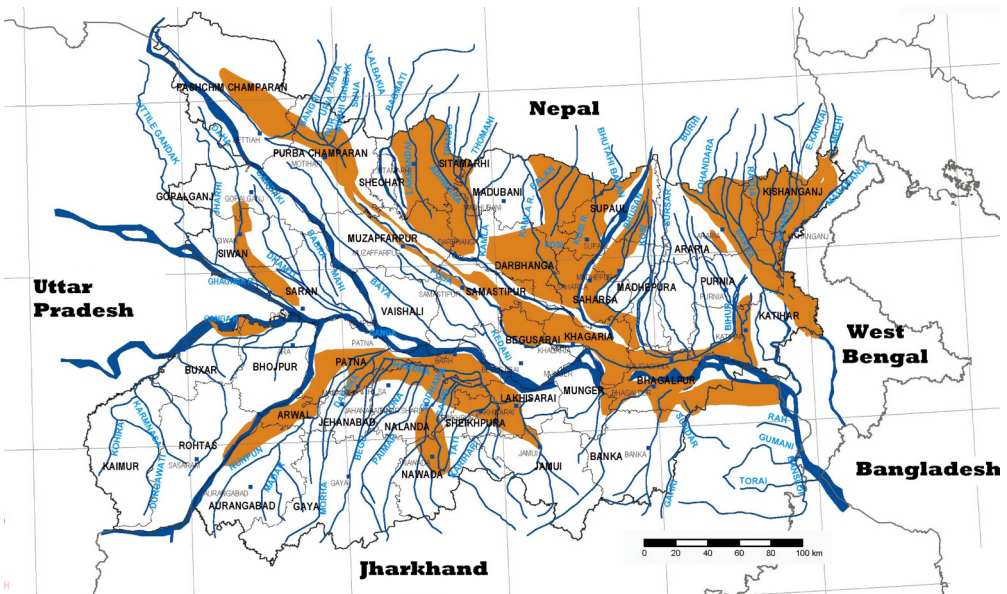
Bihar is one of India's worst flood-affected states. Around 68.80 lakh hectares—or about 73 percent—of Bihar's total area is susceptible to flooding, accounting for about 1/5th of the country's total flood-prone area.¹⁷ As much as 82.64 percent of North Bihar and 60.32 percent of South Bihar are flood prone.¹⁸

Several large rivers such as the Kosi, Gandaki, Bagmati, Kamala and Mahananda run through North Bihar, joining the mainstream Ganges on its left bank. These rivers carry large volumes of water through the Terai region of Nepal and North Bihar, leaving the area particularly susceptible to floods. Almost all the rivers that flow through this region emerge from the mountains of Nepal or Tibet. The riverbed slopes change abruptly as they enter the floodplains, allowing the silt to be deposited at the base. Moreover, the Lesser Himalayan terrain in Nepal is rising at a rate of 3-4 millimetre per year while the Indo-Gangetic Plain is sinking at a rate of 0.2-0.3 mm/year.¹⁹ This difference has led to an increased rate of denudation in the Nepal Himalaya, which in turn has increased the deposition of sediments in the channels. This has contributed to a decrease of gradient in the channels and the slackening of flow. For instance, the denudation rate in the Nepal Himalaya is more than 6 mm/year, which has contributed to the filling of the Bagmati channel at a rate of 9.3 cm/year.²⁰

The accumulation of sediments in the drainage channel and the progressive decrease in the carrying capacity of the channel leads to

drainage congestion. Consequently, the water regularly spills over the banks of the channel if there is even slightly higher than normal discharge. This makes Bihar, and particularly its Terai region (comprising the bulk of North Bihar), inherently susceptible to floods.²¹

Figure 2: Bihar Flood Hazard Map (BMTPC – Vulnerability Atlas of India)²²

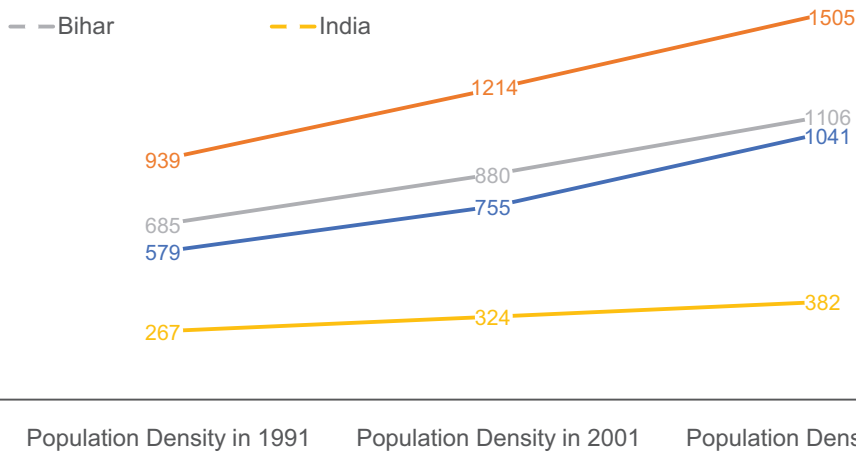


Source: BMTPC – Vulnerability Atlas of India

The impact of floods is further exacerbated by the steadily growing human encroachment of floodplains and the resultant land-use change. This is evident through the decadal increase in population density in Bihar’s flood ‘risk zones’. Zones have been delineated using K-means clustering, as proposed by Matheswaran et al (2019),²³ and the Getis–Ord G_i^* spatial statistical analysis. Only the districts that overlap in

both data sets under each category (high risk and very high risk) are included. As a benchmark, the population density of Bihar and India are plotted on the same graph.

Figure 3: Decadal changes in population density in Bihar.

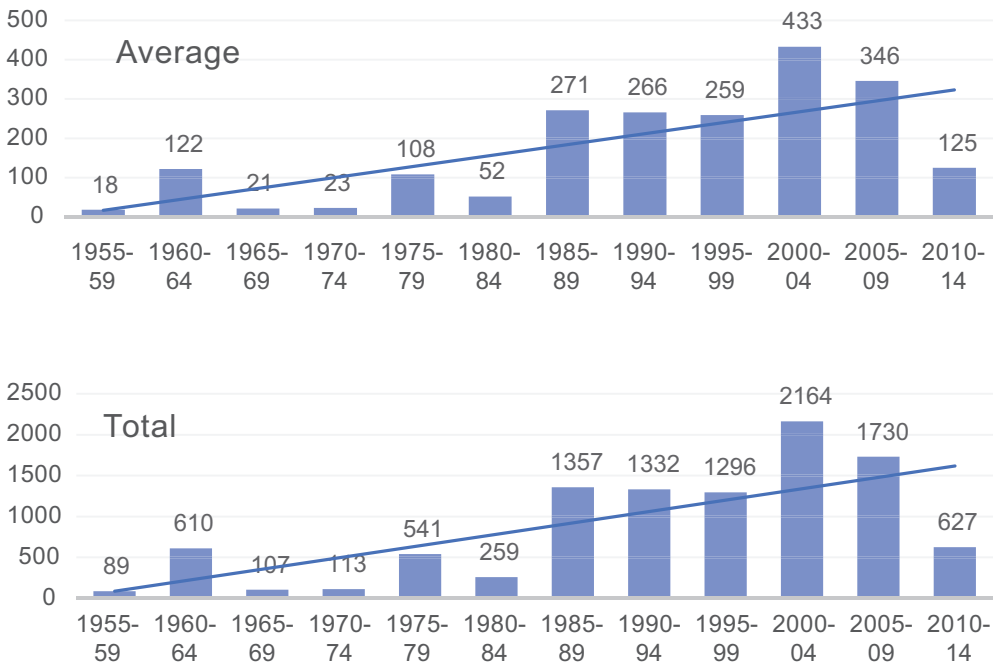


Source: Census of India

The districts of Darbhanga, Madhubani, Muzzafarpur and Sitamarhi are in the ‘very high risk’ category, while Kishanganj, Madhepura and Supaul are ‘high risk’. The population density in the ‘very high risk’ districts is substantially higher than the state average. It is crucial to consider the change in land use in the two sets of districts through the following categories—area under non-agricultural uses, land under miscellaneous tree crops and groves, and the net sown area. An analysis of data (from Bihar’s Department of Planning and Development) on the ‘very high risk’ and ‘high risk’ zones over two representative years 2004-05 and 2014-15 suggests a three percent increase in exposure

for the ‘very high risk’ category and a five percent decline for the ‘high risk’ category. However, the rate of exposure of human interest (a combination of the three types of land use) is very high—greater than 90 percent for the ‘very high risk’ category and greater than 80 percent for ‘high risk’. The net sown area (area under cultivation) comprises more than 60 percent of the total reporting area for land use.

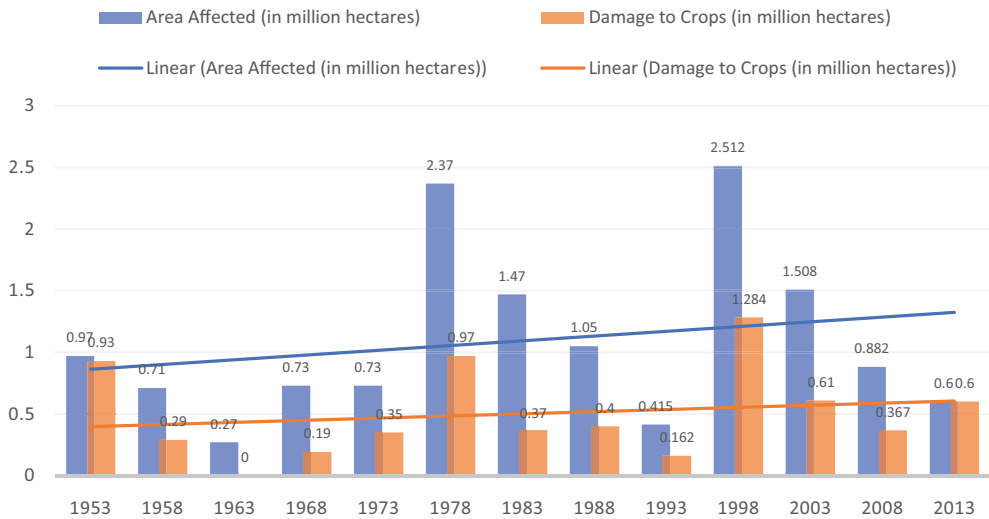
Figure 4: Semi-Decadal trend of lives lost due to floods in Bihar.



Source: Ministry of Water Resources, River Development and Ganga Rejuvenation

The loss of lives and livelihood in Bihar’s flood-affected regions are a cause for concern. The increased exposure to floods from people inhabiting and altering the floodplains directly impacts the losses incurred due to floods, which have consistently risen over the years (see Figure 5). An analysis of the flood loss for the entire state reveals that the areas affected by floods and the loss to agriculture, as well as lives lost to floods, have consistently increased (see Figures 4 and 5).

Figure 5: Flood losses in Bihar (area affected and damage to crops).



Source: Ministry of Water Resources, River Development and Ganga Rejuvenation

It is thus necessary to consider alternative solutions to reduce the exposure to floods in Bihar and other chronically flood-ravaged parts of the country through concerted policy measures.

The Bihar government has mostly depended on structural measures such as building embankments and barrages to mitigate the risk

of flooding. The length of embankments in the state has risen from 160 kms prior to 1954 to 2192 kms in 1974, currently standing at around 3400 kms.^{24,25} Despite these embankments, the state's flood-prone area has only increased, as have the number of breaches due to embankment failure.²⁶ Researchers have highlighted the socially maladaptive implications of using embankments to manage flood risk—recursive cycles of vulnerability that has affected the socially weak and has further perpetuated the rampant social and economic inequality in the state.²⁷

Given the ineffectiveness of short-term structural measures in managing floods, Integrated Flood Risk Management plan has been recommended for Bihar. The proposal seeks to minimise the loss of life and infrastructure, preserve the ecosystem, develop floodplains in a sustainable manner, and maximise the net benefits from floodplains.²⁸ Crucial to realisation of such plans in Bihar and elsewhere is legislation and the implementation of floodplain zoning. The Central Water Commission has also long asserted the need for states to adopt a floodplain zoning approach to mitigate damages caused by floods and to allow rivers to have their 'right of way'.²⁹ The central government's MBFPZ was circulated to all states in 1975 to encourage discussion and the enactment of state-specific laws. However, resistance from many states, including Bihar, has meant that the floodplains are yet to be demarcated.³⁰

EXAMINING INDIA'S FLOODPLAIN ZONING POLICIES

Flood control and mitigation are not directly mentioned in any of the three legislative lists included in the Constitution. Therefore, based on the inclusion of drainage embankments as entry 17 of List II (State List), flood control has been seen to fall under the purview of the state

government, except in the case of “regulation and development of inter-state rivers and river valleys,” which is mentioned in entry 56 of List I (Union List). Floodplain zoning is firmly within the state government’s ambit as it deals with the land along the riverbanks and land is a state subject under entry 18 of List II. As such, the central government’s role can only be to issue advisories and prescribe guidelines.

The MBFPZ and the NDMG are two key policy documents that reflect the central government’s position on floodplain zoning and capture the governance mechanism that it has tried to impress upon the states. The MBFPZ and NDMG are the only policy documents that lay down the procedural and operative aspects of floodplain zoning in India.^e

The MBFPZ is a prescriptive guideline that was sent to all the states in 1975 to enact appropriate legislation and implement floodplain zoning across the country. It is a structure for the states to model their own bills on, but by and large, the states have simply replicated it.

The NDMG was prepared through a nine-step process that included consultations with senior representatives from the central ministries, state governments and related agencies, as well as academics and professionals. It includes an entire chapter on the regulation of floodplains and enforcement of floodplain zoning, emphasising that zoning cannot remedy existing situations but would help minimise flood damage in new areas.³¹

e The Draft River Conservation Zone (Regulation of Harmful Activities) Rules, 2012 has been excluded since its focus is to prevent water pollution in river stretches and cause destruction to river morphology and biota, which would lead to drying of river systems.

The MBFPZ and NDGM have been analysed through the governance dynamics framework (GDF)³² to assess their strengths, identify gaps and provide recommendations to make the policy instruments more holistic. The GDF is ideal for this assessment as it allows the unpacking of a policy document and helps to understand how different components are geared towards addressing a social problem. According to this framework, a social issue is the result of the problematic behaviour of some divergent actors. Social problems are matters of concern for society (social concern) for which the government devises policy instruments.

For this analysis, the social concern is *'Increasing loss from floods due to encroachment of floodplains, wetlands and unregulated construction in floodplains.'* The policy instruments to address this social concern are the MBFPZ and the NDMG. But these instruments will remain ineffective unless the state governments can muster enough political will to pass a legislation.

Similarly, the policies will have to be contextualised according to the existing socio-political and economic realities in each state. This is important for customising the 'model bill' and the guidelines to fit the needs and constraints of the region where it is to be implemented. This contextualisation of the MBFPZ and NDGM is beyond the scope of this paper.

Governance Objectives (GO)

This is the expression or embodiment of the public interest in a particular sector or pertaining to a particular issue. The governance objective clearly spells out the focus of the policy needed to govern the sector. It forms the overall goal before the task of governance. The

MBFPZ does not explicitly state any governance objective, making it a ship without a rudder. This lack of clarity permeates throughout the bill. The NDMG, on the other hand, clearly states its objective of regulating land use in the floodplains to restrict the damage caused by floods.

To avoid any ambiguity, policy documents should clearly spell out the two-pronged governance objective—removing the encroachment on the floodplains (GO-1) and regulating the land use within it (GO-2).

Core Policy Remedies (CPR)

The governance objective is followed by certain core strategies that need to be employed for achieving the GOs related to the issue. Together, along with the GOs, the CPRs help to resolve the social concern that begets the exposed community.

The first set of CPRs involve delineating the floodplain area (CPR-1) to take stock of the population that will be exposed to floods (for GO-1), relocating this group of people (CPR-2 for GO-1), and regulating the land use in the floodplain (CPR-3 for GO-2).

A second set of core policy remedies pertain to incorporating flood-resilient design elements in various constructions (CPR-4 for GO-2) and conserving the wetlands within the floodplains (CPR-5 for GO-2).

The MBFPZ explicitly mentions the first set of CPRs, while the NDMG addresses the second set. This shows that the MBFPZ is limited in its scope to achieve GO-2 (regulating the land use within the floodplain). Any state government legislation must be based on both these documents

Operational Policy Details (OPD)

Operational policy details are the various aspects critical to the effective and efficient operationalisation of the core remedies. For every CPR, there are OPDs that are articulated in the legal language in the form of Policy Provisions.

The MBFPZ stipulates that to delineate the floodplain (CPR-1), a survey establishing the floodplain zones and identifying the areas prone to flooding (OPD-1) must be conducted.

It also mentions the need to classify land according to the risk posed by floodplain use so as to safeguard the health, safety and property of the people (OPD-2).

For the relocation of people from the demarcated zones (CPR-2), the MBFPZ establishes that compensation be provided for any loss or damage incurred due to the prohibition or restriction on any person (OPD-3).

To regulate land use in the floodplains (CPR-3), the MBFPZ stipulates the removal of any unauthorised obstruction after giving the owner or occupier a certain amount of time to comply with the order (OPD-4). But it also says that no compensation will be paid for the removal of encroachments. The MBFPZ also states that the government may prohibit or restrict the activities in the floodplain (OPD-5), or penalise those found guilty of carrying out or attempting to carry out restricted activities in the floodplain (OPD-6) to regulate the use of such land (CPR-3).

The MBFPZ makes no mention of CPR-4 (incorporating flood-resilient design elements in various construction within the floodplains)

and CPR-5 (conserving the wetlands), but they are discussed in the NDMG.

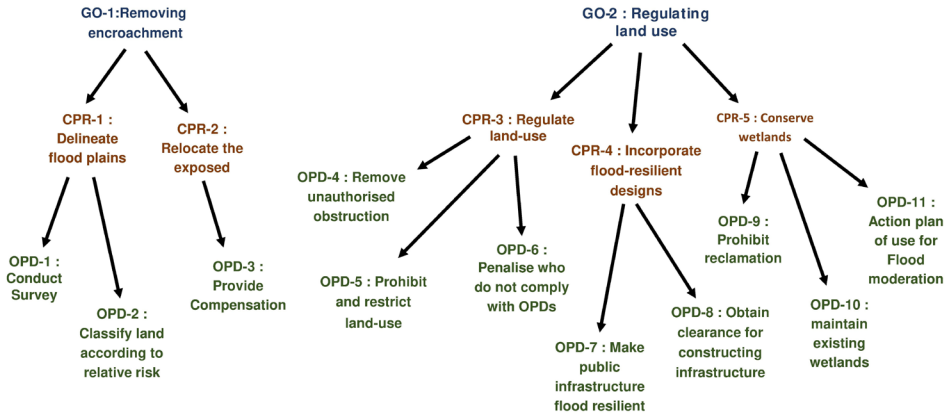
The NDMG mandates that infrastructural activities in flood-prone areas be made flood-resilient (OPD-7). It also discusses the development of an appropriate legal framework by the state governments or disaster management authorities to make it mandatory to obtain clearances for all proposed constructi in the flood-prone areas (OPD-8).

The NDMG outlines three operational policy details for the conservation of the wetlands within floodplains (CPR-5)—prohibiting the reclamation of the existing wetlands/natural depressions (OPD-9), reviving and maintaining the existing wetlands in the floodplains (OPD-10), formulating an action plan to use the wetlands for flood moderation (OPD-11).

Policy Provisions (PPs)

Policy provisions help articulate the different operational details and are often called sections or are present as individual rules.

Figure 6: The governance objectives, core policy remedies and operational policy details.



Source: Author's own

The MBFPZ’s policy provisions are quite broad. For OPD-1 (conducting a survey to establish the floodplain zones and identify flood-prone areas), it merely says that proper charts and registers should be prepared with details of all boundaries to determine the limits of the floodplain. It also mentions that the land in the floodplain should be classified with reference to the relative risk of the floodplain, but it does not elaborate on just how such a classification should be made.

The NDMG provides some guidelines on conducting a survey to establish the floodplain zones and identify flood-prone areas (OPD-1). According to it, the state government should prepare maps for areas vulnerable to flooding at a scale of 1:15,000 by using the markings of reference river gauges. If such marks are not available, then the exercise should be done on larger scales of 1:25,000 or 1:50,000. The NDMG also suggests that the demarcation should consider floods of

various frequencies (once a year, every two years and so on) and the area likely to be affected by the accumulation of rainfall at the different frequencies.

The NDMG also includes detailed policy provisions for OPD-2 (classification of land according to relative risk). According to the guidelines, areas likely to be affected by floods at up to a ten-year frequency should be reserved for gardens, parks and playgrounds with a prohibition on residential and commercial buildings and public utilities (PP-3). In areas likely to be affected by floods at a medium frequency (25 years), residential buildings could be allowed but only after incorporating certain design elements, such as using stilts, during construction (PP-2). In areas likely to be affected by floods at the highest frequency (100 years), all important and emergency establishments, such as defence installations, hospitals, electricity installations, water supply infrastructure and railway stations, could be allowed (PP-1).

The MBFPZ provides a mechanism to calculate the compensation for any loss or damage incurred through the prohibition of land use (OPD-3), stipulating that it should not exceed the difference between the value of land as determined by the Land Acquisition Act and its value had it been used for the purpose intended. Further provisions detail the process to be followed if there is no agreement between the governing agencies and the person concerned, and conditions under which compensation will not be provided—if a law restricting the use of the land existed before the state law on floodplain zoning came into being, and in instances of removal of unauthorised obstructions (OPD-4).

The MBFPZ specifies that the government must notify through the official gazette if it plans to prohibit or restrict the activities in the

floodplain (OPD-5), mentioning the areas where the prohibitions are applicable and their nature. The NDMG provides the details of these restrictions (see Figure 1), which is missing from the MBFPZ.

The MBFPZ also stipulates that a fine of up to INR 500 be imposed on those found guilty of carrying out or attempting to carry out restricted activities in the floodplains (OPD-6), with further remedies for failure to pay the fine.

The NDMG contains policy provisions for making flood-resilient public infrastructure (OPD-7). First is to construct buildings above a level corresponding to the interval of flood occurrence that has been designated for that priority zone. The NDMG also states that some drains should be designated as green belts to disallow the construction of any building. These could be used as passages for the excess water to flow out or as parks and gardens that will not obstruct the flow of water. For the construction of buildings within the floodplains, the NDMG specifies having plinth levels above 0.6 metre from the drainage/flood submersion line. Moreover, in flood-prone areas, buildings should be multi-storeyed. For single-storeyed buildings, NDMG provisions dictate that a stairway to the roof be provided. The roofs of single-storeyed buildings and the first-floor of double- and multi-storeyed buildings must be above the 100-year flood levels.

The MBFPZ and NDMG have vague policy provisions for OPD-8 (mandatory clearance to construct infrastructure in flood-prone areas), OPD-9 (prohibiting the reclamation of existing wetlands), OPD-10 (reviving and maintaining existing wetlands) and OPD-11 (formulating a plan to use the wetlands for flood moderation).

The provisions for OPD-8 partially overlap with those for OPD-5, but it makes no mention of clearances for constructing infrastructure.

One way of taking OPD-9, OPD-10 and OPD-11 forward is to by leveraging the Wetlands (Conservation and Management) Rules, 2017, the elaborate guidelines for which have been sent to the states in 2020.³³

Governing Agencies (GAs)

These are the organisations or officials entrusted with the responsibility of carrying out the governance functions, including determining the objectives. The MBFPZ stipulates that state governments should appoint a District Collector or similar level official as the Flood Zoning Authority (FZA) to oversee the implementation of its rules. The FZA is tasked with delineating the floodplain and has been empowered to enter any premises to conduct surveys, issue notices to owners of land in the restricted zones, and disburse compensations.

At the same time, the MBFPZ makes no mention of the resources available to the FZA to carry out its functions. The allocation of funds to the FZA is a critical component that will determine its efficacy. Similarly, although the FZA is accountable to the state government, the MBFZA does not specify under whose purview the authority lies, nor is there any mention of how the FZA will coordinate with other departments such as revenue, irrigation, water resources and agriculture, and agencies like the State Disaster Management Agency .

Findings and Discussion

The MBFPZ (the primary floodplain zoning policy document) and NDMG (essentially a set of prescriptive guidelines) lack clarity on several issues, including addressing the social impacts (loss of lives

and property) that arise from living on or near floodplains. Besides, floodplain zoning is an extremely sensitive issue and must be customised based on the socio-political and economic realities of the states where it is needed to be enacted.

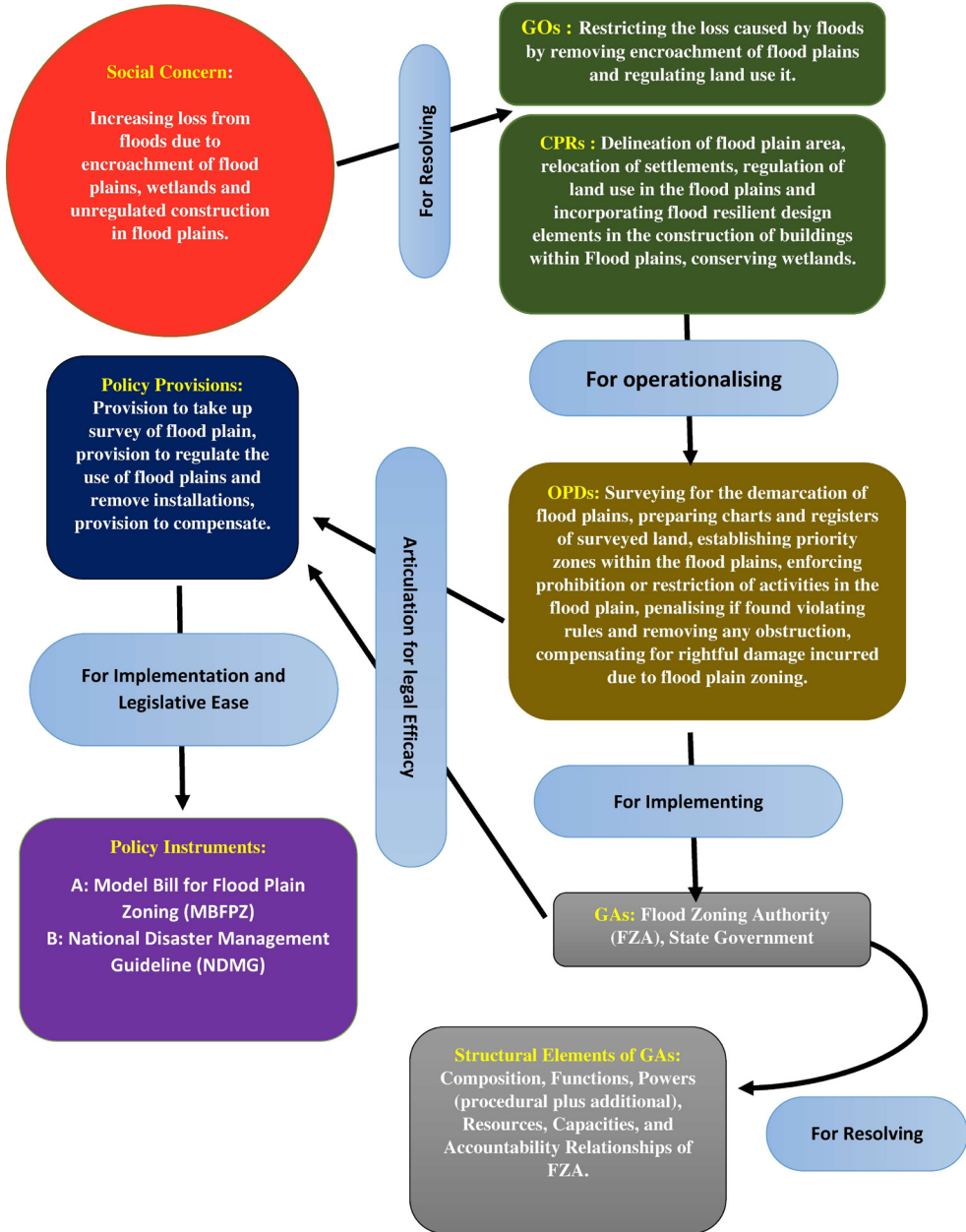
Technology has improved manifold since the MBFPZ was prepared. Presently, the National Flood Vulnerability Assessment System on Bhuvan provides an important storehouse of resources for drawing scenarios on the basis of topography, trends in spatial rainfall, spatial runoff and flood vulnerability index. It also contains a few case studies and technical reports.³⁴ In a bid to boost disaster risk reduction, the ISRO's National Remote Sensing Centre has also initiated the development of flood hazard zonation maps in addition to flood response services through the decision support centre.

A district-wise flood hazard zonation atlas is already available for Bihar, which has taken into account historical flood scenarios spanning over 13 years and intra annual flood variation from 1998-2010.³⁵ Even though the scale has to be reduced further to undertake any meaningful floodplain zoning measure, technological advancement has eased this process. However, it will require the cooperation of the states, especially for activities like validation on the ground and tabulating the list of families that will be provided with compensation. Traditionally, the Revenue Department has been entrusted with the responsibility of surveying and providing relief to the people affected by natural calamities like floods. The interaction of the FZA with the Revenue Department needs to be clearly stated in the legislation for ease of operations.

Land acquisition is an area of contestation and governments have often been accused of unfair compensation and inadequate rehabilitation efforts.³⁶ Moreover, the removal of any illegal encroachment without any compensatory mechanism is unbecoming of a welfare state like India. All procedures must comply with the constitutional mandate to protect the health and well-being of all citizens, especially those in financial or social need. Appropriate legal mechanisms must be developed to address these sensitive issues. Another important issue is finding suitable land to rehabilitate the displaced communities, a challenge that is seemingly greater than the cause in the densely populated riverine landscapes of Eastern Uttar Pradesh, North Bihar, West Bengal and Lower Assam.

The GA is crucial for the implementation of the PPs—and thereby the CPRs and OPDs contained within the PPs—but the present policy architecture lacks clarity on this. Despite the multitude of tasks that need to be carried out, sequentially and in tandem, only one GA (the FZA) has been specified in the MBFPZ, with severe limitations. There is no mention of any GA that will be responsible for delivering OPD-5 and CPR-4, both of which pertain to land-use management in the zones and ensuring that the constructions conform with the design requirements of the zone. Similarly, for implementing CPR-5 (conservation of wetlands) and all the OPDs contained within it, it is extremely likely that the State Wetland Authority, created under the Wetlands (Conservation and Management) Rules, 2017, will play a pivotal role. It is not clear how the FZA or any other relevant authority will interact with the State Wetland Authority since many such wetlands would be in the floodplains and in the periphery of urban localities. There is clearly a case of overlapping jurisdictions, and the roles and responsibilities of the various agencies need to be defined properly in any floodplain zoning legislation

Figure 7: Unpacking the provisions for flood plain zoning (by combining A and B) as it exists.



Source: Author's own

CONCLUSION

Despite the crucial need for floodplain zoning, several states have resisted such efforts, including the enactment of a law. Only three states—Manipur, Rajasthan and Uttarakhand—have enacted laws pertaining to floodplain zoning, while others, particularly the flood-affected Bihar and Assam, have shown varying degree of opposition. There could be two reasons for their reticence: the constraints arising from evacuating the people who occupy the floodplains, and resettling these people elsewhere given the paucity of land. Removing these bottlenecks is crucial for the successful realisation of floodplain zoning and to put in place an integrated approach for flood management.

Manipur enacted the floodplain zoning legislation in 1978 and has made concerted efforts to implement it fully. By 1988, the flood zoning area had been published, and the most recent activity has been an eviction campaign to free the banks of the Imphal river.³⁷ Although Rajasthan has also passed a law on floodplain management, it has not been enforced. Uttarakhand has issued two floodplain zoning notifications for two tehsils of the state—Haridwar and Uttarkashi for zones extending horizontally to 50 kms and 10 kms, respectively. These contain elaborate information on the landholding that lies within the restricted zones.³⁸ The Tamil Nadu government had proposed forming a committee provide recommendations to enact a floodplain zoning law, but no concrete efforts were made towards this goal.³⁹ Uttar Pradesh and Bihar, which are among India's worst flood-affected states, have conveyed that implementing a floodplain zoning law is neither practical nor implementable, although the UP government has taken measures to regulate the economic and development activities in the floodplains in the state. The West Bengal government has made some progress by preparing a draft bill on floodplain zoning and the

Madhya Pradesh government has demarcated 36 towns affected by floods and has carried out the necessary administrative work towards the demarcation of flood zones.⁴⁰

Regulating floodplain use in India has largely been a flawed exercise. The constitutional provision of flood management falls under the purview of the state governments, while central government organisations such as the Ganga Flood Control Commission, Brahmaputra Board and the Central Water Commission can only provide technical support to the states. It is up to the states to weigh the costs and benefits of floodplain zoning as a viable flood management option. For many states, the costs outweigh the benefits. In the third meeting of the 'Working Group on Flood Management and Region Specific Issues' for the XII Five Year Plan (2012-17) in April 2011, Bihar's engineer-in-chief and the secretary of Assam's Water Resources Department said that floodplain zoning may not be a solution for their states given the difficulty of shifting people to safer areas.⁴¹ Although some states have appeared willing to implement floodplain zoning on the condition that the central government provide sufficient incentives, the mechanism is yet to be devised, leaving floodplain zoning an unrealised proposition.

This provides an opportunity to consider alternative institutional arrangements to achieve the goal of operationalising floodplain zoning at the basin level. River Basin Organisations (RBOs), which are democratic in nature and have better professional standings than state governments,⁴² can be entrusted with the task of initiating a dialogue on floodplain zoning in contiguous states that are ravaged by floods. The RBOs must be given adequate autonomy to undertake decisive and concerted actions in coordination with state governments to achieve the governance objectives of removing encroachments on the floodplains and regulating the land use within it. Moreover, many Himalayan

rivers flow through multiple countries, and so, their floodplains are also distributed in the contiguous areas of different nations. An RBO is best suited to manage such floodplains by adhering to the tenets of Integrated Flood Management (IFM).

The Mekong River Commission (MRC), for instance, was set up with the mandate, among others, of resolving the transboundary issues, differences and disputes caused by floods. The Regional Flood Management and Mitigation Centre was set up in 2003 after two consecutive years of severe flooding caused massive economic and human loss. The MRC's Flood Management and Mitigation Program (FMMP), an adaptive response to environmental threats, has been one of its most successful programmes due to relatively low levels of uncertainty regarding exposure to the stressor (floods) and its impact.⁴³ The key activities carried out under the FMMP programme between 2004 and 2010 included using flood simulation models to understand and resolve transboundary flood issues, strengthen flood emergency management through improved inter-provincial and inter-country assistance, and incorporate flood hazard into land-use decision-making by local communities and governments.⁴⁴ The MRC has also adopted an integrated IFM to develop a coherent regional policy with land-use planning and social policies around flood resilience as its cornerstones.⁴⁵

The IFM recognises the river basin as a dynamic system with multiple interactions and flux between land and water bodies,⁴⁶ and necessitates the integration of natural and human systems within the framework of integrated water resources management (IWRM).⁴⁷ The IFM can adapt by taking into account existing knowledge on issues like climate change, and identify the ideal combination of strategies. Further, the IWRM “promotes the coordinated management and

development of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems and the environment”⁴⁸. As a result, the IFM can be understood as maximising benefits from the use of floodplains and minimising loss of life from flooding. The approach aims to reduce flood risks through a judicious combination of measures dealing with the magnitude of the hazard and the community’s exposure and vulnerability to it.⁴⁹ The MRC has shown that informal technical cooperation in the transnational or subnational realm has been readily practiced. But an RBO makes all the difference when it comes to institutional and political cooperation, which is important in the long-run to make the process sustainable and effective.⁵⁰

An overhaul of the current floodplain zoning policy architecture is the need of the hour. There are several structural gaps in the MBFPZ and the NDMG. Any policy measure that seeks to achieve the governance objectives of restricting the losses caused by floods and regulating land use within floodplains should look to fill these gaps. Globally, floodplain zoning has emerged as an important strategy at the basin level. India needs to adopt a forward-looking and proactive policy design that is embedded in an IFM-based approach and operationalise it within the entirety of a river basin. ©RF

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ANNEX - 1

Table for Number of lives lost due to floods in Bihar

Years	Total Lives Lost	Average Lives Lost	Standard Deviation
1955-59	89	18	19
1960-64	610	122	240
1965-69	107	21	14
1970-74	113	23	33
1975-79	541	108	86
1980-84	259	52	56
1985-89	1357	271	473
1990-94	1332	266	496
1995-99	1296	259	82
2000-04	2164	433	272
2005-09	1730	346	533
2010-14	627	125	78

Table for change in population density of districts in the 'very high risk' category.

Name of the District	Population Density in 1991	Population Density in 2001*	Population Density in 2011
Kishanganj	522	687	750
Madhepura	659	853	1116
Supaul	557	724	1258

Table for change in population density of districts in the 'high risk' category.

Name of the District	Population Density in 1991	Population Density in 2001*	Population Density in 2011
Darbhanga	1,102	1,442	1803
Madhubani	809	1,020	1220
Muzaffarpur	931	1,180	1506
Sitamarhi	915	1,214	1491

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