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Future Causes Of The 2025 Punjab Floods And The Likely Effects On The Indian Economy

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Abstract:
In late August 2025, the state of Punjab experienced devastating floods that drowned thousands of villages and hundreds of thousands of hectares of agricultural land due to abnormally intense rains, flooded rivers, and ruptured embankments. This paper asks two interconnected questions: (1) what are the future causes likely to cause similar or more severe flood events in Punjab in the future, and (2) how such events will ripple through and impact the entire Indian economy? Based on recent news, peer-reviewed climate science, and economic reasoning, I argue that future flood risk in Punjab will be forced by interacting climate drivers (increasing extreme precipitation associated with anthropogenic warming and changing circulation patterns), upstream hydrological management (dam releases and reservoir operations), and land-use/river management failures (siltation, embankment vulnerabilities, loss of floodplains). The economic effects will be multi-sectoral and persistent: short-term agricultural losses and food-price shocks; agro-supply chain bottlenecks and textiles; fiscal pressures on state and central government budgets; insurance and credit losses; localized disruptions to labour markets and migration; and non-trivial negative impact on short-term GDP growth and long-term productivity in the affected areas. The paper concludes with policy suggestions that minimize both hazard and economic exposure.

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I. Introduction

Floods have always been a feature of Indian monsoons, but the size, frequency, and effects have changed. Punjab's August–September 2025 floods were universally reported as one of the worst in decades: over a thousand villages impacted, dozens of deaths, hundreds of thousands of hectares of cropped area flooded, and significant populations displaced. These instantaneous facts are significant because the processes that caused this event are the processes that can cause subsequent events, particularly if human and policy forces are not adjusted. Knowing future causes thus constitutes a scientific issue (what controls rainfall and river flows) and a governance issue (how dams, embankments and land use are governed). The economic implications of recurrent large floods in a large agricultural and industrial state such as Punjab will spread across India via food markets, industrial inputs and fiscal balances. This paper synthesizes existing evidence to chart possible future causes and extrapolate economic channels of influence.

II. Background: The 2025 Punjab Floods, Quick Factual Summary

Several news sources covered that the late monsoon 2025 phase experienced severely heavy precipitation in Punjab and upstream Himalayan catchments. Rivers such as the Sutlej, Beas, Ravi and Ghaggar reached critical or danger levels; releases from reservoirs coupled with local rainfall and embankment failures to overflow vast areas. Coverage in major media placed the figures in the same general range: between 1,000–1,300 villages hit, tens of thousands (up to hundreds of thousands, according to some reports) of hectares of standing crops flooded, and a human cost running into tens of fatalities and hundreds of thousands affected or displaced.

The Punjab administration demanded big relief amounts and public infrastructure (school closures, relief camps) was mobilized.[1] [2] [3]

[1] Prakash, Priya. "Punjab Flood: Volunteers Send Boats, Rations, Mosquito Nets; State Unites in Relief Efforts as Thousands Stra." *Indiatimes*, 2 Sept. 2025, indiatimes.com/trending/punjab-flood-volunteers-send-boats-rations-mosquito-nets-state-unites-in-relief-efforts-as-thousands-stranded-in-villages-668589.html. Accessed 16 Sept. 2025.
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These concrete, near-term figures ground our inquiry: if such an event recurs, what caused it, and how will a repeating pattern play out economically across India?

III. Methodology And Evidence Base

This paper uses a mixed evidence approach:

- Synthesizing contemporaneous reporting on the 2025 floods (national press, Reuters, AP, major Indian outlets) for factual event description and government responses. Indiatimes Reuters AP News
- Drawing on recent peer-reviewed climate science and attribution studies that document trends in extreme monsoon rainfall and mechanisms (western disturbances, ENSO/G-ENSO links, intensification of extreme events) to assess meteorological drivers. Nature Science Direct World Weather Attribution
- Incorporating policy and urbanization analyses regarding land-use change, river siltation, embankment failure and reservoir operations from reputable outlets and investigative pieces. The Indian Express TIME
- Applying standard macroeconomic and sectoral reasoning, augmented with sectoral reporting on agriculture and textiles, to trace how supply shocks and fiscal responses propagate nationally. Reuters Singh Xpress

Where appropriate, I indicate the strength of evidence (high: robust measurements/peer-reviewed; medium: consistent news and expert commentary; low: scenario-based inference).

IV. Future Causes: Interacting Drivers Likely To Produce Similar Or Worse Floods

Floods are multi-causal. Below I categorize future causes into climatic drivers, hydrological and infrastructure management, land-use and urbanization, and governance/policy failure. Each one can enhance the others, increasing both hazard and exposure.

Climatic drivers: more frequent and intense extreme rainfall events

Evidence & mechanism. An increasingly large body of climate science demonstrates that anthropogenic warming enhances the atmospheric water-holding capacity (Clausius–Clapeyron scaling) and consequently the probability of large precipitation events. New research and attribution studies confirm that severe monsoon precipitation events in South Asia already occur more often and, in most instances, were intensified by human-induced climate change. Western disturbances in conjunction with the monsoon, a phenomenon increasingly mentioned in Indian media, have enhanced precipitation in upstream Himalaya and foothill catchments into the rivers of Punjab, generating heavy runoff. Peer-reviewed, attribution-based studies in 2024–2025 document an observable increase in the frequency as well as magnitude of extreme rain events over northern India. [4] [5] [6]

Why this matters for future floods. If extreme daily/weekly rainfall events become both more frequent and more intense, river catchments will receive larger, concentrated inputs of water. Earth surface processes (soil saturation, reduced infiltration) and river routing times remain the same or change slowly; hence floods become more likely because drainage systems and reservoirs are designed for earlier historical return periods. Climate models and recent observations both indicate that these return periods are shortening; a "1-in-50-year" rainfall may become a "1-in-10-year" event in some basins unless adaptation occurs. [7]

Upstream hydrology & reservoir management (dam releases)

Evidence & mechanism. News accounts of the 2025 event reported that reservoir operations and dam releases had been causative in downstream flooding. When upstream reservoirs are fed by heavy rain, operating procedure may require massive releases in order to maintain dam safety; coordinated releases, if left unchecked in synchronism with downstream capacity, could readily magnify downstream flood peaks. Due to this

[4] Varikoden, Hamza, et al. "A Comprehensive Review on the Recent Changes in Indian Summer Monsoon Rainfall and Its Relations with Global Climate Drivers Based on the CMIP6 Simulations." *Atmospheric Research*, vol. 326, 19 June 2025, p. 108302, http://www.sciencedirect.com/science/article/pii/S0169809525003941, https://doi.org/10.1016/j.atmosres.2025.108302. Accessed 16 Sept. 2025.

[5] Sharma, Devabrat, et al. "Seasonal Prediction of Indian Summer Monsoon Extreme Rainfall Frequency." *Npj Climate and Atmospheric Science*, vol. 8, no. 1, 13 Apr. 2025, http://www.nature.com/articles/s41612-025-01032-w, https://doi.org/10.1038/s41612-025-01032-w. Accessed 15 Sept. 2025.

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transboundary as well as inter-state nature of Himalayan River governance, releases of upstream reservoirs (Himachal Pradesh & Jammu & Kashmir included) could rapidly accelerate Sutlej/Beas flow in Punjab. [8] [9]

Why this will matter in the future. Two dynamics increase risk: (a) more frequent intense precipitation increases the chance that upstream reservoirs reach critical levels simultaneously across basins, forcing large, sometimes emergency releases; (b) if reservoir operation rules are not updated to account for more volatile inflows and downstream channel capacity, releases meant to protect dam structures can become a primary driver of downstream flooding. These risks are heightened where institutional coordination across states and with central regulators is weak.

Land-use change, floodplain encroachment and siltation

Evidence & mechanism. Human alteration of floodplains and wetlands, urban expansion, agriculture intensification, and infrastructure, reduces natural storage and slows floodplain attenuation. Reports and analyses of the 2025 events highlighted that river channels and floodplains have been constrained in many places, embankments are aging or breached, and siltation reduces channel capacity. Urbanization (including in secondary cities and peri-urban zones) increases runoff and removes permeable surfaces. [10] [11]

Why this will matter in the future. If floodplains continue to be built over and channels are narrowed, the same volume of stormwater will produce higher water levels. Siltation, if not dredged, is a long-term, cumulative issue that reduces channel carrying capacity. These are largely reversible but expensive corrections; if left unchecked, they make future floods larger and more damaging.

Weak or aging infrastructure and poor maintenance (embankments, drainage)

Embankments, drainage networks, rural road infrastructure and urban storm drains are first-order defences. Reports from 2025 show breaches and washouts at multiple embankment locations; similarly, many urban drainage systems failed where installed capacity and maintenance were inadequate. Engineering structures have design lives and require maintenance budgets; deferred maintenance combined with more intense loads increases failure probability.

Socio-economic exposure: cropping patterns and settlement choices

Punjab's agrarian prosperity has led to high densities of population and infrastructure in low-lying agricultural landscapes. Changes in cropping patterns toward high-value, water-intensive crops and consolidation of landholdings increase exposure. Large numbers of households, storage facilities, logistics hubs, and processing units located within historically flood-prone tracts mean more assets at risk. This exposure amplifies economic impact even if hazard intensity is stable.

Compound extremes and synchronised shocks

Climate models and recent observations indicate that compound events, e.g., intense rainfall in multiple catchments at once, or consecutive high-rainfall weeks, are more damaging than single events. Reservoir storage built up from earlier rainfall can combine with new storms to create synchronized flood peaks across river networks. Such compound extremes are especially hazardous because they overwhelm multi-level response capacity and make inter-regional relief and resource reallocation harder.

V. Pathways: How Future Floods Will Transmit To The Indian Economy

A major flood in Punjab will not remain a local or state problem. Punjab's role in agriculture, agro-processing, textiles and as part of inter-state supply chains means shocks propagate nationally through multiple channels. I outline direct channels (agriculture, infrastructure), indirect channels (prices, trade), financial channels (fiscal burden, banking and insurance), and long-run structural channels (human capital and productivity).

[8] Prakash, Priya. "Punjab Flood: Volunteers Send Boats, Rations, Mosquito Nets; State Unites in Relief Efforts as Thousands Stra." *Indiatimes*, 2 Sept. 2025, indiatimes.com/trending/punjab-flood-volunteers-send-boats-rations-mosquito-nets-state-unites-in-relief-efforts-as-thousands-stranded-in-villages-668589.html. Accessed 16 Sept. 2025.

[9] Shahid, Ariba. "Punjab Floods Washed Away Thousands of Villages and Farms; Now the Devastation Threatens Pakistan's Economy." *Reuters*, 1 Sept. 2025, https://www.reuters.com/sustainability/climate-energy/punjab-floods-washed-away-thousands-villages-farms-now-devastation-threatens-2025-09-01/?utm_source=chatgpt.com. Accessed 16 Sept. 2025.

[10] Bajwa, Harpreet. "Punjab Reels under Worst Floods: 1,312 Villages Affected, 26 Dead; CM Mann Seeks Rs 60,000 Cr "Pending" State Fund." *The New Indian Express*, 31 Aug. 2025, https://www.newindianexpress.com/nation/2025/Aug/31/punjab-reels-under-worst-floods-1312-villages-affected-26-dead-cm-mann-seeks-rs-60000-cr-pending-state-fund. Accessed 15 Sept. 2025.

[11] India. "Urbanization Is Intensifying India's Summer Heat and Rain." *TIME*, Time, 7 July 2025, time.com/7300435/india-urbanization-climate-impacts-heat-monsoons/. Accessed 16 Sept. 2025.

Direct channel, agricultural output, prices and food security

Magnitude of damage. Punjab is a major producer of rice, wheat and other cereals; large floods during key crop windows (paddy transplanting/standing paddy or late-season crops) destroy yields. Several reports estimated hundreds of thousands of hectares of standing crops lost in 2025, with preliminary loss estimates already running into crores/rupees (local estimates vary). Reuters and local reporting signalled risks of rice and cotton losses, with potential price effects. [12] [13]

Price channel. Crop losses reduce supply, raising wholesale and retail prices for staples and inputs. In India, food inflation is politically sensitive and macro-relevant: it affects the consumer price index (CPI), real incomes, and monetary policy. Even a localized supply shortfall in a major producing state can tighten national markets if buffer stocks, interstate flows, and imports do not fill the gap quickly. Expect short-to-medium term increases in rice and other commodity prices, particularly in nearby urban markets and in states dependent on Punjab supplies. Reuters reporting suggested rice price expectations could spike materially if damage persists. [14]

Welfare effects. Higher food prices hit poor households hardest, reversing consumption gains. Rural households that suffered asset loss will have both diminished production and higher food costs, a double burden. Nationally, such shocks raise poverty vulnerability metrics and may increase the need for expanded subsidized food distribution.

Supply-chain and industry impacts: textiles, agro-processing, logistics

Textiles and raw inputs. Punjab and neighbouring states supply cotton and other inputs to India's textile and apparel industry. Flooding during key windows can damage cotton standing crops and ginning/warehousing infrastructure. Reuters reporting connected agricultural losses to textile sector pressure in the Pakistan context; similar mechanics operate within India's integrated supply chains. Disruptions can raise input costs for textiles and downstream manufacturing. [15]

Agro-processing and cold chains. Loss of stored grain, damage to processing plants, and interruption of cold chain logistics (roads and rail submerged) impede value addition and raise post-harvest losses. Firms depending on timely flows face higher working capital needs and potential revenue loss.

Transport and logistics. Flooded roads and rail lines disrupt movement of goods nationally. Delays and higher transport costs translate into supply shortages for manufacturers and retailers, adding to price pressures and raising inventories through precautionary hoarding.

Financial and fiscal channels

State fiscal stress and central transfers. The Punjab government's requests for large relief funds (reportedly seeking large pending transfers and additional compensation for farmers) highlight fiscal exposure. Relief, reconstruction, and crop compensation programs impose significant budgets. If multiple states face similar events, the central budget and disaster funds may be strained, forcing either re-allocation from other programs or higher deficit financing. [16] [17]

[12] Bajwa, Harpreet. "Punjab Reels under Worst Floods: 1,312 Villages Affected, 26 Dead; CM Mann Seeks Rs 60,000 Cr "Pending" State Fund." *The New Indian Express*, 31 Aug. 2025, https://www.newindianexpress.com/nation/2025/Aug/31/punjab-reels-under-worst-floods-1312-villages-affected-26-dead-cm-mann-seeks-rs-60000-cr-pending-state-fund. Accessed 15 Sept. 2025.

[13] Shahid, Ariba. "Punjab Floods Washed Away Thousands of Villages and Farms; Now the Devastation Threatens Pakistan's Economy." *Reuters*, 1 Sept. 2025, http://www.reuters.com/sustainability/climate-energy/punjab-floods-washed-away-thousands-villages-farms-now-devastation-threatens-2025-09-01/. Accessed 16 Sept. 2025.

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[16] Bajwa, Harpreet. "Punjab Reels under Worst Floods: 1,312 Villages Affected, 26 Dead; CM Mann Seeks Rs 60,000 Cr "Pending" State Fund." *The New Indian Express*, 31 Aug. 2025, https://www.newindianexpress.com/nation/2025/Aug/31/punjab-reels-under-worst-floods-1312-villages-affected-26-dead-cm-mann-seeks-rs-60000-cr-pending-state-fund. Accessed 15 Sept. 2025.

[17] Prakash, Priya. "Punjab Flood: Volunteers Send Boats, Rations, Mosquito Nets; State Unites in Relief Efforts as Thousands Stra." *Indiatimes*, 2 Sept. 2025, indiatimes.com/trending/punjab-flood-volunteers-send-boats-rations-mosquito-nets-state-unites-in-relief-efforts-as-thousands-stranded-in-villages-668589.html. Accessed 16 Sept. 2025.

Insurance, credit and banking stress. Agricultural losses translate into stressed farm incomes and higher non-performing loans (if uninsured or underinsured). Insurance penetration in Indian agriculture is limited; government schemes (crop insurance) may partly cover losses but carry fiscal cost and administrative delays. If floods damage rural incomes and small enterprises, local banks and NBFCs may face elevated repayment stress, particularly in microfinance portfolios or seasonal credit. This could result in localized credit tightening, with knock-on effects on investment and consumption.

Private sector balance sheets. Firms with assets or operations in affected zones (processing units, warehouses, manufacturing plants) will face asset losses, business interruption, and higher insurance claims. Insurers may raise premiums or reduce coverage in high-risk zones going forward, increasing costs for businesses.

Trade and macroeconomic effects

Short-run GDP impacts. Agricultural losses reduce value added in the primary sector; disruptions to industry and services in affected districts aggregate into state GDP losses. If the shock is large enough and sticky (e.g., harvest lost plus damaged infrastructure), national quarterly GDP growth can come under pressure, especially if recovery spending is slow or fiscal constraints limit public investment in reconstruction.

Inflation and monetary implications. Food price spikes drive CPI inflation. The Reserve Bank of India (RBI) may face the difficult trade-off between easing liquidity to support growth and preventing inflation expectations from unmooring. This can complicate monetary policy at a time when global rates and domestic growth goals already constrain central bankers.

External sector and trade. If key export-linked inputs (e.g., textiles) are hit, export volumes and competitiveness can be affected. Conversely, if domestic food shortages are acute, India may increase imports of staples, affecting trade balances and domestic price signals. In 2025, reporting suggested ripple effects across regionally integrated markets, cross-border flood warnings and transboundary releases affected Pakistan's agriculture as well, illustrating how hydrological shocks can propagate internationally. [18] [19]

Labour markets, migration and long-run productivity

Short-term labour disruption. Floods displace agricultural labour and seasonal migrants, interrupting employment and incomes for millions. Casual labour faces lost wages; small enterprises may fire or scale down operations.

Migration and urban pressure. Repeated shocks may accelerate rural-urban migration, increasing pressure on urban infrastructure and services. Urban areas may experience higher informal employment and slums growth if absorptive capacity is insufficient.

Human capital losses. Damage to schools, health facilities and sanitation facilities impacts long-term human capital accumulation, especially if closure periods are prolonged or disease outbreaks occur post-flood.

Productivity and investment climate. Repeated disasters reduce private investment in high-risk zones, cause capital flight to safer regions, and depress long-run productivity growth in affected regions.

Quantitative magnitudes: plausible scenarios

Precise economy-wide numerical forecasts require econometric modelling beyond this paper's scope. Still, we can sketch plausible scenarios based on crop damage and loss estimates reported during the 2025 event and using standard economic multipliers.

[18] Saaliq, Sheikh, and Rajesh Roy. "India Warns Pakistan of More Flooding." *AP News*, 2 Sept. 2025, apnews.com/article/pakistan-india-warning-flood-monsoon-cf6cd61e864182e69b71f30cfda29e38. Accessed 15 Sept. 2025.

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Baseline reported losses (2025, preliminary): many outlets reported 100,000s of hectares flooded; some local numbers cited ~3 lakh acres (~120,000 hectares) or higher for cropped land inundated; others reported near 96,000 hectares or more damaged. Loss estimates in crores/rupees vary by source and crop. [20] [21]

Scenario A, localized severe crop loss but rapid recovery (lower bound): 10–20% annual output loss in Punjab crops for the year, compensated partially by buffer stocks and inter-state flows; short-term rise in rice prices by 10–20% for a quarter; national GDP drag of 0.1–0.3 percentage points in the quarter (agriculture contraction, temporary industrial slowdowns), with swift reconstruction financed by state and central transfers.

Scenario B, protracted damage with supply shocks (central estimate): 20–35% output loss in the state's harvested value for key crops, major damage to processing and logistics; national rice prices rise 15–40% depending on buffers and imports; inflation upticks of 0.5–1.5 percentage points in CPI over two quarters; GDP growth down 0.3–0.8 percentage points for the year after factoring in fiscal drag and private sector disruption; fiscal cost for reconstruction and compensation running into tens of thousands of crores. (These magnitudes are consistent with the scale of area flooded and past episodes where state-level agricultural shocks translated into national price movements.)

Scenario C, systemic, compounding shocks (upper bound): simultaneous multi-state floods, prolonged repairs, and supply chain disruptions push food inflation into sustained double-digit territory for quarters (unlikely but possible under compound extremes). Banking sector stress in affected districts raises NPLs locally, and credit contraction deepens GDP loss.

These scenario ranges reflect how local disaster scale, timing in crop cycles, and nationwide policy responses interact. The real outcome depends on buffer stock availability, import options, speed of relief and reconstruction spending, and monetary policy response.

VI. Distributional Impacts And Equity Considerations

Flood impacts are regressive. Smallholder farmers, agricultural labour, informal workers, women, and low-income urban households bear disproportionate burdens. Compensation schemes often inadequately cover small losses, and delays in payments compound hardship. Food price increases consume a larger share of poorer households' budgets, increasing food insecurity. Any analysis of macro impacts should therefore be complemented by micro-level safety nets, targeted cash transfers, food distribution expansion, and reconstruction programs prioritizing vulnerable groups.

VII. Policy Implications: How To Reduce Future Flood Frequency And Economic Harm

Dealing with future floods requires both hazard reduction (lower the probability or intensity of damaging floods) and vulnerability reduction (lower economic exposure and increase resilience). Below are practical, evidence-grounded policy directions.

Update reservoir operation rules and improve coordination

- Implement dynamic reservoir operation protocols that incorporate short-term weather forecasts and downstream channel capacity.
- Institutionalise inter-state and upstream–downstream coordination committees with real-time data sharing on reservoir levels and inflows to avoid uncoordinated emergency releases.

Invest in early warning, forecasting and modelling

- Improve ensemble forecasting for extreme precipitation and river routing. Recent modelling advances (deep-learning seasonal ERE prediction, attribution studies) should be operationalised to give one-to-two-week lead times for high-risk events. [22] [23]

[20] Bajwa, Harpreet. "Punjab Reels under Worst Floods: 1,312 Villages Affected, 26 Dead; CM Mann Seeks Rs 60,000 Cr "Pending" State Fund." *The New Indian Express*, 31 Aug. 2025, https://www.newindianexpress.com/nation/2025/Aug/31/punjab-reels-under-worst-floods-1312-villages-affected-26-dead-cm-mann-seeks-rs-60000-cr-pending-state-fund. Accessed 15 Sept. 2025.

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Restore floodplains and regulate land use

- Prioritise no-build zones in active floodplains, restore wetlands that act as natural buffers, and enforce zoning to prevent encroachment that reduces attenuation capacity.

Strengthen embankments and drainage while avoiding false security

- Rehabilitate and upgrade embankments and drainage networks, but avoid encouraging risky settlement behind embankments without evacuation plans; engineered solutions must be combined with land-use planning.

Agricultural adaptation and risk sharing

- Promote crop diversification, flood-tolerant varieties, staggered planting dates, and community storage that can mitigate losses.
- Improve crop insurance schemes (timely payouts, better indexing) and expand disaster micro-credit to help recovery without default spirals.

Fiscal preparedness and contingency funds

- Reserve dedicated state and central contingency funds for rapid relief; streamline processes so compensation and repair funds reach beneficiaries quickly to prevent long-term economic scarring.

Build resilient supply chains and redundancy

- Encourage decentralized storage, multiple sourcing for critical inputs, and resilient logistics corridors so a flood in one region does not create national shortages.

Climate mitigation and long-run planning

- While adaptation is urgent, broader mitigation to limit warming and future extremes remains central to reducing long-term flood risk.

VIII. Limitations And Areas For Future Research

This paper synthesises available reporting and scientific studies to create plausible causal narratives and economic pathways. Limitations include: (1) lack of a dedicated econometric simulation calibrated to actual 2025 loss numbers (would improve quantitative precision), (2) evolving data, many damage estimates were preliminary at the time of writing, and (3) heterogeneity in reporting across districts. Future work should build a detailed computable general equilibrium or regional input-output model to quantify GDP and price impacts, and integrate hydrologic flood models with economic exposure layers for granular risk mapping.

IX. Conclusion

The 2025 Punjab floods are a stark reminder that meteorological extremes, when combined with legacy land-use choices and institutional gaps in water and disaster management, can produce large and cascading economic shocks. The most probable future causes of similar or worse floods are not a single failure but an interaction: a climate system increasingly prone to extreme, concentrated rainfall events; upstream hydrological decisions that, unless modernised and coordinated, will continue to amplify downstream hazards; and socio-economic exposure created by floodplain encroachment and aging infrastructure. The economic consequences for India are significant: immediate agricultural losses and food-price inflation; disruptions across textiles, agro-processing and logistics; fiscal stress and potential financial sector weakness in affected pockets; labour market shocks and human capital losses; and a dampening of regional productivity and investment.

The policy response must therefore be comprehensive: modernise reservoir operation and forecasting, restore natural flood attenuation, strengthen social protection and crop insurance, invest in resilient infrastructure and logistics, and update land-use and urban planning rules. Many of these steps are politically and financially challenging, but the alternative, repeated, deeper economic shocks from predictable interactions of climate and policy failures, would be far more costly.

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